Supporting Documents

3.4.5 Number of research papers per teacher in the Journals notified on UGC website during the last year

Sr. No.	Department	Supporting Documents
1.	Chemical Sciences	**Proofs of published papers**
2.	Physical Sciences	
3.	Mathematical Sciences	
4.	Civil Engineering	
5.	Computer Science & Engineering	
6.	Mechanical Engineering	
7.	Electrical Engineering	
8.	Electronics and Communication Engineering	
9.	Food Science & Technology	
10.	Management & Hospitality	
11.	Journalism and Mass Communication	
12.	Humanities, Languages and Cultural Studies	
13.	IKGPTU Hoshiarpur Campus	
14.	IKGPTU Amritsar Campus	
15.	IKGPTU Mohali Campus-I	
16.	IKGPTU Mohali Campus-II	

Materials Chemistry and Physics 272 (2021) 124832

Contents lists available at ScienceDirect

Materials Chemistry and Physics

journal homepage: www.elsevier.com/locate/matchemphys

Bioactivity of microwave and conventionally synthesized 70sr–HA.xZn (30-x)si composites

Ravinder Kumar Chadha [a], Kanchan L. Singh [b], Chetan Sharma [a,c], Anirudh P. Singh [a,*], Vandana Naithani [a]

[a] I.K.G. Punjab Technical University, Jalandhar, India
[b] D.A.V. Institute of Engineering and Technology, Jalandhar, India
[c] Baba Farid College, Deon, Bathinda, Punjab, India

HIGHLIGHTS

- Composites sintered by microwave and conventional methods.
- Microwave sintered samples have higher density, hardness and bioactivity.
- Silica enhances the grain growth.
- Microwave processed samples showed high pH change in SBF solution.

ARTICLE INFO

Keywords:
Microwave processing
X-ray diffraction
Scanning electron microscopy
Hardness
Bioactivity

ABSTRACT

The composites of different compositions of 70Sr–HA.xZn (30-x)Si were prepared by two different methods: conventional sintering and microwave sintering. XRD characterized the prepared samples for phase identification, FTIR and Raman for functional groups, SEM for microstructure, hardness for mechanical properties. X-ray diffraction studies showed that multiple phases were present in all the samples. The values of density and hardness of apatite composite samples sintered by microwave processing were higher than the apatite composite samples sintered by the conventional method. Microwave sintered products showed more uniform and higher grain growth in comparison to conventionally sintered products. In vitro bioactivity of the synthesized composites was assessed by the SBF immersion method. It was observed that the bioactivity of the microwave processed apatite was better than the conventionally processed apatite.

1. Introduction

The calcium phosphate group constitutes the largest and most significant inorganic part of bones and dentine materials [1]. Synthetic calcium phosphate resembles natural bone materials, chemically and crystallographically. $CaHPO_4.2H_2O$, $Ca_3(PO_4)_2$ and $Ca_{10}(PO_4)_6(OH)_2$, etc., are the different phases of Calcium phosphate [2]. Among these, the main focus is towards HA, $Ca_{10}(PO_4)_6(OH)_2$ as it constitutes 60–65% as a main inorganic part of the natural bone [3]. Due to its chemical resemblance with bone and biofunctional properties such as bioactivity and biocompatibility, HA can be used for bone applications because it can be slowly substituted by natural bone after implantation [4]. The hexagonal structure of HA comprises of complexes of orthophosphates tetrahedra and Ca^{2+} ions [5]. Calcium and phosphate are key components of the mineralized matrix, acting as the calcium reservoir and plays a vital role to maintain calcium homeostasis across the body [6]. The chemical composition of HA is non-stoichiometric as it is calcium deficient with a mole ratio of Ca/P of 1.67. When it was implanted with the bone, it takes sodium, zinc, magnesium, iron, and carbonate from the body fluid due to bone metabolism [7]. In spite of these useful properties of HA, its use is still limited to a non-load bearing area such as powders, coatings, and porous scaffolds due to its poor mechanical properties and in vivo bioactive properties [8]. The possibility of using HA ceramic as a load-bearing implant is entirely dependent upon the availability of properly sintered hydroxyapatite with improved mechanical properties [9].

* Corresponding author.
E-mail address: deanricptu@gmail.com (A.P. Singh).

https://doi.org/10.1016/j.matchemphys.2021.124832
Received 3 April 2021; Received in revised form 26 May 2021; Accepted 9 June 2021
Available online 14 June 2021
0254-0584/

Est. 1984

ORIENTAL JOURNAL OF CHEMISTRY
An International Open Access, Peer Reviewed Research Journal

www.orientjchem.org

ISSN: 0970-020 X
CODEN: OJCHEG
2022, Vol. 38, No.(3):
Pg. 790-795

Facially Selective Oxo-Diels-Alder Cycloadditions of α-dienyl-β-lactam: An entry to pyrano-tethered β-lactams bifunctional hybrids

MANINDERJEET KAUR MANN[1], RUPESH KUMAR[1]* and GAURAV BHARGAVA[1]*

Department of Chemical Sciences, I. K. Gujral Punjab Technical University,
Kapurthala, Punjab 144 603, India.
*Corresponding author E-mail: rupesh.manak@gmail.com, gaurav@ptu.ac.in

http://dx.doi.org/10.13005/ojc/380334

(Received: May 04, 2022; Accepted: June 21, 2022)

ABSTRACT

The functionalization of β-lactams at C-3 position are useful for the strategic improvement in both the dimensions, namely synthetic utility, as versatile intermediate in organic synthesis and biological potential of these heterocyclic systems. The present manuscript involved the π-facial selective synthesis β-lactam hybrids employing highly regioselective and diastereoselective Oxo-Diels–Alder reaction of diethyl ketomalonate with α-dienyl-β-lactam with stereocentres at its α- and β- positions. This protocol provided the cycloaddition of α- and β- stereocentric diene with symmetrical heterodienophiles forming biologically potent regioselective and diastereoselective α-lactams substituted pyrano bifunctional hybrids in good yields and β-facially selectivity.

Keywords: Regioselective synthesis, π-facial selective synthesis, Diastereoselective synthesis, β-lactams, Dienyl-β-lactams.

INTRODUCTION

The hetero-Diels–Alder (HDA) reactions[1-5] are significant tools in establishing 6-membered heterocyclic scaffolds having immense biological relevance. A variety of hetero-Diels-Alder reactions ensured an opening for the development of diverse heterocyclic systems. HDA reactions drew a lot of attention because of their extensive industrial and other important applications.[6-8] Different variants of HDA reactions have been explored for a highly efficient stereoselective[9-13] synthesis of six-membered ring compounds. Of these, oxo-Diels-Alder (ODA)[14-18] variant has considerable potential because of the tactical formation of a variety of six membered derivatives such as dihydropyrans, dihydropyrones etc.

On the other hand, the β-lactams C-3 functionalization[19] has continual significant concern of chemists because of its use as important core in the fabrication of organic compounds and their therapeutic biological uses. These 3-substituted prototypes are an important building blocks for development of conformationally constrained and medicinally potent products or for library generation

J. Chem. Sci. (2022)134:44
https://doi.org/10.1007/s12039-022-02039-z

REGULAR ARTICLE

Eosin Y photocatalyzed access to Biginelli reaction using primary alcohols *via* domino multicomponent cascade: an approach towards sustainable synthesis of 3,4-dihydropyrimidin-2(1H)-ones

GOBIND KUMAR[a], GAURAV BHARGAVA[a], YOGESH KUMAR[b,*] and RUPESH KUMAR[a,*]

[a]Department of Chemical Sciences, I. K. G. Punjab Technical University, Kapurthala, Punjab 144603, India
[b]Department of Chemistry, Durham University, Durham DH1 3LE, UK
E-mail: yogeshsynthesis@gmail.com; rupesh.manak@gmail.com

MS received 14 October 2021; revised 17 January 2022; accepted 29 January 2022

Abstract. The Eosin Y photocatalyzed Biginelli protocol has been established by a cascade one-pot three-component reaction of primary alcohols, α-ketoester, and urea to provide pharmacologically promising 3,4-dihydropyrimidin-2(1H)-ones in high yields. The key benefits of the present scheme are the capability to allow operational simplicity, readily available substrates, straightforward workup and high yields. This Eosin Y based photocatalytic approach can permit conquering traditional metal-catalyzed reactions in a sustainable manner, thus delivering economic and environmental rewards.

Keywords. Biginelli reaction; Photocatalysis; Eosin Y; 3,4-dihydropyrimidin-2(1H)-ones; Multicomponent reaction.

1. Introduction

The gradually increasing demand for greener methodology for concurrent chemical synthesis has enforced chemists to develop atomic economically and environmentally benign synthetic routes for producing well usable chemicals.[1] Visible-light-assisted transformations have especially attracted growing interest due to their green and beneficial properties, sustainability, readily availability and ease of handling.[2] In addition, compared to the conventional catalytic protocols, photo-catalysis under visible-light irradiation has been revealed as a powerful synthetic tool that produces mild and eco-friendly organic conversions.[3–6] Exhilarate by this, various dyes and metal-complexes; bearing ruthenium and iridium, are reported as photocatalysts in the last couple of years especially.[7–16]

The controlled oxidation of alcohols is one of the important transformations in organic synthetic chemistry as their products play an important intermediate role in the formation of fine chemicals, important agrochemicals, pharmaceutical entities and other high-value products.[17–19] Oxidation of primary aromatic alcohols are mostly achieved using rather strong oxidizing agents, that are toxic and hazardous to the environment *i.e.* hyperchlorite, permanganate, *etc.* and expensive noble metal catalysts including Au, Pt, Pd.[20–25] As the alternative route, oxygen plays an important role as an excellent oxidant because of prevention of toxic, hazardous and stoichiometric by-products.[26] Based on the perspective, various homogenous and heterogeneous metal catalysts have been reported. In equality, transition-metal free photocatalysts are greener and striking, because of inexpensive, easy departure from the reaction mixture and non-poisonous.[27,28] So far, several photocatalytic methods have also been reported for the oxidation of primary aromatic alcohols.[29–34]

Notably, 3,4-dihydropyrimidin-2(1H)-one (DHPMs) are the core structural motifs for many potentially active biological molecules such as calcium channel blockers, ant-inflammatory and antitumor.[35] DHPMs are identified as encouraging anticancer agents (Figure 1)

*For correspondence

Supplementary Information: The online version contains supplementary material available at https://doi.org/10.1007/s12039-022-02039-z.

Published online: 15 March 2022

JOURNAL OF SULFUR CHEMISTRY
2022, VOL. 43, NO. 2, 117–123
https://doi.org/10.1080/17415993.2021.1983574

Taylor & Francis
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BRIEF REPORT

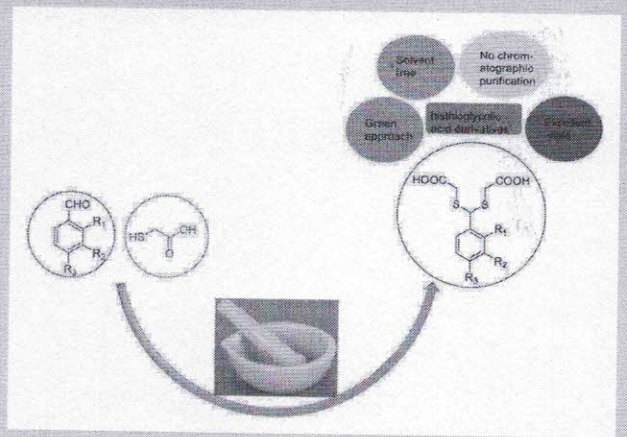
Solvent-free mechanochemical synthesis of bisthioglycolic acid derivatives: an efficient and versatile strategy for carbon–sulfur bond formation

Rayees Ahmad Naikoo[a], Parvesh Singh[b], Rupesh Kumar [a] and Gaurav Bhargava[a]

[a]Department of Chemical Sciences, I. K. Gujral Punjab Technical University, Kapurthala, India; [b]School of Chemistry and Physics, University of KwaZulu Natal, Durban, South Africa

ABSTRACT

An eco-friendly, easily achievable and efficient strategy has been explored to synthesize functionalized bisthioglycolic acids using a variety of aldehydes and thioglycolic acid. The employed protocol is solvent free and provides the desirable products in excellent yields (90–99%) with atom economy. Besides, cost effectiveness, short reaction times and milder reaction conditions are among other captivating benefits of the reported methodology.



ARTICLE HISTORY
Received 8 June 2021
Accepted 17 September 2021

KEYWORDS
bisthioglycolic acid; mechanochemical synthesis; carbon–sulfur bond; formation; solvent-free synthesis; Green synthesis

Introduction

The exploration of atom economical greener protocols with easily accessible final products without any additional extraction or chromatographic procedures is among the significant aims in organic chemistry. Solvent-free mechanochemical strategies for synthetic transformations have created a niche at the forefront of sustainable green chemistry. These strategic

CONTACT Gaurav Bhargava gaurav@ptu.ac.in; gauravorganic@gmail.com; Rupesh Kumar rupesh.manak@gmail.com Department of chemical sciences, I. K. Gujral Punjab Technical University, Kapurthala, Punjab 144 603, India

Supplemental data for this article can be accessed here. https://doi.org/10.1080/17415993.2021.1983574

Recent Developments in the Synthesis of Bicyclic Condensed Pyrimidinones

Authors: Naikoo, Rayees A.; Kumar, Rupesh; Kumar, Vipan; Bhargava, Gaurav
Source: Current Organic Chemistry, Volume 26, Number 2, 2022, pp. 122-161(40)
Publisher: Bentham Science Publishers
DOI: https://doi.org/10.2174/1385272826666220112152330

Functionalized bicyclic pyrimidinones and their derivatives are significant heterocyclic scaffolds being their all-around prevalence in biologically potent compounds. In several attempts to explore the different synthetic methodologies for the construction of bicyclic condensed pyrimidinones, different researchers from all across the globe have reported numerous substantial methods. In the present review, considerable work has been critically compiled on the synthesis of substituted and functionalized bicyclic pyrimidinones from 2000 onwards.

Keywords: Bicyclic pyrimidinones; Nitrogen heterocycles; biologically active heterocycles; condensed pyrimidinones; fused heterocycles; heterocycles
Document Type: Review Article
Publication date: January 1, 2022

View Article Online
DOI: 10.1039/D1CC04034K

ARTICLE

Fluorescent Molecular Probes based Activity and Inhibition monitoring of Histone Deacetylases

Roopa,*[a] Bhanu Priya, Vandana Bhalla,[b] Manoj Kumar,[b] and Naresh Kumar*[c]

Received 00th January 20xx,
Accepted 00th January 20xx

DOI: 10.1039/x0xx00000x

Extensive studies in the past decades have revealed that gene expression regulation is not limited to genetic mutations but also to processes that do not alter the genetic sequence. Post-translational histone modification is one of these processes in addition to DNA or RNA modifications. Histone modifications are essential in controlling histone functions and play a vital role in cellular gene expression. The reversible histone acetylation, regulated by histone acetyltransferases (HATs) and histone deacetylases (HDACs), is an example of such modifications. HDACs are involved in the deacetylation of histones and lead to the termination of gene expression. Although this cellular process is essential, upregulation of HDACs is found in numerous cancers. Therefore, research related to the activity and inhibition monitoring of HDACs is necessary to gain profound knowledge of these enzymes and evaluate the success of the therapeutic approach. In this perspective, methodology derived from fluorescent molecular probes is one of the preferable methods. Herein, we describe fluorescent probes developed to target HDACs by considering their activity and inhibition characteristics.

Introduction

In eukaryotic cells, various physiological and pathological processes like genomic and genetic aberrations are associated with mutations, but epigenetics also play a crucial role in maintaining cellular functions.[1–3] The epigenetic mechanism includes chemical alteration of DNA/RNA[4] and post-translational histone modifications.[5,6] Among these epigenetic modifications, post-translational histone modifications involve reversible acetylation, methylation, phosphorylation, ubiquitylation, sumoylation and ADP ribosylation of amino terminals of histone proteins.[7,8] Such chemical modification of histones is associated with altered gene expression as well as chromatin remodelling.[9]

The reversible acetylation on selected ε-amino lysine residues of histones is maintained and equilibrated by enzymes known as histone acetyltransferases (HATs) and histone deacetylases (HDACs), which are decisive in controlling the gene expression.[10,11] HATs catalyze the acetylation reaction of the ε-amino terminal of a lysine residue of histones that decreases the positive charge and ultimately perturbs the interaction of histones with DNA, essential for the activation of the transcription process.[12] HATs and other enzymes involved in the chemical modification of histones are generally known as "writers". On the other hand, chromatin condensation and stabilization occurs with HDACs, which remove the acetyl group from the lysine residue of histones, responsible for gene and transcriptional repression (Figure 1).[13,14] Enzymes including HDACs that remove histone modifications are known as "erasers". Nevertheless, the deacetylation process of non-histone proteins like chaperone proteins, transcription factors, signalling molecules, and other cytoplasmic proteins is also governed by HDACs, also known as lysine DACs or KDACs.[15–17]

The deacetylation of histone and non-histone proteins is ubiquitous in regulating gene expression, signal transduction, and cell homeostasis. There are eighteen mammalian HDACs categorized into four different classes based on the functional and structural units of these enzymes.[18] Class I HDACs include HDAC1, 2, 3, and 8, preferentially localized in the nucleus. Class II HDACs have two subclasses: IIa (HDAC4, 5, 7, and 9) are present both in the nucleus and cytoplasm of the cell; however, IIb HDACs (HDAC6 and 10) are localized mainly in the cytoplasm. Class IV consists of HDAC11. Class I, II, and IV are Zn^{2+} dependent enzymes. On the other hand, Class III, i.e., sirtuins (SIRT1, SIRT2, SIRT3, SIRT4, SIRT5, SIRT6, and SIRT7) are nicotinamide adenine dinucleotide (NAD^+)-dependent enzymes localized in the nucleus, cytoplasm, and mitochondria of the cell.

The irregularities in the expression of specific genes and chromatin structure due to HDACs cause cell apoptosis, differentiation, angiogenesis, cancer, and neurological disorders.[19–24] For instance, deacetylation of lysine 16 and lysine 18 of H4 and H3 histones by HDACs are found in several cancers, including lung,[25] prostate[26] and breast cancer.[27] The elevated levels of HDACs are not only linked with tumorigenesis,[28,29] certainly, but it also signifies the positive diagnosis, like, in breast cancer, the estrogen receptor-positive (ER-positive) results occur due to the overexpression of HDAC6.[30] Similarly, the increased level of HDAC2 is observed in patients having Alzheimer's disease as well as in mouse model due to the

[a] Department of Chemical Sciences, IKG-Punjab Technical University, Kapurthala 144603 Punjab, India.
[b] Department of Chemistry, UGC Center of Advanced Study-II, Guru Nanak Dev University, Amritsar-143005, Punjab, India.
[c] Department of Chemistry, SRM University, Delhi-NCR, Sonepat-131029, Haryana, India.
E-mail: dr.roopa@ptu.ac.in; naresh.chem.ia@gmail.com

3.4.5

Department of Physical Sciences

IOP Publishing

Journal of Physics G: Nuclear and Particle Physics

J. Phys. G: Nucl. Part. Phys. 48 (2021) 075104 (17pp)

https://doi.org/10.1088/1361-6471/abe8cd

Measurement of fission excitation function for $^{19}F + ^{194,196,198}Pt$ reactions

Varinderjit Singh[1,2,*], B R Behera[1], Maninder Kaur[1,2], A Jhingan[3], Rupinder Kaur[2], P Sugathan[3], Davinder Siwal[1,4], S Goyal[4], K P Singh[1], Santanu Pal[5], A Saxena[6] and S Kailas[7]

[1] Department of Physics, Panjab University, Chandigarh 160014, India
[2] Department of Physical Sciences, IKG Punjab Technical University, Kapurthala 144603, India
[3] Inter University Accelerator Centre, New Delhi 110067, India
[4] Department of Physics and Astrophysics, University of Delhi, Delhi 110007, India
[5] CS-6/1, Golf Green, Kolkata 700095, India
[6] Nuclear Physics Division, Bhabha Atomic Research Centre, Mumbai 400085, India
[7] UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, Mumbai 400098, India

E-mail: vickymangat3@gmail.com

Received 3 December 2020, revised 18 February 2021
Accepted for publication 22 February 2021
Published 21 May 2021

Abstract

Experimental fission cross-sections are reported for the $^{19}F + ^{194,196,198}Pt$ reactions populating an isotopic chain of compound nuclei comprising both closed and non-closed shell nuclei. The fission cross-sections are obtained at near and above Coulomb barrier energies by measuring fission fragment angular distributions. The present work aims to estimate nuclear dissipation and find its isotopic and shell closure dependence from statistical model (SM) analysis of experimental data. Pre-scission neutron multiplicity data for the same systems is also included in the SM analysis. An updated version of SM is used in the present analysis, which includes shell corrections in level density and fission barrier as well as the effect of collective enhancement of level density and orientation effect of the compound nucleus along the symmetry axis. An isotopic dependence of the dissipation strength fitting the fission excitation functions is observed. The pre-scission neutron multiplicity, however, is underestimated by the SM.

Keywords: nuclear reactions, fusion–fission reaction, fission fragment angular distribution, statistical model of nuclear reactions

(Some figures may appear in colour only in the online journal)

* Author to whom any correspondence should be addressed.

0954-3899/21/075104+17$33.00

Head of Department
Department of Physics
I.K.Gujral Punjab Technical University Jalandhar
Kapurthala, Punjab-144603

V.S

IOP Publishing Journal of Physics G: Nuclear and Particle Physics
J. Phys. G: Nucl. Part. Phys. 48 (2021) 075104 (17pp) https://doi.org/10.1088/1361-6471/abe8cd

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[1] Department of Physics, Panjab University, Chandigarh 160014, India
[2] Department of Physical Sciences, IKG Punjab Technical University, Kapurthala 144603, India
[3] Inter University Accelerator Centre, New Delhi 110067, India
[4] Department of Physics and Astrophysics, University of Delhi, Delhi 110007, India
[5] CS-6/1, Golf Green, Kolkata 700095, India
[6] Nuclear Physics Division, Bhabha Atomic Research Centre, Mumbai 400085, India
[7] UM-DAE Centre for Excellence in Basic Sciences, University of Mumbai, Mumbai 400098, India

E-mail: vickymangat3@gmail.com

Received 3 December 2020, revised 18 February 2021
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Abstract

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*Author to whom any correspondence should be addressed.

0954-3899/21/075104+17$33.00

Head of Department
Department of Physics
I.K.Gujral Punjab Technical University Jalandhar,
Kapurthala, Punjab-144603

V.S

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Physics Letters B 814 (2021) 136115

Contents lists available at ScienceDirect

Physics Letters B

www.elsevier.com/locate/physletb

Effect of increasing neutron-excess on the fusion cross-section in $^{12-15}C + ^{12}C$ at above-barrier energies

R.T. deSouza [a,*], Varinderjit Singh [a], S. Hudan [a], Z. Lin [b,c], C.J. Horowitz [b]

[a] Department of Chemistry and Center for Exploration of Energy and Matter, Indiana University, 2401 Milo B. Sampson Lane, Bloomington, IN 47408, USA
[b] Department of Physics and Center for Exploration of Energy and Matter, Indiana University, 2401 Milo B. Sampson Lane, Bloomington, IN 47408, USA
[c] Department of Physics, Arizona State University, 450 E. Tyler Mall, Tempe, AZ 85287-1504, USA

ARTICLE INFO

Article history:
Received 24 November 2020
Received in revised form 12 January 2021
Accepted 27 January 2021
Available online 29 January 2021
Editor: D.F. Geesaman

Keywords:
Near-barrier fusion
Neutron-rich fusion
RIB fusion
Fusion enhancement

ABSTRACT

Fusion excitation functions at energies above the fusion barrier for $^{12-15}C + ^{12}C$ are examined. From these excitation functions the average fusion cross-section, $< \sigma_F >$, is calculated. For this isotopic chain, the measured dependence of $< \sigma_F >$ on neutron excess is compared with static barrier penetration models. The more rapid increase observed for the experimental cross-sections above the geometric increase predicted by the static models suggests that the stronger dependence on neutron-excess measured may be attributable to dynamics. Calculations with a time-dependent Hartree-Fock model also fail to describe the observed trend suggesting that for neutron-rich nuclei, neutron dynamics may play a larger role than is presently accounted for.

1. Introduction

Nuclei are extremely interesting quantal systems. Despite a limited number of constituent particles, they manifest collective behavior. This collective behavior is observed in many forms including giant multipole resonances [1], shape coexistence [2], and the quintessential case of fission [3]. In the case of nuclear fission the evolution of collective degrees of freedom is key to understanding the process. Although typically associated with the structure and reactions of mid-mass and heavy nuclei, collectivity for very light nuclei has recently been reported [4]. Nuclear fusion provides another example in which collective degrees of freedom undergo substantial change as the reaction proceeds. Of particular interest is the role of collectivity for neutron-rich nuclei as for these nuclei the dependence of collective behavior on the asymmetry between the neutron and proton densities can be probed. Fusion reactions provide a powerful means to assess the response of neutron-rich nuclei to perturbation. As fusion involves the interplay of the repulsive Coulomb and attractive nuclear potentials, by examining fusion for an isotopic chain one probes the neutron density distribution and how that density distribution evolves as the two nuclei approach and overlap [5–8]. On qualitative grounds, increasing neutron excess leads to a larger range of the nuclear interaction, resulting in a lower value for the height of the s-wave fusion barrier and a larger barrier radius. Consequently, a larger fusion cross-section is expected with increasing neutron excess. At near-barrier energies this fusion cross-section reflects both the increase in the static size as well as any dynamics present. In addition to an improved fundamental understanding of the dynamics of neutron-rich nuclei, investigating the fusion of neutron-rich nuclei is also important for describing reactions occurring in the crusts of accreting neutron stars [9]. In this manuscript, careful comparison of the experimental above-barrier fusion cross-section for an isotopic chain with the prediction of both static and dynamical models, reveals the failure of these models to describe the dependence of the fusion cross-section on neutron excess. The stronger dependence of the average fusion cross-sections on neutron-excess observed may reflect the increasing importance of dynamics for neutron-rich nuclei.

At high incident energy one expects the sudden approximation to be valid. Consequently, the nuclear densities do not have enough time to rearrange in the contact region and the cross-section is a manifestation of nuclear size and other geometrical features such as ground-state deformation, all of which are considered "static". Hence, the measured interaction cross-section, σ_I, provides a direct and effective measure of the extent of the matter distribution. Collision of nuclei at lower energy is more complex with a multitude of processes that constitute the "dynamics". These processes include excitation of the entrance channel nuclei and formation of a neck where multi-nucleon transfer occurs, all influenced by the quantal Pauli exclusion principle [10]. Comparison of high-energy

* Corresponding author.
E-mail address: desouza@indiana.edu (R.T. deSouza).

https://doi.org/10.1016/j.physletb.2021.136115

Assessing the impact of valence *sd* neutrons and protons on fusion

Varinderjit Singh, J. Vadas, T. K. Steinbach, B. B. Wiggins, S. Hudan, and R. T. deSouza*
Department of Chemistry and Center for Exploration of Energy and Matter, Indiana University, 2401 Milo B. Sampson Lane, Bloomington, Indiana 47408, USA

(Received 13 April 2021; accepted 1 June 2021; published 10 June 2021)

Experimental near-barrier fusion cross sections for $^{17}F + ^{12}C$ are compared to the fusion excitation functions for $^{16,17,18}O$, ^{19}F, and ^{20}Ne ions on a carbon target. Normalized or reduced fusion cross sections are utilized in order to compare the different systems and account for the differing static size of the incident ions as well as changes in fusion barrier. Fusion excitation functions for the case of the mirror nuclei ^{17}F and ^{17}O with a single *sd* nucleon are compared. The ^{17}F data are also juxtaposed with nuclei involving multiple *sd* nucleons. Trends of the fusion cross section above the barrier beyond the expected systematic behavior are observed. These trends are interpreted as the interplay of the *sd* protons and neutrons. The experimental data are also compared to a widely used analytic model of near-barrier fusion, a time-dependent Hartree-Fock model, and coupled channels calculations.

DOI: 10.1103/PhysRevC.103.064606

I. INTRODUCTION

Nuclear fusion is a topic of considerable interest both from a fundamental perspective as well as in the field of nuclear astrophysics [1]. Nuclei just beyond a closed shell present a unique opportunity to probe the interplay of shell and collective effects on the fusion process. In particular, light nuclei just beyond the $1p_{1/2}$ shell, namely isotopes of oxygen, fluorine, and neon, are good candidates for examination. In this work, the fusion of various isotopes of these elements with a carbon target at near-barrier energies is examined. The results of this work, which combines both stable and radioactive beams, point to the potential of low-energy beams at radioactive beam facilities [2,3] for examining the impact of neutron excess on fusion.

Addition of neutrons and protons just beyond the $1p_{1/2}$ shells of ^{16}O clearly changes both the matter and charge distributions of the nuclei. Theoretical calculations indicate that for a large neutron excess, e.g., ^{24}O as compared to ^{16}O, fusion with ^{16}O target is significantly enhanced [4]. The impact of adding just a few neutrons or protons beyond the $1p_{\frac{1}{2}}$ shell on fusion is less clear. With increased atomic or mass number, the fusion barrier and consequently the fusion cross section are clearly impacted. We propose to go beyond these trivial systematic differences and examine the detailed differences in the fusion cross section. A particularly interesting case to investigate is fusion of the nucleus ^{17}F, which exhibits a proton halo when in its $2s_{1/2}$ excited state [5]. It is presently unclear whether an increased radial extent results in a fusion enhancement or weak binding results in a decreased fusion cross section. For the case of $^{17}F + ^{208}Pb$, neither an enhancement nor a suppression of fusion was observed relative to $^{19}F + ^{208}Pb$ [6]. However, in the case of fusion with a large target nucleus, such as ^{208}Pb, the impact on fusion of adding two neutrons might be diminished. Recently, the fusion cross section for $^{17}F + ^{12}C$ both at near-barrier energies [7] and higher energies [8] has been reported, indicating that the low binding energy of ^{17}F and the halo properties of the low-lying first excited state do not affect the low-energy fusion cross section. In this work we report an independent, higher statistics measurement of near barrier fusion for $^{17}F + ^{12}C$. By comparing the present measurement with fusion induced by O, F, and Ne beams on ^{12}C the impact of adding a few protons and neutrons to the *sd* shell on the fusion cross section is examined.

II. EXPERIMENTAL DETAILS

Discovery of halo nuclei, notably ^{11}Li [9,10] was achieved through systematic examination of the interaction cross sections for lithium isotopes. At high incident energy one expects the sudden approximation to be valid in describing the collision of the nuclei. Consequently, the nuclear densities do not have enough time to rearrange as the projectile and target nuclei come into contact. Thus, a measurement of the interaction cross section at high energy probes the nuclear size and other geometrical features such as deformation, all of which are considered "static" [9]. Hence, the measured interaction cross section, σ_I, provides a direct and effective measure of the extent of the matter distribution.

To better understand the change in the static size of the different nuclei considered in this work, we examine the interaction cross sections measured at high energy. Presented in Table I are σ_I for O, F, and Ne nuclei with a carbon target [11] with the number of protons and neutrons in the *sd* shell indicated. The closure of the $1p_{\frac{1}{2}}$ with $N = 8$ provides a natural reference from which to examine the impact made by

*desouza@indiana.edu

Nuclear Inst. and Methods in Physics Research, A 1014 (2021) 165697

Contents lists available at ScienceDirect

Nuclear Inst. and Methods in Physics Research, A

journal homepage: www.elsevier.com/locate/nima

MuSIC@Indiana: An effective tool for accurate measurement of fusion with low-intensity radioactive beams

J.E. Johnstone [a,b], Rohit Kumar [a,b], S. Hudan [a,b], Varinderjit Singh [a,b], R.T. deSouza [a,b,*], J. Allen [c], D.W. Bardayan [c], D. Blankstein [c], C. Boomershine [c], S. Carmichael [c], A. Clark [c], S. Coil [c], S.L. Henderson [c], P.D. O'Malley [c]

[a] Department of Chemistry, Indiana University, 800 E. Kirkwood Ave., Bloomington, IN 47405, USA
[b] Center for Exploration of Energy and Matter, Indiana University, 2401 Milo B. Sampson Lane, Bloomington, IN 47408, USA
[c] Department of Physics, University of Notre Dame, Notre Dame, IN 46556, USA

ARTICLE INFO

Keywords:
MuSIC
Multi-sampling ionization chamber
Active target
Fusion

ABSTRACT

The design, construction, and characterization of the Multi-Sampling Ionization Chamber, MuSIC@Indiana, are described. This detector provides efficient and accurate measurement of the fusion cross-section at near-barrier energies. The response of the detector to low-intensity beams of ^{17,18}O, ^{19}F, ^{23}Na, ^{24,26}Mg, ^{27}Al, and ^{28}Si at E_{lab} = 50–60 MeV was examined. MuSIC@Indiana was commissioned by measuring the ^{18}O+^{12}C fusion excitation function for 11 < E_{cm} < 20 MeV using CH_4 gas. A simple, effective analysis cleanly distinguishes proton capture and two-body scattering events from fusion on carbon. With MuSIC@Indiana, measurement of 15 points on the excitation function for a single incident beam energy is achieved. The resulting excitation function is shown to be in good agreement with literature data.

1. Introduction

The structure and reactions of neutron-rich isotopes is presently a topic of significant interest [1]. As nuclei become more neutron-rich their properties are expected to change and new collective modes may emerge. The availability of neutron-rich beams at radioactive beam facilities now allows the systematic exploration of fusion for an isotopic chain of neutron-rich nuclei [2–6]. While the next generation of radioactive beam facilities, such as the Facility for Rare Isotope Beams (FRIB), will provide radioactive beams closer to the neutron drip-line than ever before [7], it also presents experimental challenges. Due to their short half-lives, these exotic beams will only be available at low intensity mandating use of an effective and efficient means for accurately measuring fusion probability.

The low intensity of exotic radioactive beams suggests that a thick target approach should be used. Thick target approaches have previously been used in the measurement of fusion by identifying the fusion products via their characteristic γ-radiation as they de-excite [8]. However, utilizing this approach requires accurate knowledge of the γ detection efficiency – which is often low – as well as knowledge of the decay properties of the neutron-rich fusion products — which may not exist.

An alternative approach is to use an active target in which direct detection of the primary charged fusion products provides the signal that fusion has occurred. A Multi-Sampling Ionization Chamber (MuSIC) detector [2] provides an effective means of measuring the fusion cross-section by identifying the heavy fusion product. While MuSIC detectors were originally developed for use in high-energy heavy-ion experiments [9–11], more recently their use has been extended to low energy nuclear reactions namely the measurement of the fusion excitation function for $^{10-15}$C+^{12}C [2,12] and ^{17}F+^{12}C [13], or studies of (α,n)/(α,p) reactions [14,15].

The MuSIC approach provides a couple of intrinsic advantages over the typical thin-target measurement. Traditional thin-target measurements were performed with limited angular coverage, identifying the fusion products by either ΔE-E [16,17] or ETOF [18] techniques. Extraction of the fusion cross-section thus required integration of the angle and energy distributions for the individual heavy product introducing an uncertainty into the total extracted fusion cross-section. Use of a MuSIC detector provides a direct integrated measure of the fusion cross-section. In contrast to the thin-target approach where the incident beam energy must be changed, MuSIC detectors allow measurement of multiple points on the excitation function simultaneously [12]. In addition, MuSIC detectors are self-normalizing since the incident beam is detected by the same detector as the reaction products. These advantages make MuSIC detectors an efficient means for measuring fusion excitation functions for neutron-rich nuclei when available beam intensities are limited.

* Corresponding author at: Department of Chemistry, Indiana University, 800 E. Kirkwood Ave., Bloomington, IN 47405, USA.
E-mail address: desouza@indiana.edu (R.T. deSouza).

https://doi.org/10.1016/j.nima.2021.165697
Received 11 July 2021; Accepted 27 July 2021
Available online 3 August 2021

Open Access

Issue	Math. Model. Nat. Phenom. **Volume** 17, 2022
Article Number	37
Number of page(s)	18
DOI	https://doi.org/10.1051/mmnp/2022025
Published online	02 September 2022

Math. Model. Nat. Phenom. 17 (2022) 37

The Effect of Composite Material on Rayleigh Wave at Free Surface of Composite Matrix Saturated by Fluids

Ashish Arora[1*] and Neeru Bala[2]

[1] Department of Mathematical Sciences, IKG Punjab Technical University, Kapurthala 144 603, Punjab, India

[2] Department of Mathematics, DAV Institute of Engineering and Technology, Jalandhar 144 008, India

* Corresponding author: dr.ashish10@hotmail.com

Received: 15 October 2021 | **Accepted:** 6 June 2022

Abstract

The present study signifies the effect of distinct solids on the phase speed and attenuation of Rayleigh surface wave propagating on the boundary of composite porous matrix saturated with fluids. Secular equation depicting propagation

Computational and Applied Mathematics (2021) 40:220
https://doi.org/10.1007/s40314-021-01599-z

Efficient adaptive step-size formulation of an optimized two-step hybrid block method for directly solving general second-order initial-value problems

Rajat Singla[1,2] · Gurjinder Singh[1] · V. Kanwar[3] · Higinio Ramos[4,5]

Received: 3 April 2021 / Revised: 24 July 2021 / Accepted: 27 July 2021

Abstract
In this article, we have considered an adaptive step-size formulation of an optimized block method for directly solving general second-order initial value problems of ODEs numerically. This formulation has been done using an embedded-type procedure resulting in an efficient method that performs much better compared to its counterpart fixed step-size method and other existing block strategies.

Keywords Ordinary differential equations · Hybrid methods · Block methods · Embedded-type procedure

Mathematics Subject Classification 65L04 · 65L05 · 65L06 · 65L20

Communicated by Jose Alberto Cuminato.

✉ Gurjinder Singh
gurjinder11@gmail.com

Rajat Singla
rajatsingla1310@gmail.com

V. Kanwar
vmithil@yahoo.co.in

Higinio Ramos
higra@usal.es

1 Department of Mathematical Sciences, I. K. Gujral Punjab Technical University Jalandhar, Main Campus, Kapurthala, Punjab 144603, India

2 Department of Mathematics, Akal University Talwandi Sabo, Bathinda, Punjab 151302, India

3 University Institute of Engineering and Technology, Panjab University, Chandigarh 160014, India

4 Scientific Computing Group, Universidad de Salamanca, Plaza de la Merced, 37008 Salamanca, Spain

5 Escuela Politécnica Superior de Zamora, Campus Viriato, 49029 Zamora, Spain

Published online: 19 August 2021

East Asian Journal on Applied Mathematics
doi: 10.4208/eajam.251220.291220

Vol. 11, No. 3, pp. 515-539
August 2021

A High-Order Efficient Optimised Global Hybrid Method for Singular Two-Point Boundary Value Problems

Higinio Ramos[1,2] and Gurjinder Singh[3,*]

[1]*Scientific Computing Group, Universidad de Salamanca, Plaza de la Merced, 37008 Salamanca, Spain.*
[2]*Escuela Politécnica Superior de Zamora, Universidad de Salamanca, Campus Viriato, 49022 Zamora, Spain.*
[3]*Department of Mathematical Sciences, I.K. Gujral Punjab Technical University Jalandhar, Main Campus, Kapurthala-144603, Punjab, India.*

Received 25 December 2020; Accepted (in revised version) 29 December 2020.

Abstract. An optimised global hybrid block method for second order singular boundary value problems with two boundary conditions is developed. A special attention is paid to the problems having solutions with singularities at the left end of the interval considered. The method is a combination of the optimised hybrid formulas in [43] and a new set of formulas. The ad hoc procedure is used just to pass the singularity and the main formulas are applied to obtain approximations at other discrete points. Numerical experiments show that the method is a good alternative for the problems studied.

AMS subject classifications: 65L10, 65L10

Key words: Singular boundary value problem, hybrid methods, block methods, optimisation technique.

1. Introduction

Two-point boundary value problems occur in various applications, including fluid flow, shock waves and geophysical models. The problems can be categorised as singular and singularly perturbed ones and we refer the reader to [4] for more information about BVPs. In the present work we are concerned with numerical solution of two-point singular boundary value problems (SBVPs) for ODEs. Such problems frequently occur in practical phenomena such as reaction-diffusion processes, chemical kinetics, physiological processes, thermal-explosion theory, electro hydro-dynamics and shallow membrane caps theory [5, 9, 11, 13, 15, 16, 18, 23]. Since it is not always possible to find closed form solutions of SBVPs, these

*Corresponding author. *Email addresses:* higra@usal.es (H. Ramos), gurjinder11@gmail.com (G. Singh)

Mediterr. J. Math. (2022) 19:85
https://doi.org/10.1007/s00009-022-01982-y

Mediterranean Journal of Mathematics

Explicit Solutions of the Singular Yang–Baxter-like Matrix Equation and Their Numerical Computation

Ashim Kumar, João R. Cardoso and Gurjinder Singh

Abstract. We derive several explicit formulae for finding infinitely many solutions of the equation $AXA = XAX$, when A is singular. We start by splitting the equation into a couple of linear matrix equations and then show how the projectors commuting with A can be used to get families containing an infinite number of solutions. Some techniques for determining those projectors are proposed, which use, in particular, the properties of the Drazin inverse, spectral projectors, the matrix sign function, and eigenvalues. We also investigate in detail how well-known similarity transformations like Jordan and Schur decompositions can be used to obtain new representations of the solutions. The computation of solutions by the suggested methods using finite precision arithmetic is also a concern. Difficulties arising in their implementation are identified and ideas to overcome them are discussed. Numerical experiments shed some light on the methods that may be promising for solving numerically the matrix equation.

Mathematics Subject Classification. 15A24, 65H10, 65F20.

Keywords. Yang–Baxter-like matrix equation, generalized outer inverse, spectral projector, matrix sign function, Schur decomposition.

1. Introduction

This paper deals with the equation

$$AXA = XAX, \tag{1.1}$$

where $A \in \mathbb{C}^{n\times n}$ is a given complex matrix and $X \in \mathbb{C}^{n\times n}$ has to be determined. This equation is called the *Yang–Baxter-like (YB-like, for short) matrix equation*. If A is singular (nonsingular), then the equation (1.1) is said to be the singular (nonsingular) Yang–Baxter-like matrix equation. The equation (1.1) has its origins in the classical papers by Yang [30] and Baxter [1]. Their pioneering works have led to extensive research on the various forms of the Yang–Baxter equation arising in braid groups, knot theory and quantum theory (see, e.g., the books [22,31]). The YB-like equation (1.1) is also known

Published online: 18 March 2022

Applied Mathematics and Computation 421 (2022) 126960

Contents lists available at ScienceDirect

Applied Mathematics and Computation

journal homepage: www.elsevier.com/locate/amc

Solving second order two-point boundary value problems accurately by a third derivative hybrid block integrator

Higinio Ramos [a,b], Gurjinder Singh [c,*]

[a] Scientific Computing Group, Universidad de Salamanca, Plaza de la Merced 37008 Salamanca, Spain
[b] Spain Escuela Politécnica Superior de Zamora, Universidad de Salamanca, Campus Viriato, 49022 Zamora, Spain
[c] Department of Mathematical Sciences, I. K. Gujral Punjab Technical University, Jalandhar, Main Campus, Kapurthala 144603, Punjab, India

ARTICLE INFO

Article history:
Received 30 July 2019
Revised 29 December 2021
Accepted 17 January 2022

Keywords:
Ordinary differential equations
Boundary value problems
Block scheme
Convergence
Optimization strategy

ABSTRACT

This article deals with the development of an optimized third-derivative hybrid block method for integrating general second order two-point boundary value problems (BVPs) subject to different types of boundary conditions (BCs) such as Dirichlet, Neumann or Robin. A purely interpolation and collocation approach has been used in order to develop the method. A constructive approach has been applied in the development of the method to consider two off-step optimal points among an infinite number of possible choices in a two-step block corresponding to a generic interval of the form $[x_n, x_{n+2}]$. The obtained method simultaneously produces an approximate solution over the entire integration interval. Some numerical experiments have been presented that show the good performance of the presented scheme.

1. Introduction

The field of numerical analysis of differential equations is continuously growing due to the gradual development of new models of real-world phenomena. Due to the unavailability of analytical solutions for most differential systems, it is necessary to obtain numerical approximations to the solutions. It is a well-known fact that existing approaches for solving differential equations are modified as the perspectives change or new techniques are developed to get approximate solutions more accurately and efficiently (see [1–54]).

Our goal in this article is to develop an efficient two-step block method in global sense (that produces approximate solutions simultaneously at all nodal points in an interval of interest) and show its good performance in solving second order two-point BVPs of ordinary differential equations (ODEs) of the form

$$u''(x) = f(x, u(x), u'(x)), \quad x \in [a, b], \tag{1}$$

with any one of the given possible types of BCs in Table 1:

Before proceeding, we assume that the equation in (1) together with the given boundary conditions satisfy the requirements that ensure the existence and uniqueness of the true solution (see [1–3]), namely, we assume that the function f is continuous in $[a, b] \times \mathbf{R}^2$ and verifies a Lipschitz condition in the variable $\mathbf{u} = (u, u')$, that is, it holds that for any $\mathbf{u}_1, \mathbf{u}_2 \in \mathbf{R}^2$

* Corresponding author.
E-mail addresses: higra@usal.es (H. Ramos), gurjinder@ptu.ac.in (G. Singh).

https://doi.org/10.1016/j.amc.2022.126960
0096-3003/

Materials Today: Proceedings

Volume 50, Part 5, 2022, Pages 797-803

An investigation on the effect of lime addition on UCS of Indian black cotton soil

Karanbir Singh Randhawa [a], Rajiv Chauhan [b], Raman Kumar [c]

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https://doi.org/10.1016/j.matpr.2021.05.586

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Abstract

The study's objective is to determine the optimum content of lime added to Indian black cotton soil to improve the soil's unconfined compressive strength (UCS). The lime was added to the black cotton soil in varying proportions of 3%, 6%, 9% and 12% of the dry weight of the soil. The engineering properties of weak black cotton soil (BCS) were determined experimentally according to Indian Standard specifications. It was found that the soil under test consisted mainly of silt 75.60% and clay 18.80%. The laboratory testing showed that the value of maximum dry density (MDD) increases from 1.605 gm/cc to 1.693 gm/cc and the UCS value increased from 50.2 kN/m^2 to 90.6 kN/m^2 with 9% addition of lime content and for 28 days of curing time. The UCS of soil–lime mix decreased drastically beyond 9% addition of lime, showing that the optimum value of lime content to strengthen the weak soil is 9%. The strengthening of black cotton soil with the addition of lime as an additive provides stability to the civil engineering structures like sub-base/subgrade for roads and other engineering projects.

Introduction

The black cotton soils have been considered problematic soils to be used for civil engineering applications. These soils possess poor engineering properties and show abnormal shrink-swell behaviour with the variation of moisture content. This property of these soils makes them unfit for civil engineering structures of all types. Moreover, these soils depict low values of strength capacity when used in natural form. This property of black cotton soil can cause heavy damage to civil engineering works. Hence, it becomes of utmost importance to blend these soils with some stabilizing agent before using them. The present study focuses on using lime to improve the unconfined compressive strength (UCS) of Indian black cotton soil. The study decides the maximum lime proportion to be added to the soil to achieve the soil's ultimate strength.

The engineering characteristics of expansive soils have been studied by several researchers [1], [2], [3]. The study of geotechnical properties of an expansive soil from Thailand stabilized with recycled calcium carbide residue (CCR) depicted that the clay treated with recycled CCR with an amount of 5 to 7% of CCR was found fit for fill and pavement sub-base material [2]. The improvements in the properties of expansive soil investigated with fly ash in varying proportions have proposed using "DISC HARROW" to mix expansive soil and fly ash in proper proportion [4]. Job and Sasikumar (2015) investigated the stabilization of clayey soil from Kerala (India) after the addition of CCR and fly ash (FA). It was observed that the addition of 10% CCR results in maximum strength of treated soil [5]. Daipuria and Trivedi [6] studied that adding 20% of sand and 2% cement to the expansive soil (black cotton soil) shows a reduction in swell index, liquid limit and plastic limit from 46% to 6% by 30% and 10%, respectively. Also, there was a decrease of 38% in optimum moisture content and an increase of 12% in maximum dry density (MDD). Hudyma et al. [7] assessed the effect of the addition of varying quantities of silica sand (10–75) % to expansive soils in Las Vegas (USA). It was found that the addition of sand decreased the plasticity and swelling of soil to bring these soils into the category of low expansive soils. Krishnappa [8] studied that the addition of sand, cement and fly ash in different proportions to black cotton soil depicted an increase in maximum dry density (MDD) from 2.02 to 2.07 along with an increase in percentage CBR values of the mix from 2.01 to 5.52. Noolu et al. [9]

Head
Department of Civil Engineering
IKG PTU Main Campus
Kapurthala-144603

International Journal of Computer Networks and Applications (IJCNA)
DOI: 10.22247/ijcna/2021/210724 Volume 8, Issue 6, November – December (2021)

SURVEY ARTICLE

A Survey on Malware Classification Using Machine Learning and Deep Learning

Manish Goyal
Department of Computer Science and Engineering, IK Gujral Punjab Technical University, Kapurthala, Punjab, India
manishgoyalpup@gmail.com

Raman Kumar
Department of Computer Science and Engineering, IK Gujral Punjab Technical University, Kapurthala, Punjab, India
raman.kumarptu@gmail.com

Received: 01 October 2021 / Revised: 12 November 2021 / Accepted: 17 November 2021 / Published: 30 December 2021

Abstract – In today's era, there is fast development in the field of Information Technology. It is a matter of great concern for cyber professionals to maintain security and privacy. Studies revealed that the number of new malware is increasing tremendously. It is a never-ending cycle between the world of attack and the defense of malicious software. Antivirus companies are always putting their efforts to develop signatures of malicious software and attackers are always in try to overcome those signatures. For the detection of malware machine learning are highly efficient. The process of detection of malware is split into two categories first is feature extraction and the second is malware classification. The effectiveness of classification algorithms depends on the feature extracted. In this paper, firstly an in-depth study of the features is provided that can be used to differentiate malware. Thereafter describe the various stages of machine learning and deep learning that researchers use in their research work and the pros and cons they face that can assist new researchers while selecting an algorithm for their research work.

Index Terms – Malware Detection, Static Analysis, Dynamic Analysis, Security, Features of Malware, Machine Learning, Deep Learning.

1. INTRODUCTION

There has been a mushroom growth of malware which is articulated by various encyclopedias such as; in 2014 panda reported 84 million new variants [1]. Similarly, in the 3rdquarter of 2020 McAfee reported new MacOS malware surged 420% [2]. At the stage of inception, the computer virus was developed just for fun. The malicious code that was evolved by teenagers to play pranks with their friends has now turned into a serious malware threat. Malware writers have started using their brains professionally to do unlawful activities such as stealing money, crashing system, burglarizing very important information, etc.

In Dec 1999, the San Diego Supercomputer Center (SDSC) experimented by installing Red Hat Linux 5.2 without any security patches on a computer with an internet connection [3]. The computer was attacked in just 8 hours of installation and in 21 days the computer was attacked 20 times and compromised 40 days after installation.

Anti-virus companies mainly use signature-based detection techniques (it is a technique in which detection of malware is done based on features extracted from previously known malware) to capture malware, but using this technique only known malware can be detected. Zero-day malware (new and unseen malware) can't be detected using this approach. Moreover, malware writers practice evasion techniques like encryption and obfuscation to prevent them from being detected at an early stage. After knowing the catastrophic effects of malware, it is necessary to protect systems from malware.

1.1. Background Motivation

In 2012 Egele et.al. [4] Surveyed the default strategies and tools for malware detection. They first describe the malware and its variants and then the vectors of infection. After that, the malware analysis techniques used are described, namely parameter analysis of function, monitoring of function calls, information flow tracking instruction trace, and automated extensible points. Malware analysis is defined in the context of the user/kernel space, emulator and virtual machine, etc. The researchers explained a lot of tools that run malware samples like Anubis, CWSandbox, Norman Sandbox, Joebox, WiLDCAT, etc. According to their observation, most of the dynamic tools analyze system call and API they are required to interact with the system. Some tools observe the sensitivity of processed data. This information can be used to determine if the sample is malware.

In 2013 Bazrafshan et. al. [5] discussed 3 methods namely, behavior-based, signature-based and heuristic-based malware detection. He first explained these methods and then the strategies to hide the malware. They mainly focus on

International Journal of Image and Graphics

DSIT: A DYNAMIC LIGHTWEIGHT CRYPTOGRAPHY ALGORITHM FOR SECURING IMAGE IN IOT COMMUNICATION

NAVDEEP LATA
Research Scholar, Department of Computer Science and Engineering,
I.K. Gujral Punjab Technical University,
Kapurthala, Punjab, India.
ernavdeeplata@gmail.com

RAMAN KUMAR
Assistant Professor, Department of Computer Science and Engineering,
I.K. Gujral Punjab Technical University,
Kapurthala, Punjab, India.
er.ramankumar@aol.in

Received (Day Month Year)
Revised (Day Month Year)
Accepted (Day Month Year)

One of the most significant challenges appears to be securing the IoT communication network. As a corollary, information security has become the basis for establishing trustworthiness in IoT network communication. Cryptography is one of the ways for securing information in this case. However, the majority of current approaches are static, making them subject to security threats. As a consequence, a new concept, dynamic encryption, is growing rapidly in IoT communication. In the present paper, a dynamic encryption algorithm (DSIT) has been proposed to secure IoT communication. This algorithm is based on Feistel and Substitution Permutation Network (SPN). DSIT is a block cipher that takes the 64-bit block of plaintext, 64-bit secret key, and a secret dynamic box (D-box) as input. It produces a 64-bit ciphertext by performing 8 rounds of the DSIT algorithm. For each round, the key and D-box are updated. This dynamic effect provides high security to a dynamic IoT network. The proposed algorithm has been executed in IoT environment using Raspberry Pi 3 Model B+ and 50% average Avalanche effect has been achieved. The proposed algorithm efficiently encrypts the image data to secure the communication and high resistant to Cryptanalysis attacks.

Keywords: Dynamic Encryption; IoT; IoT security; Lightweight Cryptography.

1. Introduction

The IoT is enabling resource-constrained devices to accomplish different jobs in many emerging areas. It has given devices the ability to do computation, communication, and intelligent decisions utilising the internet.[1]. This resource sharing and internet connectivity among devices makes human life very comfortable. It is

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 10 Issue: 1s
DOI: https://doi.org/10.17762/ijritcc.v10i1s.5817
***Article Received**: 21 August 2022 **Revised**: 26 October 2022 **Accepted**: 18 November 2022*

A Multi-Level Enhanced Color Image Compression Algorithm using SVD & DCT

Garima Garg[1], Raman Kumar[2]
Department of Computer Science and Engineering, IKGPTU, Kapurthala, Punjab, India
Email: [1]garimagarghce@gmail.com, [2]er.ramankumar@aol.in

Abstract
Nowadays, computer technology is mostly concerned with storage capacity and performance. Compression of digital images has become a fundamental aspect of their transmission and storage. Due to storage and bandwidth constraints, it has become necessary to compress images before to transmission and storage. Not only can image compression techniques help to reduce storage space requirements, but they also aid increase transmission bandwidth. Color images are in trend these days during communication. Most of the researchers have worked only on grayscale images. This research proposes a hybrid approach that encompasses two cutting-edge picture compression algorithms: DCT & SVD. This research involves the advantages and strength of two cutting-edge picture compression algorithms that enable us to compress the color images without additional cost in computation, space and time. Here in this research, for experimental purposes, seam carving image dataset is used. The proposed method's performance is evaluated using the performance evaluation matrices, i.e., Size after Compression, MSE, PSNR, Normalized Co-relation (NC), Percentage Space-Saving, and Compression Ratio. The proposed method performance is also correlated with the two latest image compression techniques, i.e., DCT Block Truncation (DCTBT) and Discrete Cosine Transform - Vector Quantization (DCT-VQ). The findings show that the suggested hybrid color image compression approach is superior to existing compression according to different performance metrics.

Keywords: Hybrid Image Compression, Singular Value Decomposition (SVD), Compression, Discrete Cosine Transform (DCT), and Discrete Wavelet Transform (DWT).

I. Introduction

Image compression has become an ever–growing component and source of worry in the context of mental image quality and file size as a result of the rise of multimedia technologies (Joshi & Sarode, 2020; Dixit, 2020). Compression of data aims to eliminate redundancy in order to save money on archiving and data transmission bandwidth. Lossless compression, in which the restored image is completely identical however, it has a very low compression ratio and a lossy compression, where there is a very high compression ratio but there is a lot of data loss, are indeed the two forms of compression. We set our sights on lossy compression in particular. The SVD, DWHT, DWGT, DCT, DFT are all employed in the DWT. These are all symmetric, unitary, and reversible transformations. The primary objective is to investigate picture compression algorithms based on transforms techniques for more efficient data transfer and storage, while preserving compression rates and SNR ratio balance (Cooper & Lorenc, 2006). Despite rapid increases in mass storage density, processing speeds continues to surpass present options. Not only has the recent growth of data-intensive multimedia-based web services reaffirmed the need for more efficient signal and image encoding, but it has also elevated signal compression to a critical component of storage and communication technologies (Aishwarya et al., 2016).

Data compression is necessary for successful data transmission and storage because to the channel's constrained bandwidth and the memory space constraint, which prevents severe information loss (Jayasankar et al., (2021)). There are various methods for performing data compression, including audio, image, video, and document compression (Chen et al., (2019)). An image can contain three different forms of information: relevant, redundant, and valuable. For picture compression, irrelevant information might be omitted. While valuable information is neither redundant nor irrelevant, redundant information is essential for drawing attention to features in images. We cannot correctly rebuild or decompress photos without accurate information (Piran et al., (2020)). Two main types can be found in image compression. The first type of picture compression preserves all information, while the second type is lossy. For small-size data, lossless picture compression algorithms are particularly effective (Jamil & Piran, (2022)). But in this paper we are going to be working on the hybrid algorithms that is the combination of the SVD and DCT methods.

Computers, Materials & Continua
DOI: 10.32604/cmc.2022.022904
Article

Tech Science Press

Detection of Behavioral Patterns Employing a Hybrid Approach of Computational Techniques

Rohit Raja[1], Chetan Swarup[2], Abhishek Kumar[3,*], Kamred Udham Singh[4], Teekam Singh[5], Dinesh Gupta[6], Neeraj Varshney[7] and Swati Jain[8]

[1]Department of Information Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur, 495009, India
[2]Department of Basic Science, College of Science & Theoretical Studies, Saudi Electronic University, 13316, Saudi Arabia
[3]Department of Computer Science & IT, JAIN (Deemed to be University), Bangalore, 560069, India
[4]Computer Science and Information Science, Cheng Kung University, 621301, Taiwan
[5]School of Computer Science, University of Petroleum and Energy Studies, Dehradun, 248007, India
[6]Department of CSE, I K Gujral Punjab Technical University, Jalandhar, 144603, India
[7]Department of Computer Engineering and Applications, GLA University, Mathura, 281406, India
[8]Department of Computer Science, Government J Yoganandam Chhattisgarh College, Raipur, 492001, India
*Corresponding Author: Abhishek Kumar. Email: abhishek.maacindia@gmail.com
Received: 22 August 2021; Accepted: 17 January 2022

Abstract: As far as the present state is concerned in detecting the behavioral pattern of humans (subject) using morphological image processing, a considerable portion of the study has been conducted utilizing frontal vision data of human faces. The present research work had used a side vision of human-face data to develop a theoretical framework via a hybrid analytical model approach. In this example, hybridization includes an artificial neural network (ANN) with a genetic algorithm (GA). We researched the geometrical properties extracted from side-vision human-face data. An additional study was conducted to determine the ideal number of geometrical characteristics to pick while clustering. The close vicinity of minimum distance measurements is done for these clusters, mapped for proper classification and decision process of behavioral pattern. To identify the data acquired, support vector machines and artificial neural networks are utilized. A method known as an adaptive-unidirectional associative memory (AUTAM) was used to map one side of a human face to the other side of the same subject. The behavioral pattern has been detected based on two-class problem classification, and the decision process has been done using a genetic algorithm with best-fit measurements. The developed algorithm in the present work has been tested by considering a dataset of 100 subjects and tested using standard databases like FERET, Multi-PIE, Yale Face database, RTR, CASIA, etc. The complexity measures have also been calculated under worst-case and best-case situations.

Keywords: Adaptive-unidirectional-associative-memory technique; artificial neural network; genetic algorithm; hybrid approach

Integration of Multi-Class Service Paradigm With Generic Trust Mechanism for Innovation, Customization and Adaptability in MANETs

Authors: Nitin Khanna, Sandeep Singh, Anshu Bhasin, Kamal Malik Authors Info & Claims

International Journal of Information Retrieval Research, Volume 12, Issue 3 • Aug 2022 • pp 1–15 • https://doi.org/10.4018/IJIRR.300290

Published: 26 August 2022 Publication History

Abstract

Trust-based mechanisms are widely used in wireless networks of different kinds for providing security against attack. Trust mechanism provides security from various attacks using both detective and preventive manner. This paper presents a quality service paradigm that can be integrated with any underlying trust mechanism. The paradigm includes different flags corresponding to different services incorporated in various routing packets. The paradigm provides flexible customization and adaptability as per the demand of communicating nodes for effective data transfer. Various quality service classes are designed to formulate route as per the requirement to minimize the routing overhead and balancing of load among nodes. This paradigm power is the trust mechanism with proactive action for detection of malicious nodes

Ad Hoc & Sensor Wireless Networks, Vol. 50, pp. 277–303
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NMTBR: Normalized Multilevel Trust Based Routing for Security Against Packet Drop Attacks in MANETs

NITIN KHANNA[1,*], SANDEEP SINGH[2], ANSHU BHASIN[3] AND KAMAL MALIK[4]

[1]Kanya Maha Vidyalaya, Jalandhar, India
[2,4]CT University, Ludhiana, India
E-mail: Sandeep_madda@yahoo.co.in, kamal17203@ctuniversity.in
[3]I.K.G. Punjab Technical University, Kapurthala, India
E-mail: anshukmv@gmail.com

Received: June 13, 2021. Accepted: September 6, 2021.

Purpose: This paper aims to put forward a quarantine phased normalized multilevel trust based routing mechanism for mitigation of packet drop attacks in MANET.

Design/methodology/approach: The new mechanism uses the Packet Forwarding Ratio, Residual energy, Connectivity Index, Link Quality Index and Control Flow Ratio to calculate the slotted trust value. Then final trust is calculated by balancing current slotted trust and historical trust. The enhancement in base routing protocol is performed to support trust notion, dissemination for isolation, and effective routing. Further, the quarantine phase algorithm is proposed to minimize the false positivity which makes trust based system more accurate. Dissemination procedure and local neighbourhood recommender system is employed for isolation of malicious node with increased accuracy.

Findings: A reliable routing paradigm is presented that boosts the mitigation mechanism. The routing paradigm is enhanced with introduction of new fields in existing packets of generic routing protocol. This enhancement is done to incorporate the notion of trust. Some new packets added in base routing protocol to help in dissemination, validation and recommendation as well. With the help of this, a secure and reliable route is formed that helps in prevention of attacks. The advantage of new mechanism is that it accurately mitigate and isolate packet drop attacks with

*Corresponding author: E-mail address: nitinkhanna300@gmail.com

3.4.5 Number of research papers per teacher in the Journals notified on UGC website during the session 2021-22

3.4.5.1: Number of research papers in the Journals notified on UGC website during the session 2021-22

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal
1	Torsion strength of TIG welded similar and dissimilar metal joints of ASME SA213 Gr.T11 and BS3059:1987 PT1 ERW320	Sewa Singh, Vikas Chawla, Gurbhinder Singh Brar	Mechanical Engineering	Springer	2021	0302-9743	https://link.springer.com/article/10.1007/s12046-021-01750-w
2	Microstructure and characterization of LVOF sprayed aluminium oxide-13% titanium dioxide and aluminium oxide-40% titanium dioxide coatings on ASTM 316 boiler steel	Shehbaaz Singh Brar, Gurbhinder Singh Brar, Vikas Chawla	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.10.413
3	Characterization of D-gun sprayed Al2O3-13%TiO2 and Al2O3-40%TiO2 coatings on ASTM 316 boiler steel and their microstructure	Shehbaaz Singh Brar, Gurbhinder Singh Brar, Vikas Chawla	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.10.005
4	Analysis of plasma gun sprayed coatings on SS-304 steel to evaluate cyclic oxidation and hot corrosion	Satjot Singh Dhillon, Vikas Chawla, Gurbhinder Singh	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.09.120
5	Analysis of solid particle erosion in plasma sprayed alumina based coatings on SAE-347H steel	Satjot Singh Dhillon, Vikas Chawla, Gurbhinder Singh	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.08.072
6	Hot corrosion behavior of HVOF-sprayed carbide based composite coatings for boiler steel in Na2SO4–60 % V2O5 environment at 900 °C under cyclic conditions	Gurmail Singh, Niraj Bala, Vikas Chawla, Yogesh Kumar Singla	Mechanical Engineering	Corrosion Science	2021	0010-938X	https://doi.org/10.1016/j.corsci.2021.109666
7	Wear studies on plasma-sprayed pure and reinforced hydroxyapatite coatings	Vikas Rattan, T S Sidhu, Manoj Mittal	Mechanical Engineering	Materials today: proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.12.306
8	Erosive wear behavior of Microwave Processed WC-10Co-4Cr clad on SS-316	Paramjit Singh, Deepak Kumar Goyal, Amit Bansal	Mechanical Engineering	Journal of Emerging Technologies and Innovative Research	2021	2349-5162	UGC Approved Journal no 63975
9	Electrochemical corrosion and erosive wear behaviour of microwave processed WC-10Co4Cr clad on SS-316	Paramjit Singh, Deepak Kumar Goyal, Amit Bansal	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://www.scopus.com/sourceid/21100370037
10	Investigations on the effect of electrical discharge machining process parameters on the machining behavior of aluminium matrix composites	Dar, Sajad Ahmad, Jatinder Kumar, Shubham Sharma, Gursharan Singh, Jujhar Singh, Vivek Aggarwal, Jasgurpreet Chohan et al.	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.07.126
11	Analysis and optimization of nozzle distance during turning of EN-31 steel using minimum quantity lubrication	Kumar, Ajay, Gurpreet Singh, and Vivek Aggarwal	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.07.060
12	Experimental investigations and optimization of machining performance during turning of EN-31 steel using TOPSIS approach	Singh, Gurpreet, Ajay Kumar, Vivek Aggarwal, and Sehijpal Singh	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.07.381

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13	Experimental investigations into machining performance of Hastelloy C-276 in different cooling environments	Singh, Gurpreet, Vivek Aggarwal, and Sehijpal Singh	Mechanical Engineering	Materials and Manufacturing Processes	2021	1532-2475	https://doi.org/10.1080/10426914.2021.1945099
14	Comparative Study of High-Temperature Oxidation Behavior of Bare and Plasma Sprayed Al2O3-40% TiO2 Coated T-91, A-1 Boiler Steel and Superfer800H Superalloy in Air	Ansari, Mohd Shadab, Vikas Chawla, Amit Bansal, and Vivek Aggarwal	Mechanical Engineering	Journal of Materials Engineering and Performance	2021	1059-9495	https://link.springer.com/article/10.1007/s11665-021-06187-0
15	Ecological aspects of cutting fluids applications in small scale industries of Northern India region	Gurpreet Singh, Sehijpal Singh, Vivek Aggarwal, Jujhar Singh, Neelkanth Grover, Amoljit Singh Gill	Mechanical Engineering	Materials Today: Proceedings	2021	2214-7853	https://doi.org/10.1016/j.matpr.2021.08.348
16	Recent Trends and Developments in Conducting Polymer Nanocomposites for Multifunctional Applications	Shubham Sharma, P. Sudhakara, Abdoulhdi A. Borhana Omran, Jujhar Singh and R. A. Ilyas	Mechanical Engineering	Polymers	2021	2073-4360	https://doi.org/10.3390/polym13172898
17	Optimisation of engine operating variables on performance and emission characteristics of biogas fuelled CI engine by the design of experiments: Taguchi approach	Sunil Kumar Mahla, Tarun Goyal, Deepam Goyal, Himanshu Sharma, Amit Dhir, Geetesh Goga	Mechanical Engineering	Environmental Progress & Sustainable Energy	2021	1944-7450	https://doi.org/10.1002/ep.13736
18	COVID-19 pandemic: A seismically disruptive environmental event	R.K. Dang, D.Goyal, T.Goyal, N.Mago	Mechanical Engineering	ECS Transactions	2022	1938-6737	DOI 10.1149/10701.5553ecst
19	Mechanical, morphological, and fracture deformation behavior of MWCNTs-reinforced (Al–Cu–Mg–T351) alloy cast nanocomposites fabricated by optimized mechanical milling and powder metallurgy techniques	Shubham Sharma, Vikas Patyal, P. Sudhakara, Jujhar Singh, Michal Petru, and R. A. Ilyas	Mechanical Engineering	Nanotechnology Reviews	2022	2191-9097	https://doi.org/10.1515/ntrev-2022-0005
20	Hand and abrasive flow polished tungsten carbide die: optimization of surface roughness, polishing time and comparative analysis in wire drawing	Kumar, Raman, Sehijpal Singh, Vivek Aggarwal, Sunpreet Singh, Danil Yurievich Pimenov, Khaled Giasin, and Krzysztof Nadolny	Mechanical Engineering	Materials	2022	1996-1944	https://doi.org/10.3390/ma15041287
21	.6 Si-0.375 Cr-0.25 Zn metal matrix nanocomposites for engineering applications: Fabrication and morphological analysis	Muni, Ram Narayan, Jujhar Singh, Vineet Kumar, Shubham Sharma, P. Sudhakara, Vivek Aggarwal, and S. Rajkumar	Mechanical Engineering	Journal of Nanomaterials	2022	1687-4129	https://doi.org/10.1155/2022/2188705
22	Investigation of geo-mining green roof seismic energy balancing with resin bolting by Universal Drilling Machine: a novel energy-absorbing-based support system	Siddiqui, Mohd Ahtesham Hussain, Shahzad Akhtar, Somnath Chattopadhyaya, Shubham Sharma, Mamdouh El Haj Assad, Jujhar Singh, Vivek Aggarwal, Shashi Prakash Dwivedi, and Ambuj Saxena	Mechanical Engineering	Arabian Journal of Geosciences	2022	1866-7511	https://link.springer.com/article/10.1007/s12517-022-09594-2

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23	Cavitation erosion behavior of high velocity oxy fuel (HVOF) sprayed (VC + CuNi-Cr) based novel coatings on SS316 steel	Vikrant Singh, Indraj Singh, Anuj Bansal, Ankita Omer, Anil Kumar Singla, Rampal, Deepak Kumar Goyal	Mechanical Engineering	Surface & Coatings Technology, Elsevier	2022	0257-8972	https://mjl.clarivate.com:/search-results?issn=0257-8972&hide_exact_match_fl=true&utm_source=mjl&utm_medium=share-by-link&utm_campaign=search-results-share-this-journal
24	Influence of laser cladding parameters on slurry erosion performance of NiCrSiBC + 50WC claddings	Sarpreet Singh, Deepak Kumar Goyal, Parlad Kumar, Anuj Bansal	Mechanical Engineering	International Journal of Refractory Metals & Hard Materials, Elsevier	2022	0263-4368	https://mjl.clarivate.com:/search-results?issn=0263-4368&hide_exact_match_fl=true&utm_source=mjl&utm_medium=share-by-link&utm_campaign=search-results-share-this-journal
25	CFD and experimental study of slurry erosion wear in Hydro-machinery	Mithlesh Sharma, Deepak Kumar Goyal, Gagandeep Kaushal, Neel Kanth Grover, Anuj Bansal, Khushdeep Goyal	Mechanical Engineering	Materials Today: Proceedings	2022	2214-7853	https://www.scopus.com/sourceid/21100370037
26	Effect of filler material on the microwave joining of SS-430 steel	D. S. Sahota, Amit Bansal & Vinod Kumar	Mechanical Engineering	Materials and Manufacturing Processes	2022	1042-6914	https://doi.org/10.1080/10426914.2022.2149784
27	Effect of post-heat treatment on the microstructural, mechanical, and bioactivity behavior of the microwave-assisted alumina-reinforced hydroxyapatite cladding	Pradeep Singh, Hitesh Vasudev , Amit Bansal	Mechanical Engineering	Journal of Process Mechanical Engineering	2022	20413009	doi:10.1177/09544089221116168
28	Hydroxyapatite reinforced surface modification of SS-316L by microwave processing	Parmjit Singh, Amit Bansal, Vinod Kumar Verma,	Mechanical Engineering	Surfaces and Interfaces	2022	2468-0230	https://www.scopus.com/sourceid/21100788797
29	First and second order analysis of functionally graded composite material	Sharma, Rajesh, Vijay Kumar Jadon, Balkar Singh, Rajneesh Kumar, and Sanjeev Kumar	Mechanical Engineering	Materials Today: Proceedings	2022	2214-7853	https://doi.org/10.1016/j.matpr.2021.11.658
30	Experimental Investigation and Performance Optimization during Machining of Hastelloy C-276 Using Green Lubricants	Singh, Gurpreet, Vivek Aggarwal, Sehijpal Singh, Balkar Singh, Shubham Sharma, Jujhar Singh, Changhe Li, R. A. Ilyas, and Abdullah Mohamed	Mechanical Engineering	Materials	2022	1996-1944	https://doi.org/10.3390/ma15155451
31	Effect of post coating processing on the morphological and mechanical properties of plasma Spray-reinforced hydroxyapatite coating	Gursharan Singh, Manoj Mittal, Jujhar Singh et.al.	Mechanical Engineering	Materials Today: proceedings	2022	2214-7853	https://doi.org/10.1016/j.matpr.2022.10.108

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32	Impact of post-heat-treatment on the surface-roughness, residual stresses, and micromorphology characteristics of plasma-sprayed pure hydroxyapatite and 7%-Aloxitereinforced hydroxyapatite coatings deposited on titanium alloy-based biomedical implants	Gursharan Singh, Shubham Sharma, Manoj Mittal, Gurminder Singh, Jujhar Singh, Li Changhe, Aqib Mashood Khan, Shashi Prakash Dwivedi, Ray Tahir Mushtaq, Sunpreet Singh	Mechanical Engineering	Journal of Materials research and Technology	2022	2238-7854	https://doi.org/10.1016/j.jmrt.2022.03.065
33	Study on the morphological and mechanical properties of TaC reinforced plasma spray coating deposited on titanium alloy	Gursharan Singh, Manoj Mittal, Jujhar Singh, Shubham Sharma, Amoljit Singh Gill, Jasgurpreet Singh Chohan, Raman Kumar, Abhishek Joshi	Mechanical Engineering	Materials Today: proceedings	2022	2214-7853	https://doi.org/10.1016/j.matpr.2022.11.024
34	Microwave processing and characterization of alumina reinforced HA cladding for biomedical applications	Arun Sharma, Avtar Singh, Vikas Chawla, J.S. Grewal, Amit Bansal	Mechanical Engineering	Materials Today: proceedings	2022	2214-7853	https://doi.org/10.1016/j.matpr.2022.02.069

3.4.5

Number of research papers per teacher in the Journals notified on UGC website during the session 2021-22

3.4.5.1: Number of research papers in the Journals notified on UGC website during the session 2021-22

Year	2021	2022	Total
Number	17	17	34

No. of full time teachers = 11

Total No. of Research Papers (2021-22) : 34

Average : 34/11 = 3.09

Data Requirements: (As per Data Template)

- Title of paper
- Name of the author/s
- Department of the teacher
- Name of journal
- Year of publication
- ISBN/ISSN number

Formula: Number of publications in UGC notified of journals during the session 2021-22 / Average of teachers during the session 2021-22

File Description (Upload)

- Any additional information: Nil
- List of research papers by title, author, department, name and year of publication (Data Template)

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Published: 29 October 2021

Torsion strength of TIG welded similar and dissimilar metal joints of ASME SA213 Gr.T11 and BS3059:1987 PT1 ERW320

Sewa Singh ✉, Vikas Chawla & Gurbhinder Singh Brar

Sādhanā **46**, Article number: 231 (2021) | Cite this article

Abstract

Tungsten Inert Gas (TIG) welding has been learnt to be the most widely used technique among the fusion welding techniques. Welding of different components of boilers is preferably accomplished by TIG welding, due to the process capabilities of the technique to produce sound joints, even in case of Dissimilar Metal Joints (DMJ). DMJs owing to the techno-economic advantages, find vast area of application especially in boiler fabrication industry. It

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Volume 50, Part 5, 2022, Pages 2474-2481

Microstructure and characterization of LVOF sprayed aluminium oxide-13% titanium dioxide and aluminium oxide-40% titanium dioxide coatings on ASTM 316 boiler steel

Shehbaaz Singh Brar [a], Gurbhinder Singh Brar [b], Vikas Chawla [c]

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https://doi.org/10.1016/j.matpr.2021.10.413

Abstract

Mostly common issue in power generation plant is recognised as disintegration or degradation of steels used in boilers in recent days and main causes for this type of

materialstoday: PROCEEDINGS

Volume 50, Part 5, 2022, Pages 2299-2306

Characterization of D-gun sprayed Al_2O_3-13%TiO_2 and Al_2O_3-40%TiO_2 coatings on ASTM 316 boiler steel and their microstructure

Shehbaaz Singh Brar [a], Gurbhinder Singh Brar [b], Vikas Chawla [c]

[a] IKGPTU Kapurthala, Punjab, India
[b] Anand College of Engineering & Management, Kapurthala, Punjab, India
[c] Mechanical Engineering Department, IKGPTU Kapurthala, Punjab, India

Received 15 August 2021, Revised 29 September 2021, Accepted 2 October 2021, Available online 6 November 2021, Version of Record 7 February 2022.

https://doi.org/10.1016/j.matpr.2021.10.005

materialstoday: PROCEEDINGS

Volume 50, Part 5, 2022, Pages 1580-1590

Analysis of plasma gun sprayed coatings on SS-304 steel to evaluate cyclic oxidation and hot corrosion

Satjot Singh Dhillon [a], Vikas Chawla [b], Gurbhinder Singh [c]

[a] Mech. Engg., I.K.G.P.T.U., Kapurthala, Punjab, India
[b] Dean Academics, I.K.G.P.T.U, Kapurthala, Punjab, India
[c] Anand College of Engg. and Management, Kapurthala, Punjab, India

Received 21 August 2021, Revised 1 September 2021, Accepted 8 September 2021, Available online 13 October 2021, Version of Record 7 February 2022.

https://doi.org/10.1016/j.matpr.2021.09.120 ↗

materialstoday: PROCEEDINGS

Volume 50, Part 5, 2022, Pages 1210-1220

Analysis of solid particle erosion in plasma sprayed alumina based coatings on SAE-347H steel

Satjot Singh Dhillon [a], Vikas Chawla [b], Gurbhinder Singh [c]

[a] Mech. Engg., I.K.G.P.T.U., Kapurthala, Punjab, India
[b] Dean Academics, I.K.G.P.T.U, Kapurthala, Punjab, India
[c] ACEM, Kapurthala, Punjab, India

Received 7 July 2021, Revised 6 August 2021, Accepted 11 August 2021, Available online 26 August 2021, Version of Record 7 February 2022.

https://doi.org/10.1016/j.matpr.2021.08.072

Corrosion Science 190 (2021) 109666

Contents lists available at ScienceDirect

Corrosion Science

journal homepage: www.elsevier.com/locate/corsci

Hot corrosion behavior of HVOF-sprayed carbide based composite coatings for boiler steel in Na_2SO_4–60 % V_2O_5 environment at 900 °C under cyclic conditions

Gurmail Singh [a], Niraj Bala [b], Vikas Chawla [c], Yogesh Kumar Singla [d,*]

[a] Department of Aerospace Engineering, Chandigarh University, Gharuan, 140413, India
[b] Department of Mechanical Engineering, NITTTR, Chandigarh, 160019, India
[c] Department of Mechanical Engineering, IKGPTU, Jalandhar, 144603, India
[d] Department of Materials Science and Engineering, Case Western Reserve University, Cleveland, OH 44106, USA

ARTICLE INFO

Keywords:
Boiler steel
Hot corrosion
HVOF spray
Protective oxides
Composite coatings

ABSTRACT

Hot corrosion behavior of HVOF sprayed coatings, namely NiCrAlY-SiC and NiCrAlY-B_4C deposited on T22 steel were studied for 50 cycles at 900 °C in an Na_2SO_4-60 wt%V_2O_5 molten-salt environment. Compound formations and microstructure were analyzed using XRD, SEM-EDS and EDS mapping techniques. Uncoated T22 steel suffered an accelerated corrosion attack due to the formation of unprotective FeO, Fe_2O_3, FeS and $FeSO_4$ phases. NiCrAlY-SiC coatings showed formation of a protective layer containing SiO_2, Al_2O_3, Cr_2O_3, NiO with spinals phases, whereas NiCrAlY-B_4C coatings featured layers comprising B_2O_3, Al_3BC, Al_2O_3, Cr_2O_3 and spinals phases. NiCrAlY-SiC coatings delivered greater hot corrosion resistance than NiCrAlY-B_4C coatings.

1. Introduction

The boiler heat exchanger's components like super-heater (SH) and re-heater (RH) pipes are always exposed to chemically aggressive environments at elevated temperatures greater than 750 °C. Even though the alloys used for these tubes are designed to sustain a considerable service life-time, the intended lifespan is often shortened due to hot corrosion attack. The failure of tubes because of this is evident in the subjected alloy surfaces [1]. Type-I hot corrosion usually been witnessed at a temperature between the melting point (T_m) of the surface deposit and vapor deposition dew point (T_{dp}) for the deposit. For instance, the formation of sodium sulfate (Na_2SO_4) deposits, which have 884 °C T_m and T_{dp} lies in the temperature range of 810–900 °C. A dominant presence of fused Na_2SO_4 salt (which is an ionic conductor) originates the electrochemical corrosion mechanism. The acid/base nature of this oxyanion salt causes dissolution (fluxing) of the typically protective oxide scale. During fluxing mechanism, the protective oxide is favored to dissolve at oxide/scale interface and re-precipitate as non-protective particles within salt film. This form of corrosion damage is generally characterized by the appearance of internal sulfide phases in a zone of selective alloy depletion beneath a fairly smooth scale-metal interface. The typical temperature ranges quoted for this type of attack are 750–900 °C. As economical low grade coal or oil as boiler fuel produces numerous impurities like Na, Cl, V and S, which in turn generate certain oxides, alkali and alkaline-earth sulfates compounds, hardwear surfaces of industrial boilers are constantly exposed to hot corrosion environments. During combustion, these compounds combine to form low-melting eutectics, for example $Na_2O{\cdot}V_2O_4{\cdot}11V_2O_5$ (T_m =535 °C) on the tubes. These formations would cause Type II hot corrosion at a lower range of temperatures (600–750 °C). This form of attack relies on the formation of a complex mixed metal sulfate deposit. The corrosion mechanism occurs over the stability range of the liquid deposit from its melting point to its dissociation temperature. In practice, the temperature ranges of Type I and Type II hot corrosion are affected by the composition of deposits formed.

In general, a film made from amalgam of Na_2SO_4 and vanadium-pentoxide (V_2O_5) melt is often observed on industrial boiler components. The Na_2SO_4 (T_m =884 °C) with 60 %V_2O_5 (T_m =670 °C) could form liquefied salt $NaVO_3$ (T_m =610 °C), and eutectic reactions can happen at lower temperatures. These compound formations originate and promote hot corrosion reactions and ultimately result in shortened lifetimes of boiler tube materials [2–4].

In order to protect the materials of high temperature working boilers, several protective measure techniques can be adopted, such as suitable

* Corresponding author.
E-mail address: yogesh123s@gmail.com (Y.K. Singla).

https://doi.org/10.1016/j.corsci.2021.109666
Received 8 September 2020; Received in revised form 4 July 2021; Accepted 4 July 2021
Available online 6 July 2021

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Wear studies on plasma-sprayed pure and reinforced hydroxyapatite coatings

Vikas Rattan [a,*], Tejinder Singh Sidhu [b], Manoj Mittal [c]

[a] Lyallpur Khalsa College Technical Campus, Jalandhar-Cantt Road, Jalandhar City 144001, Punjab, India
[b] Shaheed Bhagat Singh State University, Moga Road (NH-95), Ferozepur 152004, Punjab, India
[c] Mechanical Engineering Department, Inder Kumar Gujral Punjab Technical University, Jalandhar-Kapurthala Highway, Kapurthala 144603, Punjab, India

ARTICLE INFO

Article history:
Received 27 November 2021
Accepted 16 December 2021
Available online xxxx

Keywords:
Hydroxyapatite
Wear
Plasma spraying
Pure Ti
Aluminium oxide
Microstructure

ABSTRACT

The wear properties of hydroxyapatite (HA_{pure}) coatings and HA_{pure} coatings reinforced with 15 wt-% aluminium oxide (Al_2O_3) are described in this paper. Scanning Electron Microscopy (SEM) with Energy Dispersive X-ray Spectroscopy (EDX) and X-ray Diffraction (XRD) were used to examine the coated samples. Wear tests on coatings were carried out using a Tribometer (Ball on a disc assembly). The wear resistance in $HA_{+15\ wt\text{-}\%}\ Al_2O_3$ coatings (wear rate = 4.9×10^{-3} mm^3/N-m) was found to be better than HA_{pure} coatings (wear rate = 8.4×10^{-3} mm^3/N- m). The results revealed that adding Al_2O_3 to the coatings has a considerable impact on their tribological properties.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Diamond and Carbon Materials 2020.

1. Introduction

Surgical implants such as orthopaedic implants (knee and hip joints) and dental implants are normally manufactured from metallic materials [1]. A large variety of metals and alloys are available for the manufacturing of bioimplants but very few of them are biocompatible. These materials are broadly categorized into four groups: titanium and its alloys, stainless steels, cobalt-based alloys and others like (NiTi, magnesium and its alloys and Tantalum). The Food and Drug Administration (FDA) of the USA has approved the range of materials grouped in the first three categories to be used for the manufacturing of medical implants [2–4]. Commercially pure titanium (cp- Ti) and titanium alloys (e.g. Ti-6Al-4V) are generally used as implant materials for orthopaedics and dentistry applications because of their good metal characteristics and biocompatibility. A very good amalgamation of biomaterial properties like lightweight, high specific strength, high resistance to corrosion and integration with the surrounding bones make the cp-Ti the foremost choice of the implant materials [5,6]. Metallic implants, on the other hand, suffer from challenges such as debris build-up due to wear, the release of unwanted metal ions and corrosion which are responsible for implant dislocation. These issues can be addressed by utilizing hydroxyapatite-coated implants. Plasma electrolytic oxidation, Plasma spraying, sol-gel, electrophoretic deposition, and pulsed laser deposition are among the surface modification techniques used by the researchers to coat hydroxyapatite onto metallic implants [7–13]. Among the several technologies outlined the FDA has recommended plasma spraying for biomedical coatings applications. The hydroxyapatite coating facilitates the biocompatibility and bone adherence of the implants [6]. For biomedical applications, Hydroxyapatite [$Ca_{10}(PO_4)_6(OH)_2$], is a potential candidate as it has a chemical structure (Ca/P ratio: 1.67) very close to the human bone. Due to its highly bioactive nature, prosthesis becomes stable within a very short span of time because apatite or the bone layer starts growing from the existing bone walls into the implant coated with hydroxyapatite. However, due to its poor mechanical characteristics, it is not suitable for orthopaedic applications such as hip and knee joints that must bear load [9,14–17]. The problem can be addressed by reinforcing HAp with bioinert materials that have better mechanical attributes. The composite coatings can be formulated on bioinert metallic substrates like titanium and its alloys, stainless steels, etc. This enhances their applicability as a biomaterial, which has to work under stress by taking advantage of the mechanical properties of the substrate [18–21]. Researchers have used reinforcements like CNT's, TiO_2, Al_2O_3, Al_2O_3 - fluorapatite and

* Corresponding author at: Lyallpur Khalsa College Technical Campus, Jalandhar-Cantt Road, Jalandhar City 144001, Punjab, India.
E-mail address: akshatrattan@gmail.com (V. Rattan).

https://doi.org/10.1016/j.matpr.2021.12.306
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the International Conference on Diamond and Carbon Materials 2020.

Please cite this article as: V. Rattan, T. Singh Sidhu and M. Mittal, Wear studies on plasma-sprayed pure and reinforced hydroxyapatite coatings, Materials Today: Proceedings, https://doi.org/10.1016/j.matpr.2021.12.306

JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

EROSIVE WEAR BEHAVIOR OF MICROWAVE PROCESSED WC10Co4Cr CLAD ON SS-316

[1]Paramjit Singh, [2]Dr. Deepak Kumar Goyal, [3*]Dr. Amit Bansal

[1]Ph.D student, [2]Assistant Professor, [3]Assistant professor

[1,2,3] Department of Mechanical Engineering,

[1,2,3] Inder Kumar Gujral Punjab Technical University, Jalandhar, India

Abstract: The current study focused on deposition of protective clad of WC10Co4Cr on alloy steel (SS-316) through microwave technique. The layer was deposited in an industrial microwave oven functioned at 1.20 kW and 2.45 GHz. The XRD observation revealed the cluster of carbide phases in W-Cr-Fe based hexagonal matrix. The SEMsurveillance showed a homogenous reinforced skeleton and dense microstructure with porosity measured less than 1%. The experiment results indicated that Tungsten (W) distributed uniformly in matrix and carbides results bulk hardness. The maximum hardness of the hard protective layer was observed to be 750HV. The erosive wear test performed at different impact angles indicates that the protective clad have significantly less erosive wear than the bare alloy steel (SS-316).

Key words **– hybrid, microwave, heating, clad, hardness, erosive.**

1. INTRODUCTION

Engineering components employed in aerospace, power and petrochemical endure facet deterioration primarily due to erosion. Surface engineering is uttermost extensively used approach for improving the surface properties and functionality of a material without altering its bulk properties [1]. Shield against erosion for ferrous alloys (stainless steel, mild steel) exploited in hydro & thermal power plants is a crucial arena of research. Surface assets of a ferrous alloy could be altering via diverse modes, namely heat treatment, physical vapor deposition (PVD) technique, thermal spurting, epoxy coating, enamel coatings, laser cladding, and microwave cladding [2–7]. Thermal spurting is the most frequently used technique owing to mitigate operation and versatile in nature. Despite that, the frail mechanical bonding amidst splats and the significantly higher porosity are the substantial limitations allied with the thermal spray technique [7–9]. Recently the altering the surface properties of metallic materials using microwave cladding is gaining popularity. At present materials processing induced microwave heating attaining popularity owing to its distinct advantages namely consistent heating, volumetric heating, ameliorate mechanical properties and microstructural characteristics [10-12]. Moreover, microwave processing of the material is also one of the most environmental amiable processes [12]. In microwave processing of materials, the heat generates at the atomic level with in the material which concluded lower energy depletion and increased productivity. In microwaves, the volumetric heat generated with-in the material owing to the atomic level interaction compared to conductive mode of heat transfer in conventional surface heating technique. This phenomenon causes reduced thermal gradient inside the material which leads to curtail remnant stresses with in the material and reformed functional properties [13, 14]. The application of microwave heating in the form of microwave cladding embellish functional properties of metallic material was first clarified by Sharma et al. [15] in a patent form. The authors used microwave heating (MH) technique principles for the evolution of microwave clads exhibit enriched tribological and mechanical properties. The developed clads exhibits the perfect diffusion bonding with the substrate without any interfacial cracking [15]. Afterwards a lot of research executed to ameliorate facet properties of metallic material exploiting economical, low material squander, low power consumption and capacity to produce quality cladding having better tribological performance [16–26].

Alloy steel (SS-316) is one of the uttermost routinely exploit material in many engineering components hold exquisite unification of mechanical concussions such as erosion defiance but is usually perceived as the standard "marine grade stainless steel", but it is not repellant to warm sea water. The surface properties of SS-316 can be enhanced further by depositing a layer of hard protective layer of WC-10Co-4Cr through hybrid MH. The WC–Co situate materials are preferred by virtue of being superior erosive wear defiance [8–11]. The WC phase offer hardness even though Co phase offer toughness to the overlay material. It has been narrated that the erosive wear resistance of the WC–Co based materials depends on several factors like distribution of the carbide particle size, hardness of the carbide phase and volume fraction of the carbides. The addition of the Cr matrix provides corrosion resistance in oxidizing environment by generating passivating oxide layered structure on the surface of the SS-316, which shields material from foster corrosion and tungsten (W) matrix provides high hardness property leads to low surface erosion of steel substrate [27–29].

The erosive wear of microwave cladded WC10Co4Cr on stainless steel (SS-316) substrate has never been documented.

Materials Today: Proceedings 50 (2022) 1900–1905

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Electrochemical corrosion and erosive wear behaviour of microwave processed WC-10Co4Cr clad on SS-316

Paramjit Singh, Deepak Kumar Goyal, Amit Bansal *

Department of Mechanical Engineering, Inder Kumar Gujral Punjab Technical University, Kapurthala, India

ARTICLE INFO

Article history:
Received 31 August 2021
Received in revised form 9 September 2021
Accepted 14 September 2021
Available online 28 September 2021

Keywords:
SS-316
Cladding
Microwave
Surface
Erosion
Corrosion

ABSTRACT

WC-10Co4Cr cladding over an austenitic stainless steel (SS-316) was fabricated by using a cost- effective microwave technique. Cladding was performed with 1.20 kW power and a frequency of 2.45 GHz in an industrial microwave oven. The XRD surveillance reveals a cluster of carbide phases adjunct to W-Cr-Fe based hexagonal matrix. The SEM examination reveals a solid microstructure and a homogeneous reinforced skeleton with porosity measures of less than 1% in the clad specimen. Tungsten (W) distributed equally in matrix and carbides, resulting in bulk hardness and matrix micro hardness increasing gradually and reaching a peak at 750HV, respectively, which is significantly greater than the base metal (SS-316) hardness (about 220HV). The clads erosive wear was measured at various impact angles (30°, 60°, and 90°) by utilizing a solid particle erosion with alumina as the erodent. In addition, corrosion testing found that in the NaCl solution of 3.5 wt% the cladded specimen exhibited the less corrosion resistance than that of the base metal.

Selection and peer-review under responsibility of the scientific committee of the 2nd International Conference on Functional Material, Manufacturing and Performances

1. Introduction

A critical challenge in tribological evolution persisted in requiring novel materials for usage in serially harsh conditions. Facet deterioration occurs in engineering components used in aerospace, power, and petrochemical industries, primarily due to erosion and corrosion. Surface engineering is the way most typically used to improve the quality and function of the surface of a material without changing the inside prevailing properties [1]. The erosion and corrosion resistance for ferrous alloys in oil and gas industries (stainless steel, mild steel) are an important topic of research. The surface properties of ferrous alloys can alter with example like thermal treatment, PVDs, thermal spurts, epoxy coats, enamel coatings, laser cladding and microwave cladding [2–7]. Metallic powder coating and cladding provide exceptional resistance to mechanical shocks, particularly in applications involving severe erosive wear and chemical corrosion. Furthermore, slit initiation tendency during the cladding process's brisk melt pool and solidification phase [8–12] and at these slit origin locations; corrosion (through fissures and pits) is frequently invented. Due to their special benefits such as consistently heated, volumetric heating, better mechanical qualities and microstructural characteristics, microwave heating/ processing of materials is gaining popularity [12]. Microwave material processing causes thermal energy to be reduced on the atomic level in the material and improves productivity. The volumetric temperature generated in the material by the atomic level interaction in microwave is a unique phenomenon which is different from the conductive mode of heat transfer in the conventional surface heating technique. This unique phenomenon reduces material thermal gradients and reduces the residual stresses inside the microwave processed materials [13,14]. Sharma et al., [15] structured a microwave heating patent in the form of a microwave cladding for improving metal material functionality. The authors used microwave heating (MH) approach moralities to improve the tribological and mechanical capabilities of microwave clads. Austenitic stainless steel (SS-316) is the most common material that combines good mechanical qualities, including erosion and resistance to corrosion. It is widely known as 'marine grade stainless steel' but is not resistant to warm waters. Surface corrosion is noticeable as brown discoloration in maritime conditions (SS-316), which is often associated with fissures and a rough surface finish. The SS-316's outstanding mechanical qualities ensure that the solid solution offered by the

* Corresponding author.
E-mail address: amit.bansal978@gmail.com (A. Bansal).

https://doi.org/10.1016/j.matpr.2021.09.241

Selection and peer-review under responsibility of the scientific committee of the 2nd International Conference on Functional Material, Manufacturing and Performances

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Investigations on the effect of electrical discharge machining process parameters on the machining behavior of aluminium matrix composites

Sajad Ahmad Dar [a], Jatinder Kumar [a], Shubham Sharma [b,*], Gursharan Singh [b], Jujhar Singh [b], Vivek Aggarwal [b], Jasgurpreet Chohan [c,*], Raman Kumar [c], Abhinav Sharma [b], Madhulika Mishra [d], Ahmed J. Obaid [e]

[a] St. Soldier Institute of Engineering and Technology, Jalandhar, Punjab 144011, India
[b] Department of Mechanical Engineering, IK Gujral Punjab Technical University, Jalandhar-Kapurthala Road, Kapurthala, Punjab 144603, India
[c] Department of Mechanical Engineering, Chandigarh University, Gharuan 140413, India
[d] Department of Statistics, Faculty of Science and Technology, Vishwakarma University, Pune, Maharashtra 411048, India
[e] Department of Computer Science, College of Education, Kufa University, Najaf, Iraq

ARTICLE INFO

Article history:
Received 21 June 2021
Accepted 5 July 2021
Available online xxxx

Keywords:
EDM
Stir casting
ANOVA
Taguchi method
Aluminum matrix composites

ABSTRACT

Extensive applications are found in aluminum matrix composites, where high strength to weight ratio, low weight and high corrosion resistance are needed. One of the categories of such materials is the SiC reinforced aluminum matrix composite. This reinforcing material belongs to ceramic group of materials and can withstand high temperature and improve several properties when incorporating in the grain structure of the base matrix. The introduction of SiC enhances wear resistance, hardness value and tensile strength. However, the use of high percentage of SiC material reduces the machinability (ductility) and toughness resistance and the machining of such material becomes difficult. In this current study, an attempt is made to develop an aluminum (LM25 alloy) matrix composite, which is reinforced with 7% SiC and 3%Gr particulates through stir casting route. The fabrication of composite is followed by evaluating the machining behavior of hybrid composite through electric discharge machining. During machining, current, voltage, pulse on time and pulse off time are selected as input controllable variables while material removal rate (MRR), tool wear rate (TWR) and over cut are chosen as responses. The experiments are carried out as per Taguchi's L9 OA, with the aid of ANOVA and significant parameters effecting responses are identified. Main effects plots are drawn and optimum set of input machining conditions are determined.

Selection and peer-review under responsibility of the scientific committee of the Symposium on Synthesis, Characterization 2021.

1. Introduction

Advanced materials have provided a wide range of selections to material designers in the improvement and choice of materials for different applications. Material properties are incessantly being promoted to meet safety and running standards in line with fundamental technological Developments [1]. Modern technical requirements, along with customer demands for more energy-efficient, heavier, lightweight, productive, etc. organizations and machines, declare that the search for new-fangled and revolutionary materials continues to be of interest [2]. Aluminum matrix Composite (AlMMCs) is a class of materials that have recorded success in meeting most of the applications, where the mandatory properties are light weight, high rigidity and temperate strength [3]. With a variety of reinforcement components and versatility in their primary manufacturing, AlMMCs offer great potential for composite production with the desired properties for certain applications [4]. Thus, AlMMC machining has been one of the manufacturer's big resent-time issues. In order to machine the material with traditional machining methods, remarkable research has been carried out. The processing of this hard material is not simple in traditional machining, because the wear rate of the tool is high and it gets oxidized in conventional machining [5]. Because of these surface characteristics, with traditional machining methods, the machining is

* Corresponding authors.
E-mail addresses: shubham543sharma@gmail.com, shubhamsharmaces.ch@gmail.com (S. Sharma), jaskhera@gmail.com (J. Chohan).

https://doi.org/10.1016/j.matpr.2021.07.126
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the Symposium on Synthesis, Characterization 2021.

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Analysis and optimization of nozzle distance during turning of EN-31 steel using minimum quantity lubrication

Ajay Kumar [a,b], Gurpreet Singh [a,b,*], Vivek Aggarwal [b]

[a] Department of Mechanical Engineering, Chandigarh University, Gharuan, Mohali, India
[b] Department of Mechanical Engineering, IKGPTU Kapurthala, Punjab, India

ARTICLE INFO

Article history:
Received 31 May 2021
Received in revised form 21 June 2021
Accepted 3 July 2021
Available online xxxx

Keywords:
Minimum quantity lubrication (MQL)
Vegetable oil
Cutting temperature
Taguchi L-9 array
ANOVA

ABSTRACT

Traditional high volume cutting fluid is normally applied during manufacturing of product at shop floor to minimize severity of friction, wear, temperature and machining forces. It impacts the manufacturing performance if, the choice, application, handling and disposal of cutting fluid properly designed. Contrary to this, higher volume flow rate of metal working fluids applied in flood lubrication would adversely affects the environment, machine, materials, human and costly too. Hence, for ensuring the economy and ecology of machining process the high discharge rate of cutting fluids should be minimized. Therefore, machining should be conducted in such conditions where the aforementioned limitation should be avoided i.e. dry and minimum quantity lubrication. However, dry machining has limitation at higher levels of input variables so becomes unsuitable for mass production of difficult to cut materials. Therefore, in present investigations the minimum quantity lubrication of vegetable based oil has been utilized for investigating its impact the cutting temperature at different nozzle distances. The outcomes of changing the nozzle gap on temperature during turning of EN-31 Steel have been analyzed with ANOVA. The investigation results suggested that cutting speed has greater influence (68.44%) on temperature along with nozzle distance (30.75%).

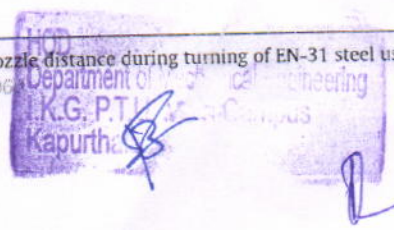
Selection and Peer-review under responsibility of the scientific committee of the Global Conference on Recent Advances in Sustainable Materials 2021.

1. Introduction

The metal machining operation produces heat on tool chip coalition due to friction that has greater influence on the machining capability. Due to this, dimensional accuracy, tool life and cost become higher. Several alternatives have been adopted to reduce this heat, such as during the early phase of industrialization the water was used as a coolant, but this approach leads to problem of corrosion on product. After several industrial growths the various methods of cooling and lubrication were developed and employed. Till now the most of the industry uses flood lubrication during machining process for cooling and lubrication purpose. In this method lubricants accumulated continuously which flow at the rate up to 4–10 litters/min which is very large and can be harmful to ecological balance. So, other alternatives of cooling should be practised to eliminate these adverse effects of conventional flood cooling [1–3]. Modern machining is facing numbers of challenges, like higher productivity, better quality, strict environment rules as well as inexpensive machining. So, it is be fitting job for the investigator to manufacture product with a procedure which is economical, accurate and environment friendly. Therefore to achieve these goals, machining with unlike cooling and lubricants the latest cooling technique like low temperature freezing, cooling assisted with Nano particles, minimal quantity cooling and MQL etc. These technologies have their own susceptible and causes because cooling with cryogenic process and cooling with nano particles has given enhanced performance during machining as compared to traditional cooling [4]. The serious concern of using nano-fluid is its cost and adverse impact on human eyes and respiratory system also this technique is very costly as compared to traditional machining. Several developing countries adopting dry machining and restricted the use of flood lubrication due to environmental concern. Scientists have mentioned about the dry machining that it is limited up to particular machining parameter level because implementing this approach very high temperature

* Corresponding author at: Department of Mechanical Engineering, Chandigarh University, Gharuan, Mohali, India.
E-mail addresses: [illegible] (A. Kumar), [illegible] (G. Singh).

https://doi.org/10.1016/j.matpr.2021.07.060
2214-7853/
Selection and Peer-review under responsibility of the scientific committee of the Global Conference on Recent Advances in Sustainable Materials 2021.



Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Experimental investigations and optimization of machining performance during turning of EN-31 steel using TOPSIS approach

Gurpreet Singh [a,b,*], Ajay Kumar [b], Vivek Aggarwal [c], Sehijpal Singh [d]

[a] Research Scholar, Department of Mechanical Engineering, I.K.G.P.T.U Main Campus, Kapurthala, Punjab, India
[b] Department of Mechanical Engineering, Chandigarh University, Gharuan, Mohali, Punjab, India
[c] Department of Mechanical Engineering, I.K.G.P.T.U Main Campus Kapurthala, Punjab, India
[d] Department of Mechanical Engineering, Guru Nanak Dev Engineering College, Ludhiana, Punjab, India

ARTICLE INFO

Article history:
Received 14 May 2021
Received in revised form 6 July 2021
Accepted 19 July 2021
Available online xxxx

Keywords:
Minimum quantity lubrication (M.Q.L)
Dry machining
Tool-chip interface temperature
Chip reduction coefficient
EN-31steel
TOPSIS

ABSTRACT

Machining of difficult to cut material at advanced range of process parameters is the requirement of modern day machining scenario for achieving the goals of sustainable machining through utilization of modern cooling techniques to minimizing the friction, heat generation and tool damage. Consequently, leads to profitable machining under the provision of suitable volume, application method and environmental friendly cutting fluids. Contrary to this, larger flow rate and inferior methodology of cutting fluid application leads to various health problems, environment issues and imperfect product quality. So, to achieve targets the sustainable machining, the firm has to meet certain environmental norms regarding the application and disposal of cutting fluids. Therefore, to tackle the aforementioned ecological issues the dry machining is preferred which exhibit solution, but this option does not endure economic plan at accelerated machining parameter levels due to lower tool life and impaired quality of product. Hence, the alternative to all these situations are the requirement of such a cooling system which does not pollute the environment, operator friendly as well as economical to use. Henceforth, the minimum quantity lubrication using soybean oil has been used in present investigation as a replacement to flood lubrication. The experiments have been conducted on EN-31 Steel taking advanced ranges of machining parameter in dry and M.Q.L system. Research outcomes revealed that the M.Q.L machining improved the surface finish, lowered the cutting temperature and enhanced the chip reduction coefficient with comparison to dry machining system. The Parametric optimization evaluated by TOPSIS approach pointed out that the best machining combination has been observed at 196 m/min, 0.088 mm/rev in vegetable oil environment.

Selection and peer-review under responsibility of the scientific committee of the Symposium on Synthesis, Characterization & Processing of Inorganic, bio and nano Materials – 2021.

1. Introduction

Mass production of hard grade steel components produces intense heat due to friction and deformation occurring at various points of tool work and tool-chip interface resulting into higher cutting forces, rapid tool wear, poor surface quality and lower productivity of machining operation. Hence to lower the unwanted heat generation in different zones of machining the various types of cutting fluids have used through numerous ways of cooling and lubrication methodologies such as conventional flood cooling, high pressure cooling, minimum quantity cooling, minimum quantity lubrication and hybrid cooling strategy. The application of any of the mentioned cooling and lubrication methodology is fruitful only when the quantity, quality and application techniques is properly designed as per the requirement of machining parameters, operator safety, environmental regulation and most important economical. But on the other hand poorly designed cooling strategy would leads to negative impact on the social, economic and ecological factors which furthermore will also face challenges from different government and other agencies. Keeping in mind all these machining scenario the industry prefer the dry machining during which no cutting fluid has been utilized and is free from all kind of environmental,

* Corresponding author.
E-mail address: gssingh410@gmail.com (G. Singh).

https://doi.org/10.1016/j.matpr.2021.07.381
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the Symposium on Synthesis, Characterization & Processing of Inorganic, bio and nano Materials – 2021.

MATERIALS AND MANUFACTURING PROCESSES
https://doi.org/10.1080/10426914.2021.1945099

Taylor & Francis
Taylor & Francis Group

Experimental investigations into machining performance of Hastelloy C-276 in different cooling environments

Gurpreet Singh[a,b], Vivek Aggarwal[a], and Sehijpal Singh[c]

[a]Department of Mechanical Engineering, I.K.G.P.T.U, Kapurthala, India; [b]Department of Mechanical Engineering, Chandigarh University, Mohali, India; [c]Department of Mechanical Engineering, G.N.D.E.C, Ludhiana, India

ABSTRACT

Machining of difficult to cut materials at advanced range of machining variable is the requirement of industry 4.0 for achieving sustainable machining goals taking into consideration energy, ecology and economy. However, due to lack of information on the machining data the material is regarded as difficult to cut. Therefore, to enhance the machining performance of Hastelloy C-276 the experimental investigations have been conducted at different levels of input parameters using CNMG120408 cutting inserts under various cooling conditions. The RSM-based CCD approach has been used to to generate the design of experiment along with ANOVA analysis for finding the influence of input factors on the output signal. Investigations results exhibited that the less cutting temperature, better surface quality and lower chip reduction coefficient have been reported in vegetable oil MQL machining. Research pointed out that the S.R. is influenced by cutting speed, doc, cooling environments and feed rate; likewise the impact has been reported for cutting temperature, while the CRC is less dominated by doc compared to other parameter. The percentage errors evaluated for S.R, temperature and CRC have been reported as 0.53%, −1.52% and 1.81% indicates the significance of developed model.

ARTICLE HISTORY
Received 21 May 2021
Accepted 11 June 2021

KEYWORDS
Hastelloy C-276; RSM; CCD; ANOVA; MQL; dry machining; S.R; cutting temperature; CRC; vegetable oil

Introduction

Presently, Ni-based super alloys are utilized for applications like air craft components; check valves used in petro & chemical plants as well as elements of nuclear reactor. The nickel-based alloy survives in very critical environment due to its favorable mechanical strength, creep, resistance to wear, corrosion and can withstand these qualities at elevated temperature.[1–4] The engineering components used for various applications are manufactured by different metal cutting processes of required shape and size hence the machining performance of material depends upon process parameters and cutting environment.[5] The cutting parameters have great influence on the machining characteristics of nickel based alloy and therefore the proper selection of these parameters is of major concern while machining these super alloys.[6] The surface quality and micro hardness of alloy constituent of Ni were greatly influenced as the cutting parameters varied during dry cutting.[7] During investigation it was pointed out that the increment of v and f indirectly impacts the surface roughness and while on the other hand reverse is true for cutting forces during machining of Hastelloy C2000.[8] The applications of coolant minimize the heat generation, rubbing between tool and work and surface roughness which leads to improvement of machinability of work material.[9] During machining of super alloys higher cutting temperature results in shaping of built up edge, chip sticking and rapid tool wear, consequently lower the grade of machined surface. Hence, the application of good quality lubricant is required to diminish the heat generation along with enhancement of product quality and tool life.[10] It has been found that application of conventional cutting fluid if not selected and applied properly it would leads to severe health problems along with corrosion, fumes, chemical reaction on work material and most importantly add more cost to manufacturing the product in the form of recycling equipment and wastage disposal. Therefore, the suitable application methodology and eco-friendly cutting fluid should be the alternative to conventional cooling techniques. Hence the application of minimal cooling and lubrication together with gaseous chilling is of great concern these days.[11,12] Machining of Ni alloys is much exciting owing to outrageous mechanical strength, toughness and thermal properties and cryogenic cooling was suggested to achieve better machining performance .[13] The research was conducted on Ni-based alloys using cryogenic cooling revealed that the machining energy and surface characteristics were reduced,[14] but on the other side, application of cryogenic cooling during machining of Inconel 718 produced discontinuous chips and larger cutting forces due to the effect of strain hardening and higher compressive strength.[15] Further, research on Ni super alloys machining exhibited that regular chips with serrated edge were produced because of its ductile and difficult to machine nature.[16] Investigation on the dry machining of Inconel 825 revealed that cracking due to shear and edge flow of work metal was reported .[17] Cryogenic milling of Ni-Cr alloys minimized the teeth dimensions, chip serration along with control over tool damage.[18] Research were conducted on the wear mechanism of tool to process the various super alloys exhibited that the abrasion, adhesion,

CONTACT Gurpreet Singh gssingh410@gmail.com Department of Mechanical Engineering, I.K.G.P.T.U, Main Campus, Kapurthala, Punjab, India

JMEPEG
https://doi.org/10.1007/s11665-021-06187-0

1059-9495/$19.00

Comparative Study of High-Temperature Oxidation Behavior of Bare and Plasma Sprayed Al_2O_3-40%TiO_2 Coated T-91, A-1 Boiler Steel and Superfer800H Superalloy in Air

Mohd Shadab Ansari, Vikas Chawla, Amit Bansal, and Vivek Aggarwal

Submitted: 1 September 2020 / Revised: 13 August 2021 / Accepted: 19 August 2021

In the present investigation, a plasma spray process was used to deposit bi-layer NiCrAlY/ Al_2O_3-40%TiO_2 coating powder on three substrates namely T-91, A-1 boiler steel, and Superfer800H superalloy. The deposited coating was found to be dense, and uniform with thickness ranges from 200 to 250 µm. The oxidation behavior of both (bare and coated) specimens at elevated temperatures was ascertained by using a high-temperature furnace. The experiments were conducted over 50 cycles. In each cycle, the specimens were subjected to an isothermal temperature of 900 °C for 1 h followed by cooling for 20 min at room temperature in atmospheric air. The thermogravimetric study for both (bare and coated) specimens was conducted to find the corrosion rate by calculating the parabolic rate constant of the corroded specimens. The characterizations of the coatings before and after the high- temperature oxidation tests were investigated by employing various characterizations techniques. The result showed that the Al_2O_3-40%TiO_2 ceramic coating significantly reduced the weight gain compared with the bare substrates. The high resistance of the deposited coating against the harsh oxidizing environment was because of the occurrence of protective phase (Al_2O_3, TiO_2, and $Al_2Ti_7O_{15}$) in the oxide scale.

Keywords A-1, Al_2O_3-40% TiO_2, EDS, SEM, superfer800H, T-91, XRD

1. Introduction

Hot corrosion and erosion are severe and big problems in thermal power plants in India that use coal as a fuel. It has been reported that there is approximately US$150 million loss occurred annually in coal-based thermal power plants only due to hot corrosion and erosion of the materials (Ref 1).The coal used in the Indian thermal power plants is of deficient grade as it contains a large amount of ash, sulfur, hydrogen, and carbon, etc (Ref 2). The fly ash contains a significant amount of abrasive mineral particles, which during operation strike the surfaces of boiler tubes and cause erosion of the boiler tubes material. Simultaneously, some of these mineral particles start depositing on the different parts of the boiler like superheater tubes and water tubes, which resulted in a reduced heat transfer from the steam to the boiler tubes. Further, these deposited particles also initiate corrosion on the surfaces of the boiler tubes at high temperatures (Ref 3, 4). During the combustion of coal, sulfur trioxide (SO_3) is formed due to the partial oxidation of the sulfur present in the coal, which further reacts with water vapors (H_2O) and sodium chloride (NaCl) present in the coal to form sodium sulfate (Na_2SO_4). During the combustion of coal, a small amount of vanadium (V) also gets oxidized to form vanadium oxide (V_2O_5). Subsequently, the V_2O_5 further reacts with Na_2SO_4 to form a highly corrosive compound at high temperatures which is sodium vanadate ($NaVO_3$) (Ref 5, 6). Hence boiler tube material fails due to the simultaneous effect of both erosion and corrosion, which results in very huge economic losses. As the trend of generating power using coal-based power plants is increasing; the degradation of the material used in these plants is also increasing due to the both corrosion and erosion of materials at high-temperature by ash particles (Ref 7, 8). The corrosion reduces the thermal efficiency of the boiler tube material and increases the down-time and maintenance cost of the boiler, which resulted in an increase in economic losses (Ref 9, 10). To reduce these losses, it is required to protect the material from premature failure. The degradation of the materials at high temperature can be minimized by using various methods such as a selection of suitable superalloys, corrosion inhibitors, thermal spray coatings, laser cladding, weld overlays, and cathodic protection, etc (Ref 11, 12). Among all the processes discussed above, thermal spray coatings are gaining popularity among researchers due to their capabilities to deposit a wide range of materials with ease. Thermal spray offers hot corrosion resistance to the materials by depositing a wide variety of powder having a superior property on the substrate surface. Moreover, it also improves the surface characteristics of the base material without interfering with the metallurgical properties of the base material (Ref 13). Different types of metallic and ceramic coatings have been developed to provide corrosion-resistance to the material. Coatings give the flexibility to modify the outer surface of the material while retaining the original mechanical properties of the base material. These coatings enhance the performance of

Mohd Shadab Ansari, Vikas Chawla, Amit Bansal, and **Vivek Aggarwal,** I.K Gujral Punjab Technical University Jalandhar, Kapurthala, Punjab, India. Contact e-mail: amit.bansal978@gmail.com.

Published online: 01 September 2021

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Ecological aspects of cutting fluids applications in small scale industries of Northern India region

Gurpreet Singh [a,e,*], Sehijpal Singh [b], Vivek Aggarwal [c], Jujhar Singh [c], Neelkanth Grover [d], Amoljit Singh Gill [c]

[a] Research Scholar, Department of Mechanical Engineering, I.K.G.P.T.U Main Campus, Kapurthala, Punjab, India
[b] Department of Mechanical Engineering, Guru Nanak Dev Engineering College, Ludhiana, Punjab, India
[c] Department of Mechanical Engineering, I.K.G.P.T.U Main Campus Kapurthala, Punjab, India
[d] Department of Mechanical Engineering, I.K.G.P.T.U Main Campus Kapurthala, Punjab, India
[e] Department of Mechanical Engineering, Chandigarh University, Gharuan, Mohali, Punjab, India

ARTICLE INFO

Article history:
Received 19 July 2021
Received in revised form 26 August 2021
Accepted 31 August 2021
Available online xxxx

Keywords:
Cutting fluids
Biodegradable oils
Lubrication techniques
Health hazards
Recycling and disposal methods

ABSTRACT

The issue of cutting fluid is of great concern in present scenario of industry 4.0 due to its application in machining operation performed at wider parameter ranges. Despite of numerous advantages and enhanced machining performance, few critical issues like environmental and health hazards occurred if not controlled in efficient manner, consequently, set negative impacts on their utility. Hence, to safeguard aforementioned problems and to achieve environmental sustainability, the bio-degradable oils are gaining popularity due to their useful impact attained through latest lubrication techniques and amalgamation of nano and ionic fluids. Further, the cost of later fluids forms a barrier to their application in present competitive industrial framework as compared to conventional cutting fluids. In present investigation the survey was conducted on the scenario of cutting fluids application in small scale industries present in the Malwa belt of Punjab. The research was performed through well designed questionnaire consisting of various questions related to different aspects of cutting fluids such as fluid type, volume, application methods, recycling approach, disposal way and most important health as well as environmental issues. The data was collected by qualified engineers from various industries and further confirmed from the official source for its validity prior to analysis. The results of investigation confirmed that there was deficiency of advanced lubrication techniques utilization, insufficiency of post treatment and few cases of health hazards.

Selection and peer-review under responsibility of the scientific committee of the Symposium on Synthesis, Characterization & Processing of Inorganic, bio and nano Materials 2021

1. Introduction

The making of thing was fundamental need of human civilization utilizing different ranges of natural cutting tools since the evolution of mankind. But in the present era, product making is achieved through term manufacturing, which comprising wide ranges of metal working processes. During the conversion of raw materials to finished goods the application of coolant/lubricant or cutting fluids play important duty that enhances the machining performance by virtue of eliminating excessive heat, friction and cutting forces. From historical prospective the use of cutting fluid had begun in early 1500 s, further the extensive use of cutting fluids was reported in 18th century during the later stage of first industrial revolution [1]. Survey reports mentioned that around 100 million gallon of cutting fluid utilized every year in U.S [3]. During initial stages of lubricant development only water was used and thereafter the animal oil such as whale and animal fat was used to enhance the lubricating properties. As far as the application method is concerned the brush was employed for lubrication purpose in the early stages of lubrication techniques. In the preliminary phase of 20th century the utility of soap-water mixture was exercised to boost lubrication action [1]. Further, advancement in this connection gave birth to straight cutting oil and soluble oil around 1936 [1]. In addition to this, availability of chemical additives was reported in 1944 as per literature data [5]. Furthermore, as the chemical additive gain popularity, more complexity in handling the same was dominant in past and present scenario of cutting fluids due to machining of harder materials at advanced

* Corresponding author.
E-mail address: gssingh410@gmail.com (G. Singh).

https://doi.org/10.1016/j.matpr.2021.08.348

Selection and peer-review under responsibility of the scientific committee of the Symposium on Synthesis, Characterization & Processing of Inorganic, bio and nano Materials 2021

polymers

MDPI

Review

Recent Trends and Developments in Conducting Polymer Nanocomposites for Multifunctional Applications

Shubham Sharma [1,2,*], P. Sudhakara [1,*], Abdoulhdi A. Borhana Omran [3,4,*], Jujhar Singh [5] and R. A. Ilyas [6,7]

1 Regional Centre for Extension and Development, CSIR-Central Leather Research Institute, Leather Complex, Kapurthala Road, Jalandhar 144021, Punjab, India
2 PhD Research Scholar, IK Gujral Punjab Technical University, Jalandhar-Kapurthala, Highway, VPO, Ibban 144603, Punjab, India
3 Department of Mechanical Engineering, College of Engineering, Universiti Tenaga Nasional, Jalan Ikram-Uniten, Kajang 43000, Selangor, Malaysia
4 Department of Mechanical Engineering, College of Engineering Science & Technology, Sebha University, Sabha 00218, Libya
5 Department of Mechanical Engineering, IK Gujral Punjab Technical University, Jalandhar-Kapurthala, Highway, VPO, Ibban 144603, Punjab, India; jujharsingh2085@gmail.com
6 School of Chemical and Energy Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Johor Bahru 81310, Johor, Malaysia; ahmadilyas@utm.my
7 Centre for Advanced Composite Materials, Universiti Teknologi Malaysia, Johor Bahru 81310, Johor, Malaysia
* Correspondence: shubham543sharma@gmail.com or shubhamsharmacsirclri@gmail.com (S.S.); sudhakarp@clri.res.in (P.S.); amhmad@uniten.edu.my (A.A.B.O.); Tel.: +91-7009239473 (S.S.)

Abstract: Electrically-conducting polymers (CPs) were first developed as a revolutionary class of organic compounds that possess optical and electrical properties comparable to that of metals as well as inorganic semiconductors and display the commendable properties correlated with traditional polymers, like the ease of manufacture along with resilience in processing. Polymer nanocomposites are designed and manufactured to ensure excellent promising properties for anti-static (electrically conducting), anti-corrosion, actuators, sensors, shape memory alloys, biomedical, flexible electronics, solar cells, fuel cells, supercapacitors, LEDs, and adhesive applications with desired-appealing and cost-effective, functional surface coatings. The distinctive properties of nanocomposite materials involve significantly improved mechanical characteristics, barrier-properties, weight-reduction, and increased, long-lasting performance in terms of heat, wear, and scratch-resistant. Constraint in availability of power due to continuous depletion in the reservoirs of fossil fuels has affected the performance and functioning of electronic and energy storage appliances. For such reasons, efforts to modify the performance of such appliances are under way through blending design engineering with organic electronics. Unlike conventional inorganic semiconductors, organic electronic materials are developed from conducting polymers (CPs), dyes and charge transfer complexes. However, the conductive polymers are perhaps more bio-compatible rather than conventional metals or semi-conductive materials. Such characteristics make it more fascinating for bio-engineering investigators to conduct research on polymers possessing antistatic properties for various applications. An extensive overview of different techniques of synthesis and the applications of polymer bio-nanocomposites in various fields of sensors, actuators, shape memory polymers, flexible electronics, optical limiting, electrical properties (batteries, solar cells, fuel cells, supercapacitors, LEDs), corrosion-protection and biomedical application are well-summarized from the findings all across the world in more than 150 references, exclusively from the past four years. This paper also presents recent advancements in composites of rare-earth oxides based on conducting polymer composites. Across a variety of biological and medical applications, the fact that numerous tissues were receptive to electric fields and stimuli made CP's more enticing.

Keywords: biomedical; conducting polymers; corrosion; doped; electronics; shape memory polymers; sensors; actuators; optical limiting

Citation: Sharma, S.; Sudhakara, P.; Omran, A.A.B.; Singh, J.; Ilyas, R.A. Recent Trends and Developments in Conducting Polymer Nanocomposites for Multifunctional Applications. *Polymers* **2021**, *13*, 2898. https://doi.org/10.3390/polym13172898

Academic Editors: Emin Bayraktar

Received: 26 July 2021
Accepted: 10 August 2021
Published: 28 August 2021

Received: 14 August 2020 | Revised: 19 July 2021 | Accepted: 4 August 2021
DOI: 10.1002/ep.13736

Optimization of engine operating variables on performance and emissions characteristics of biogas fuelled CI engine by the design of experiments: Taguchi approach

Sunil Kumar Mahla[1] | Tarun Goyal[1] | Deepam Goyal[2] | Himanshu Sharma[3] | Amit Dhir[3] | Geetesh Goga[4]

[1]Department of Mechanical Engineering, I. K. Gujral Punjab Technical University, Kapurthala, India

[2]Chitkara University Institute of Engineering & Technology, Chitkara University, Rajpura, India

[3]School of Energy & Environment, Thapar Institute of Engineering & Technology, Patiala, India

[4]IES College of Technology, Bhopal, India

Correspondence
Sunil Kumar Mahla and Tarun Goyal, Department of Mechanical Engineering, I. K. Gujral Punjab Technical University, Kapurthala, India.
Email: mahla.sunil@gmail.com and tarungoyal.ikgptu@gmail.com

Deepam Goyal, Chitkara University Institute of Engineering & Technology, Chitkara University, Rajpura, India.
Email: bkdeepamgoyal@outlook.com

Funding information
Science and Engineering Research Board, Grant/Award Number: SB/FTP/ETA-306/2013

Abstract

Biogas obtained from renewable resources is a viable solution for solving energy scarcity and environmental degradation. A single-cylinder 4-stroke natural aspirated variable compression ratio research engine was fuelled with biogas as primary and diesel as a pilot injection in this work. Experiments were designed based on Taguchi L_9 OA (orthogonal array) choosing biogas flow rate, compression ratio, and engine load as input factors, while brake thermal efficiency (BTE), BSEC, CO, HC, NOx, and smoke were targeted responses. The effects level of factors on responses was analysed by using MINITAB software. The higher value of raw data and *S/N* ratios for BTE was observed with low biogas flow rate, higher compression ratio, and full engine load. On the other hand, lower raw data and high *S/N* ratio analysis for emissions characteristics (CO, HC, NOx, and smoke) were achieved in the order of rank, that is, engine load > biogas flow rate > compression ratio. With the analysis of results, optimum levels of various factors were evaluated. These results showed that the Taguchi method design was an effective tool for optimizing the elements in terms of combustion performance and emissions characteristics.

KEYWORDS
design, emissions, optimization, performance, Taguchi method

1 | INTRODUCTION

CI engine's cost-effectiveness and reliable nature make them frontier in the transportation, agriculture, construction, and shipping industry. High exhaust ejections caused by high combustion temperature have hazardous influences on the ambient air quality. Increased fossil fuel consumption by diesel engine coupled with the diminishing nature of fossil fuels and their ecological issues create stress on finding clean and alternative fuels.[1,2] Replacement of conventional fuels with clean and renewable energies will help reduce greenhouse gas emissions and reduce imports for developing countries like India. Biogas is considered an enticing clean and alternative fuel owning to its serene and cost-effectiveness under dual-fuel (DF) mode in diesel engine.[3] The DF operation entails the mixing of biogas with air before it enters

ECS Transactions, 107 (1) 5553-5567 (2022)
10.1149/10701.5553ecst ©The Electrochemical Society

COVID-19 pandemic: A Seismically Disruptive Environmental Event

R.K. Dang[a], D. Goyal[b*], T. Goyal[c], N. Mago[d]

[a] Department of Mechanical Engineering, UIET, PUSSGRC, Hoshiarpur, Punjab, India
[b] Chitkara University Institute of Engineering and Technology, Chitkara University, Punjab, India
[c] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University, Jalandhar, Punjab, India
[d] Department of Computer Science and Applications, UIET, PUSSGRC, Hoshiarpur, Punjab, India
Email: dang.rajeev@pu.ac.in[a], tarungoyal.ikgptu@gmail.com[c], neerumago@pu.ac.in[d]
Corresponding author: bkdeepamgoyal@outlook.com[b]

After Second World War, the COVID-19 pandemic has caused so much losses to humankind that some countries have started it calling as a third world war or biological war, which has been imposed for reorganisation and dominance over world economy. The whole world has come to standstill and efforts of all the countries are concentrated to avoid extinction of human species. Most of the companies have come out with zero production in month of April, 2020. This paper explores the impact of this seismically disruptive environmental event on global environment and energy scenario. It provides a valuable guide to researchers, environmentalists and policy makers to provide a linkage between COVID-19 and various environmental concerns and remedial measures have also been suggested to combat SARS-CoV-2. Although the future trajectory of the pandemic remains uncertain, the pandemic has already brought many changes to how people live, and is likely to bring many more. As all the disasters have their time limits, one should be optimistic and must put all our feet together to win over this pandemic and respect the ecosystem before it is too late.

Introduction

Public health security has been grievously threatened by the genesis of coronavirus disease 2019 (COVID-19) by imposing new challenges to whole world. Emergence of COVID-19 has demolished the boundaries between developed, developing and under developed countries in such a manner that whole world has been brought on knees by this pandemic. Despite, so much advancement in medicine field, no part of the globe is untouched by massive fury caused by this disease. Every single individual in world is busy in observing or/and analyzing the data of corona affected persons alongwith daily massacres caused by this invisible enemy. Researchers throughout the world are hell-bent on finding the exact source of inception and methodology of transmission of this virus to whole world. Initial investigations have reported this virus to cause abnormal

Research Article

Shubham Sharma*, Vikas Patyal*, P. Sudhakara, Jujhar Singh, Michal Petru*, and R. A. Ilyas

Mechanical, morphological, and fracture-deformation behavior of MWCNTs-reinforced (Al–Cu–Mg–T351) alloy cast nanocomposites fabricated by optimized mechanical milling and powder metallurgy techniques

https://doi.org/10.1515/ntrev-2022-0005
received July 12, 2021; accepted November 1, 2021

Abstract: The carbon nanotube (CNT) is becoming more popular due to their low-density, high-strength *etc.* Among CNTs, multi-walled carbon nanotubes (MWCNTs) are gaining more importance due to their enhanced thermal and electrical conductivity. The present research is exploring the applicability of MWCNTs reinforced with AA2024-T351 alloys for electromechanical applications. This study is currently undertaken for using MWCNTs as a reinforcing particulate for the purpose to enhance the characteristics including low density, high strength, and hardness together with excellent thermal and electrical conductivity of the aluminum alloy matrices. Therefore, this article provides a state-of-the-art experimental approach to fabricate and furthermore, to evaluate the mechanical characteristics, microstructural analysis, and fatigue behavior of Al–Cu–Mg–T351/MWCNT composites under both the mechanical and thermal loading by utilizing powder technology processing route. The uniform dispersion of CNTs has been exposed using ball milling process. Results revealed that the MWCNTs provide extraordinary synergistic strength, enhances fatigue resistance, creep resistance, ductility, and other mechanical characteristics of the aluminum-based composites. The mechanical loading of the composite exhibited increased properties as compared to thermal-loaded aluminum-MWCNT composites. Findings conclude that the maximum hardness of 35Hv obtained for sintered AA2024-T351 and 45Hv for 0.5% MWCNT heat-treated samples indicate that the addition of MWCNT enhances the hardness which may be because CNT is evenly dispersed at the interfacial space. Maximum UTS of 105.21 MPa was obtained with 0.5% MWCNT for sintered composites. Microstructural analysis of the Al–Cu–Mg–T351/MWCNTs composite exhibits reasonably uniform distribution, void formation, and good interfacial bonding. X-ray Diffraction method patterns of fabricated composite shows that the CNT is present at $2\beta = 23.6$ and 44.6°, whereas high peaks of aluminum are present at uniform dispersed positions. Transmission electron magnifying instrument study further substantiates the above research. Fracture micrographs of the Al–Cu–Mg–T351/MWCNTs composite portray the resistant nature of the nanotubes due to the presence of CNTs, Al–Cu, and aluminum carbide elements in the alloy and the reactions that happened during heat treatment. This significant improvement was attributed to the shear interactions among the constituents and high load carrying capacity of the CNT, uniform dispersion, and interface bond strength among the matrix and constituents. The

* **Corresponding author: Shubham Sharma,** CSIR-Central Leather Research Institute, Regional Centre for Extension and Development, Leather Complex, Kapurthala Road, Jalandhar, Punjab 144021, India; PhD Research Scholar, IK Gujral Punjab Technical University, Jalandhar-Kapurthala Highway, VPO, Ibban, Punjab 144603, India, e-mail: shubham543sharma@gmail.com, shubhamsharmacsirclri@gmail.com
* **Corresponding author: Vikas Patyal,** Department of Design and Manufacturing, Shaurya Aeronautics Private Limited Institute, New Delhi, India, e-mail: vikaspatyal04@gmail.com
* **Corresponding author: Michal Petru,** Faculty of Mechanical Engineering, Technical University of Liberec, Studentská 2, 461 17 Liberec, Czech Republic, e-mail: michal.petru@tul.cz
P. Sudhakara: CSIR-Central Leather Research Institute, Regional Centre for Extension and Development, Leather Complex, Kapurthala Road, Jalandhar, Punjab 144021, India, e-mail: sudhakar678@gmail.com
Jujhar Singh: IK Gujral Punjab Technical University, Jalandhar-Kapurthala Highway, VPO, Ibban, Punjab 144603, India, e-mail: jujharsingh2085@gmail.com
R. A. Ilyas: School of Chemical and Energy Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Johor Bahru 81310, Johor, Malaysia; Centre for Advanced Composite Materials, Universiti Teknologi Malaysia, Johor Bahru 81310, Johor, Malaysia, e-mail: ahmadilyas@utm.my

materials

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Article

Hand and Abrasive Flow Polished Tungsten Carbide Die: Optimization of Surface Roughness, Polishing Time and Comparative Analysis in Wire Drawing

Raman Kumar [1,*], Sehijpal Singh [1], Vivek Aggarwal [2], Sunpreet Singh [3], Danil Yurievich Pimenov [4], Khaled Giasin [5] and Krzysztof Nadolny [6]

1 Department of Mechanical and Production Engineering, Guru Nanak Dev Engineering College, Ludhiana 141006, India; sehijpalsingh@yahoo.in
2 Department of Mechanical Engineering, IKGPTU Main Campus, Kapurthala 144603, India; dr.vivekaggarwal@ptu.ac.in
3 Department of Mechanical Engineering, Chandigarh University, Ghauruan 140413, India; snprt.singh@gmail.com
4 Department of Automated Mechanical Engineering, South Ural State University, Lenin Prosp. 76, 454080 Chelyabinsk, Russia; danil_u@rambler.ru
5 School of Mechanical and Design Engineering, University of Portsmouth, Portsmouth PO1 3DJ, UK; khaled.giasin@port.ac.uk
6 Department of Production Engineering, Koszalin University of Technology, Raclawicka 15-17, 75-620 Koszalin, Poland; krzysztof.nadolny@tu.koszalin.pl
* Correspondence: sehgal91@yahoo.co.in; Tel.: +91-985-5100-530

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Citation: Kumar, R., Singh, S., Aggarwal, V., Singh, S., Pimenov, D.Y., Giasin, K., Nadolny, K. Hand and Abrasive Flow Polished Tungsten Carbide Die: Optimization of Surface Roughness, Polishing Time and Comparative Analysis in Wire Drawing. *Materials* **2022**, *15*, 1287. https://doi.org/10.3390/ma15041287

Academic Editor: Irina Hussainova

Received: 14 December 2021
Accepted: 7 February 2022
Published: 9 February 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Abstract: This research work highlights the benefits of abrasive flow polishing (AFP) applied to tungsten carbide dies compared with conventional hand polishing (HP). An indigenous experimental set-up for AFP was developed. The effect of prominent process parameters viz. extrusion pressure, number of cycles, and abrasive particle concentration on the final surface roughness, percentage improvement in surface roughness, and polishing time was investigated by Taguchi-designed experiments. The multi-objective optimization (MOO) was performed using the Taguchi-TOPSIS-Equal weight approach to find the respective optimized AFP parametric settings. A set of skilled operators performed the conventional HP of dies, and the best hand-polished (HPed) die was selected using the TOPSIS technique. The operational performance of the HPed dies and the abrasive flow polished (AFPed) dies were compared on the three-stage wire drawing operation. The results revealed that AFP's surface resulted in a better-quality surface than hand polishing with a 27.06% improvement in surface roughness. Furthermore, AFP can reduce the dependency on costly and tricky-to-locate skilled operators, with a reasonable amount of time saving (about 87.05%). Overall, the study's findings show that abrasive flow polishing of dies is fast and cost-effective.

Keywords: abrasive flow polishing; hand polishing; surface roughness; wire drawing die; tungsten carbide; TOPSIS; polishing time; abrasive flow machining

1. Introduction

Polishing is a type of finishing operation performed after machining, and is essential to attain final surface quality and shape accuracy. It is generally performed on dies in metal forming and drawing operations to improve die life, quality of material processed, production time, and operation efficiency. However, inadequate polishing of the die leads to reduced die life and low product quality. In most industries, the majority of polishing operations are completed by the operators manually. The operator's skill is responsible for the surface quality and shape correctness of the polished die. The skilled operators spend a lot time attaining the necessary roughness on the die surface. The die polishing operations consume almost 30% to 40% of the overall die manufacturing time. The skilled operators

Hindawi
Journal of Nanomaterials
Volume 2022, Article ID 2188705, 15 pages
https://doi.org/10.1155/2022/2188705

Research Article

Multiobjective Optimization of EDM Parameters for Rice Husk Ash/Cu/Mg-Reinforced Hybrid Al-0.7Fe-0.6Si-0.375Cr-0.25Zn Metal Matrix Nanocomposites for Engineering Applications: Fabrication and Morphological Analysis

Ram Narayan Muni,[1] Jujhar Singh ,[2] Vineet Kumar,[3] Shubham Sharma ,[2,4,5] P. Sudhakara ,[4] Vivek Aggarwal,[2] and S. Rajkumar [6]

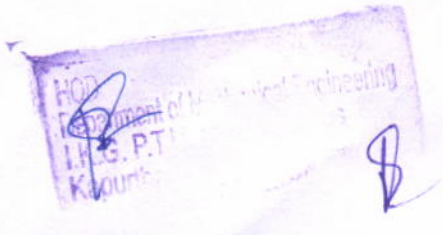
[1]*Research Scholar, Dept. of Mechanical Engg., IKGPTU, Kapurthala, 144603 Jalandhar, Punjab, India*
[2]*Department of Mechanical Engineering, IKGPTU, Main Campus, Kapurthala, 144603 Jalandhar, Punjab, India*
[3]*Department of Automobile Engineering, Chandigarh University, Gharuan, 140413 Mohali, Punjab, India*
[4]*CSIR-Central Leather Research Institute, Regional Centre-Jalandhar, 144021 Punjab, India*
[5]*Department of Mechanical Engineering, University Centre for Research and Development, Chandigarh University, 140413 Punjab, India*
[6]*Department of Mechanical Engineering, Faculty of Manufacturing, Institute of Technology, Hawassa University, Ethiopia*

Correspondence should be addressed to Jujhar Singh; jujharsingh2085@gmail.com and S. Rajkumar; rajkumar@hu.edu.et

Received 8 November 2021; Revised 21 January 2022; Accepted 15 March 2022; Published 31 March 2022

Academic Editor: Palanivel Velmurugan

The advanced class of Al/(RHA+Mg+Cu) hybrid metal matrix nanocomposites (MMNCs) has exhibited superior physical, and mechanical properties with superior wettability and chemical compatibility. This work has also been reported on the machining and multiobjective optimization of process variables for the machining of Al/(RHA+Mg+Cu) hybrid MMNCs on EDM using L_{27} Taguchi's orthogonal array integrated with Grey rational analysis (GRA). The primarily target goal of this study is to produce nanocomposite having better properties with minimal production cost, with the use of reinforcement rice husk ash (RHA). RHA is utilized in the base matrix of Al 6061 at wt.% of 6, 8, and 10. On the other hand, the elements such as Cu and Mg are placed fixed, i.e., 3 wt.% and 1 wt.%, respectively. The hardness, tensile strength, and impact strength of the nanocomposites increased with the maximum increment of 35.11%, 15.76%, and 16.67%, respectively, as compared to neat composite. Further, the purpose of this investigation was to determine the effect of various factors such as the percentage of RHA in the workpiece electrode (W), the discharge current (I), the voltage (V), the duty factor (τ), the pulse-on time (Ton), and the flushing pressure (P) on the material removal rate (MRR), the surface roughness (SR), and the tool wear rate (TWR) during the machining of hybrid nanocomposites using Taguchi's approach. The results revealed that MRR decreased with increasing the RHA content in the workpiece which can be reasoned to isolating nature of the RHA. It clearly shows that SR has decreased with an addition of RHA content from 6 wt.% to 8 wt.% in workpiece, but it slightly increased by further addition of RHA from 8 wt.% to 10 wt.%. SR has decreased with an increase in duty factor while performing EDM trials with the copper electrode, but it slightly increases with a further increase in duty factor. By the increase in pulse-on time, spark energy also increases also leading to the formation of craters. Therefore, SR has increased with an increase in pulse-on time. The TWR has increased with an increase in RHA content in the workpiece, because of the existence of hard reinforcements on the matrix which causes larger wear in the tool. Analysis of SEM micrographs showed the presence of voids, shallow and deep craters, and black voids on the machined surface of the fabricated hybrid nanocomposites. As calculated using the response graph for GRG, confirmation tests for optimal parametric setting show improvement over initial parametric setting of machining parameters. The mean of optimal MRR, SR, and TWR is estimated at the significant level of machining factors at $A_1B_3C_3D_2E_3F_1$, $A_2B_1C_1D_2E_1F_3$, and $A_1B_1C_1D_1E_1F_3$, respectively.



Arabian Journal of Geosciences (2022) 15:431
https://doi.org/10.1007/s12517-022-09594-2

ORIGINAL PAPER

Investigation of geo-mining green roof seismic energy balancing with resin bolting by Universal Drilling Machine: a novel energy-absorbing-based support system

Mohd Ahtesham Hussain Siddiqui[1,2] · Shahzad Akhtar[2] · Somnath Chattopadhyaya[1] · Shubham Sharma[3,4] · Mamdouh El Haj Assad[5] · Jujhar Singh[3] · Vivek Aggarwal[3] · Shashi Prakash Dwivedi[6] · Ambuj Saxena[6]

Received: 13 September 2021 / Accepted: 26 January 2022

Abstract
Roof bolt reinforcement of stratified carboniferous and fragile strata is a popular way of roof support in underground mines. The manifestation of strain energy of strata generated during coal winning generates convergence on established highways, the magnitude of which is exclusively determined by the strength, manner of beam construction, and time. A pattern of roof support is altered from grouting with cement bolting to resin bolting with a modification in Universal Drilling Machine (UDM), resulting in greater grip factor capacity and roof conditions compared to cement capsule grouting. This study sheds light on the modification of UDM for resin bolting provided by strata control and monitoring plan, and the reliability of roof support is demonstrated by detailed validation using modified Mohr–Coulomb theory and mechanical model method using Euler–Bernoulli theory. It has been seen in practice that the convergence in the stratified roof can be minimised and avoided with resin bolting, which is obtained from the theoretical method that maximal stress develops in the stable zone of the failure envelope. The thickness of a simply supported consolidated beam is shown in the mathematical model to be the foundation for the coal roof convergence rate, and this has been proven in the computational technique. The instantaneous roof 3D model was created to investigate the impacts of beam building thickness in Creo Simulate-6.0.4, as well as deflection analysis in Ansys 16.0 using a 3D model created by Creo Parametric-6.0.4 and practical monitoring of in situ convergence. These methods demonstrate how resin bolting improves the immediate roof's stability and prevents roof collapse during the mining process.

Keywords RMR (rock mass rating) · SCAMP (strata control and monitoring plan) · CMR (Coal Mines Regulation) · DGMS (Directorate General of Mines Safety)

Introduction

Saoner's mines are located 36 km from zero miles in the district of Nagpur, Maharashtra, India, at latitudes N 210.13′0.31″ to N 210.31′0.31″ and longitudes E 780–52′-00″ to E 780–56′-30″ to produce coal, the backbone of the Indian energy sector; it uses the board and pillar development method. A coal seam's mining creates a gallery with dips, rises, and levels depending on the shape and size of the pillars. The opening of seams disrupts in situ seismic energy due to the heavy underlying stresses, which are redistributed along its pillar to re-establish equilibrium.

The immediate and fresh exposed roof tends to flex and lead to layer separation inside the pressure arch region. As soon as the roof is exposed, active support must be provided to prevent convergence and drooping (DGMS circular, 13th July 2009) (DGMS Circular no- DGMS (Tech) Circular No.10 of 2009).

Strata control and monitoring plan (SCAMP) has been prepared, formulated, and implemented in respect of working Seam V, Seam IV (M), and Seam IV (B), as shown in Table 1. According to scientific studies conducted at Rock Testing Laboratory, Indora complex Nagpur by the Safety

Responsible Editor: Murat Karakus

✉ Shubham Sharma
shubham543sharma@gmail.com;
shubhamsharmacsircIri@gmail.com

✉ Mamdouh El Haj Assad
massad@sharjah.ac.ae

Extended author information available on the last page of the article

Published online: 26 February 2022

Surface & Coatings Technology 432 (2022) 128052

Contents lists available at ScienceDirect

Surface & Coatings Technology

journal homepage: www.elsevier.com/locate/surfcoat

Cavitation erosion behavior of high velocity oxy fuel (HVOF) sprayed (VC + CuNi-Cr) based novel coatings on SS316 steel

Vikrant Singh [a], Indraj Singh [a], Anuj Bansal [a], Ankita Omer [a], Anil Kumar Singla [a,*], Rampal [a], Deepak Kumar Goyal [b]

[a] Sant Longowal Institute of Engineering and Technology, Longowal, Sangrur 148106, Punjab, India
[b] IK Gujral Punjab Technical University, Main Campus, Kapurthala, Punjab, India

ARTICLE INFO

Keywords:
Cavitation erosion
HVOF
VC
CuNi-Cr
SS316 steel

ABSTRACT

A well-known hard material (VC) has not been explored as potential candidate for surface modifications to overcome the problem of cavitation erosion (CE) in hydro machinery components. Therefore, in this course of work, VC has been blended with a malleable and soft binder material (CuNi-Cr) in three different proportions (VC, VC + 50%CuNi-Cr, and CuNi-Cr) and coated over SS316 steel with the help of HVOF spraying system. It has been observed that with the increase in VC content in the candidate coatings, the hardness, porosity, and thickness increased. CE tests were carried out with the help of an in-house fabricated cavitation erosion apparatus as per ASTM G134 Standard. The CE resistance of SS316 steel was found to be enhanced with the application of HVOF sprayed VC and CuNi-Cr based coatings. HVOF coating prepared with 100% VC content have showed excellent wear resistive properties owing to its maximum hardness (1023 $HV_{9.81N}$) and better rebounding properties due to maximum thickness and porosity. CE parameters consisting of highest velocity of jet, intermediate stand-off distance (SOD) and normal impedance were found to be dominating to produce maximum cavitation erosion. Moreover, SS316 steel have showed ductile mode of failure with signatures of material removal as overlapped CE pits and plastic deformation sites. However, the mode of failure for coatings have been changed from ductile to brittle with the increase in VC content in the coating matrix with signatures changes from plastic deformation to cracks and pores in case of CuNi-Cr and VC coatings, respectively.

1. Introduction

Hydraulic turbines are widely used to generate electricity from renewable energy sources [1]. Water along with some sand particles flow at numerous speeds in different parts of a hydroelectric power generation system and this can cause slit erosion, corrosion erosion, and cavitation erosion in different hydro machinery components [2]. These various types of erosions can deteriorate the profile of hydro machinery components which is furthermore responsible for the reduction in efficiency of components. Among all these erosions, cavitation erosion (CE) is one of the most common causes of components deterioration [3–4]. CE occurs by the endeavor of force (shockwave with a pressure nearly 1500 MPa) generated owing to bursting of water bubbles because of the fluid pressure variations [5–6]. Due to CE, the component materials get deteriorate and loss their functionality [7–8]. In real operating conditions of hydro machineries, CE of the targeted material depends upon the fluid propertied like temperature and specific mass, vapor pressure, and operating head [3,9]. Therefore, during designing of high-speed hydrodynamic system components, CE is considered as one of the most critical aspects, and this aspect cannot be eliminated [9–10]. CE prominently occurs in various fluid-flow machines namely pumps, water turbines, marine propellers, and pipelines, and even in devices pertaining to chemical and petrochemical industries [11–13]. As when it comes to reaction turbines, CE may be observed on turbine blades and guide valves, however in case of Kaplan and Francis turbine, CE can be observed at leading edge, trailing edge, draft tube swirl, inter blade vortex, and wicket gates [14–15]. As per the studies carried out by Gohil and Saini [16], it has been reported that the degradation of efficiency and CE rate in case of Francis turbine directly depends upon the variation in suction head, flow rate, and fluid temperature. Bansal et al. [17] explained that CE predominantly depends upon the extent of pressure lower than the vapor pressure, and distance between material surface and bubble generation sites. The effect of above said operating factors on CE can be studied by varying parameters namely dimensionless aspect

* Corresponding author.
E-mail addresses: anujbansal@sliet.ac.in (A. Bansal), anilsingla@sliet.ac.in (A.K. Singla).

https://doi.org/10.1016/j.surfcoat.2021.128052
Received 17 October 2021; Received in revised form 1 December 2021; Accepted 21 December 2021
Available online 3 January 2022

International Journal of Refractory Metals and Hard Materials 105 (2022) 105825

Contents lists available at ScienceDirect

International Journal of Refractory Metals and Hard Materials

journal homepage: www.elsevier.com/locate/IJRMHM

Influence of laser cladding parameters on slurry erosion performance of NiCrSiBC + 50WC claddings

Sarpreet Singh [a], Deepak Kumar Goyal [b], Parlad Kumar [a], Anuj Bansal [c,*]

[a] Punjabi University, Patiala, Punjab, India
[b] I. K. Gujral Punjab Technical University Jalandhar, Kapurthala, Punjab, India
[c] Sant Longowal Institute of Engineering and Technology, Longowal, Punjab, India

ARTICLE INFO

Keywords:
Laser cladding parameters
NiCrSiBC+50WC
Slurry erosion
Wear mechanisms

ABSTRACT

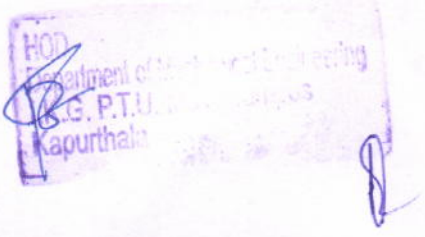
Various components employed in hydro machines are rigorously affected by the presence of sand particles throughout their operation which leads to degradation of the target surface. To counteract this menace, laser cladding has been emerged as a prominent technique to produce dense coatings along with enhanced surface properties like hardness and wear resistance. Therefore, in this study, hard layers of NiCrSiBC + 50WC powder were deposited on SS410 steel by laser cladding. Further, the effect of laser beam power, scanning speed, and powder feed rate on quality of clads was investigated. The laser cladded samples were examined for their micro structural characteristics, micro-hardness, and slurry erosion. Performance of NiCrSiBC + 50WC coatings under slurry erosion was evaluated for harsh conditions of various factors namely sand particle size, slurry concentration, impingement velocity, and impingement angle. Laser cladding parameters namely scanning speed and laser beam power were found to have a significant influence on micro-hardness of developed clads, while powder feed rate did not exhibit a significant effect on micro-hardness variations. Owing to higher hardness of deposited materials, slurry erosion resistance of NiCrSiBC + 50WC clad surfaces was greatly enhanced as that of uncoated SS410 steel. From SEM images, plastic deformation, micro-cutting, crater formation, and ploughing were observed as the major wear mechanisms for the slurry eroded clads. Further, from the obtained results, it has been noticed that a blend of high scanning speed, high laser beam power, and intermediate powder feed rate is suitable to develop coatings having superior wear resistance.

1. Introduction

The presence of irregular/hard shaped sand particles in water leads to slurry erosion in hydraulic turbines. Slurry erosion is the dominant reason of degradation in hydro machinery components, which leads to decline the turbine output and ultimately results in complete breakdown of the hydro-machinery system [1]. Components used in fluid machinery such as turbines, propeller pumps, and valves, usually undergo surface dilapidation in terms of erosion and impose major financial loss [2,3]. The slurry erosion wear of hydro turbine components is determined by diverse factors including particle size and hardness of erodent particles, slurry concentration, impingement velocity of erodent, and properties of the exposed surfaces [4]. As reported by Levy et al. [5], the hardness of component material along with erodent sand particles have found to be the major factors affecting the slurry erosion rate. AISI carbon 1020 steel was used as substrate and erosion tests were performed at a velocity of 80 m/s at two angles of impingement ($\alpha = 30°$ and 90°) by the researchers and reported variable erosion values with parameters [5]. Moreover, they concluded that angular particles had more impact on erosion as that of spherical erodent particles. Further, myriad researchers investigated that apart from hardness of sand particles, other factors such as shape of erodent sand particles, impingement velocity, slurry concentration, and impingement angle also have a paramount role in erosion [6–10]. The materials opted for such applications have minimal resistance to wear and corrosion. Hence, vigorous materials having excellent surface properties are desired to overcome these forms of degradation. To enhance the surface characteristics of the exposed material, various methods like heat treatment and coatings have been utilized, which helps to mitigate the damage from erosion [1,2,11,12]. Owing to the rapid progress in the field of laser science and technology, laser-assisted material processing [13,14] has become a popular surface treatment technique. Laser surface treatments have been known to

* Corresponding author.
E-mail addresses: anujbansalsliet@gmail.com, anujbansal@sliet.ac.in (A. Bansal).

https://doi.org/10.1016/j.ijrmhm.2022.105825
Received 27 September 2021; Received in revised form 25 February 2022; Accepted 4 March 2022
Available online 10 March 2022



Materials Today: Proceedings 62 (2022) 7581–7594

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

CFD and experimental study of slurry erosion wear in Hydro-machinery

Mithlesh Sharma [a,*], Deepak Kumar Goyal [b], Gagandeep Kaushal [c], Neel Kanth Grover [b], Anuj Bansal [d], Khushdeep Goyal [e]

[a] KC Group of Research and Professional Institutes, Pandoga, Una, 177207, India
[b] IK Gujral Punjab Technical University, Main Campus, Kapurthala, 144603, India
[c] YCOE, Punjabi University Guru Kashi Campus, Talwandi Sabo, 151302, India
[d] Sant Longowal Institute of Engineering and Technology, Longowal, Sangrur, 148106, India
[e] Punjabi University, Patiala, 147002, India

ARTICLE INFO

Article history:
Available online 5 May 2022

Keywords:
Slurry erosion
CFD
Simulation
Hydro turbines

ABSTRACT

Hydropower plants which are fed from the tributaries originating from Himalayan ranges face a serious problem due to presence of slurry erosion phenomenon which led to material degradation or failure, sometimes it results in operational failure and economic loss. The main objective of the present work is to show that one can use computational fluid dynamics (CFD) to predict the slurry erosion behaviour and particle impact profiles on hydraulic machinery. To develop the slurry erosion model, Eulerian-Lagrangian based approach is used to simulate the multiphase flow phenomenon i.e. flow behaviour and liquid–solid interaction. For considering the viscosity effect, K-epsilon (k-ε) turbulence model having realizable and scalable wall function is used which simulate the mean flow characteristics for turbulent flow conditions. Furthermore, to track the motion of the particles, the Lagrangian frame of reference was used along with Eulerian formulation for continuous phase. The results obtained from the developed CFD model were in good agreement with the experimentally obtained results.

Selection and peer-review under responsibility of the 9th International Conference on Advancements and Futuristic Trends in Mechanical and Materials Engineering(AFTMME 2021).

1. Introduction

Slurry erosion poses a great threat to the hydropower plants which are fed from the tributaries originating from Himalayan ranges [1]. During rainy season embankments of these tributaries eroded due to heavy inflow of water and results in entrained of solid particles such as pebbles, sand, clay, mud, grit etc. in the water fed to hydro turbines [2]. These unwanted particles when mixed with the flowing water results in the formation of slurry [3]. When such mixture of slurry interacted with hydro turbine components, it results in material degradation and failure due to a phenomenon known as slurry erosion [4]. The degradation of hydro turbine components by slurry erosion wear may lead to a breakdown in the power plant which results in economic loss and threat to safety [3]. Many industries are adopting erosion models to accurately predict the occurrence of erosion and its failure effect on equipment dealing with slurry to increase productivity and safety [5]. Slurry erosion phenomenon is caused by a mixture of erodent-liquid multiphase flow which is complicated in nature to understand. It has been learnt from the exhaustive study of the literature that slurry erosion is a function of various factors such as slurry concentration, impact angle, impact velocity, mechanical properties etc. [4]. It is very difficult to investigate the effect of all the factors experimentally alone. However, the advancements in the domain of simulation led to the development of a tool known as computational fluid dynamics (CFD) which observed to be very beneficial in simulating such multiphase flow [6,7]. In CFD, multiphase flow is generally represented by the Euler-Euler approach and Euler-Lagrange approach. A couple of studies used computational strategies to investigate the effect of various parameters on the slurry erosion behaviour of target surface [6-10]. Erosion prediction in a wall of the nozzle using CFD was performed by Kamarudin et al. [11]. It was concluded that different operating conditions significantly affect the erosion rate. Similar investigation on the pipe was carried out by Habib et al. [12]. To enrich the studies further, Wang et al. [13] predicted the flow pattern and particle impact profile on the target surface using the CFD model. Similar work was carried out by Messa et al., [12] for the development of the steady-state simulation of the slurry

* Corresponding author.
E-mail address: mithlesh20@gmail.com (M. Sharma).

https://doi.org/10.1016/j.matpr.2022.04.742

Selection and peer-review under responsibility of the 9th International Conference on "Advancements and Futuristic Trends in Mechanical and Materials Engineering"(AFTMME 2021).

MATERIALS AND MANUFACTURING PROCESSES
https://doi.org/10.1080/10426914.2022.2149784

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Effect of filler material on the microwave joining of SS-430 steel

D. S. Sahota[a], Amit Bansal[b], and Vinod Kumar[a]

[a]Mechanical Engineering Department, Punjabi University, Patiala, India; [b]Mechanical Engineering, IK Gujral Punjab Technical University Jalandhar, Kapurthala, India

ABSTRACT

In this research paper, the ferritic stainless steel (SS)-430 was butt-joined using nickel (Ni) and austenitic stainless steel (SS-316 L) as interface powder materials. The trials were conducted using a home microwave device that ran at 2.45 GHz and 1000 W. The fabricated weldments demonstrated metallurgical bonding of the SS-430 faying surfaces with the Ni and SS-316 L-based filler materials. The presence of various carbide phases in the joint region of both Ni and SS-316 L-based filler materials was discovered using XRD investigation. The formation of various carbides particle was significantly high in case of joint formed with Ni-based filler materials as compared to the SS-316 L-based filler materials. Microhardness of the joint zone was reported as 310 ± 25 HV and 290 ± 11 HV for weldment obtained with Ni and SS-316 L-based filler materials. The tensile strength of weldment fabricated with SS-316 L-based filler materials (416.70 MPa) is significantly high as compared to weldment fabricated with Ni-based filler materials (318.70 MPa). This was because of the presence of relatively harder carbide particles present in the joint of Ni-based filler materials, which significantly reduces the ductility and tensile strength of the fabricated weldment.

ARTICLE HISTORY
Received 29 July 2022
Accepted 11 October 2022

KEYWORDS
Microwave; hybrid; hardness; joints; welding; ferrite

Introduction

The ferritic stainless steel (SS)-430 is the frequently utilized material in the construction, aerospace, and automotive industries. It is also known as corrosion resistance steel due to the presence of chromium (16–18%) in it, and it is employed when both mechanical and corrosion resistance characteristics are necessary. This steel is widely used in refrigerator cabinet panels, heat exchangers, washing machinery parts, parts of furnace and petroleum refining equipments.[1] The prime requirement for any manufacturing and structural industry is the joining of similar or dissimilar materials. No assembly can be made without the help of any joining operations. Therefore, the researchers are in the search of better and more efficient methods to join similar and dissimilar bulk metallic materials. There are numerous conventional and advanced methods available for the joining of materials.[2–6] Each of these welding methods has benefits and drawbacks that are particular to a certain application. In the majority of the welding processes as discussed above, except LBW, and EBW, the base metal temperature reaches at a certain level that transformations in the microstructure occur near to the weld pool. These transformations significantly affect the properties of base metal and lead to the failure of the weldment in the transformed zone, when these weldments were subjected to loading in engineering applications. The processes like LBW and EBW cause less structural changes in the base metal due to the very high energy density with better control associated with these processes. But the high cost associated with these processes limits their use in engineering applications. As a result, a lot of work has been done in the welding field to join materials with ease and inexpensive processes.[7]

Recently, much work has been performed to process materials by utilizing microwave energy.[7] The researchers have extensively utilized microwave heating for material processing due to its inherent attributes such as volumetric and uniform heating, which causes less residual stresses inside the processed material, less processing time, and eco-friendly. During heating by microwave, the energy in the form of electromagnetic waves gets transformed into thermal energy through dipole rotation at an atomic level and ionic conduction at a molecular level. This energy conversion occurred at a very fast rate depending upon the dielectric properties of the materials being processed. There is a significant reduction in processing time was took place as compared to the conventional heating of materials due to the fast heating rate accompanied with microwave heating. Further, the whole of the material kept in the microwave oven is subject to this energy conversion. Therefore, microwave heating offers substantial savings, when compared to conventional heating, in terms of energy. In general, microwave heating consumes 10–100 times less energy and requires 10–200 times less time.[8] Microwave materials processing can give an alternative to high energy consumption heating techniques that are commonly used in industries. Microwave radiation has unmatchable characteristics like being eco-friendly with the environment, consume very less electricity, volumetric heating, can join/weld specific area of workpiece and microwave processed material/product exhibits better mechanical properties with less processing

CONTACT Amit Bansal amit.bansal978@gmail.com Assistant Professor in Mechanical Engineering, CB-1 Building, F-106, I.K. Gujral Punjab Technical University Jalandhar, Kapurthala, Punjab, India, Pin code: 144603

Special issue: Materials Engineering

Institution of MECHANICAL ENGINEERS

Journal of PROCESS MECHANICAL ENGINEERING

Effect of post-heat treatment on the microstructural, mechanical, and bioactivity behavior of the microwave-assisted alumina-reinforced hydroxyapatite cladding

Proc IMechE Part E:
J Process Mechanical Engineering
1–12

DOI: 10.1177/09544089221116168
journals.sagepub.com/home/pie
SAGE

Pardeep Singh[1], Hitesh Vasudev[1] and Amit Bansal[2]

Abstract

The current research involves using microwave energy to modify the surface layer of UNS S31254 stainless steel in order to improve its bioactivity by cladding it with alumina-reinforced hydroxyapatite. For the microwave surface modification process, an industrial microwave oven supported by an infrared pyrometer and functioned at 1.1 kW and 2.45 GHz was utilized. In addition, the surface-modified samples were thermally heat-treated in a muffle furnace for 1 h at three different temperatures 400°C, 600°C, and 800°C. Scanning electron microscopy, energy-dispersive spectroscopy, X-ray diffractometer, and simulated bodily fluid testing were used to investigate the metallographic, compositional, phase analysis, and bioactivity of microwave surface-modified samples. The presence of alumina in the microwave surface-modified samples was confirmed by X-ray diffractometer analysis. The microwave-assisted surface modification layer contains predominantly iron (Ni-Fe)-based austenite dendrites, as well as hydroxyapatite and certain reaction products, mostly in the interdendritic areas, according to the microstructural analysis. The results indicate that the heat-treated surface-modified samples exhibit lower porosity and higher hardness than the as-deposited surface-modified samples. Furthermore, the 800°C heat-treated samples exhibited the lowest porosity (about 56% less than that of the as-deposited sample) and maximum hardness (about 23.5% more than the as-deposited sample) among all the heat-treated samples. The bone binding ability of the surface-modified samples was decreased after heat treatment due to the reduction of pores and amorphous phase after the heat treatment process.

Keywords

Alumina, hydroxyapatite, UNS S31254 stainless steel, microwave, bioactivity, apatite

Date received: 23 March 2022; accepted: 7 July 2022

Introduction

The metallic implants were excessively utilized for joint replacement particularly in orthopedic applications. In the next 10–20 years, metallic implants demand will continue to rise.[1] It has been reported that about 20% of the metallic implant failed due to the infection and 18% of the metallic implants failed mainly due to aseptic loosening.[2,3] Therefore, the metallic material used in biomedical applications must possess both antibacterial properties and strong osseointegration.[4] Among various implant materials, steel is commonly employed as bio-implant materials because it offers various properties like adequate strength, and stability for load-bearing applications. In a variety of steel, the austenitic stainless steel (largely SS-316L) is widely used for internal fixation devices despite its lower corrosion resistance than titanium. This is due to its affordable price as well as its superior mechanical properties. Lately, a new surgical grade of stainless steel UNS S31254 (254SS) has been introduced. The presence of high nitrogen content along with the absence of toxic effects in 254SS have made it a candidate for scientific investigations in the hope to be utilized in orthopedic implant materials.[5] However, the poor biocompatibility restricts its clinical use. This problem can be mitigated by surface modifications of this steel (254SS) with bioactive materials. In bioactive material, the hydroxyapatite (HA) has attracted great attention

[1]School of Mechanical Engineering, Lovely Professional University, Phagwara, India
[2]Mechanical Engineering Department, I. K. Gujral Punjab Technical University (IKGPTU), Jalandhar, India

Corresponding author:
Amit Bansal, Mechanical Engineering Department, I. K. Gujral Punjab Technical University (IKGPTU), Jalandhar 144603, India.
Email: amit.bansal978@gmail.com

Surfaces and Interfaces 28 (2022) 101701

Contents lists available at ScienceDirect

Surfaces and Interfaces

journal homepage: www.sciencedirect.com/journal/surfaces-and-interfaces

Hydroxyapatite reinforced surface modification of SS-316L by microwave processing

Parmjit Singh [a], Amit Bansal [b,*], Vinod Kumar Verma [c]

[a] Department of Mechanical Engineering, Punjabi University, Patiala 147002, India
[b] Department of Mechanical Engineering, IK Gujral Punjab Technical University, Jalandhar 144603, India
[c] Department of Mechanical Engineering, Punjabi University, Patiala 147002, India

ARTICLE INFO

Keywords:
Microwave
Hybrid
Surface
Microstructure
Steel
Hydroxyapatite

ABSTRACT

The current study was focused to modify the surface layer of stainless steel (SS-316L) for enhancing its bioactivity by reinforcing hydroxyapatite (HAp) powder through exploiting the principle of hybrid Microwave Heating (MH) technique. The modified substrates were subjected to post heat-treatment at 400 °C and 700 °C for 1 h. The microstructural analysis of the modified composite layer revealed the existence of HAp particles along with some reaction induced products primarily in the iron-based austenite dendritic matrix. The heat-treated substrates showed a higher microhardness value than that of as-deposited substrates due to densification of the modified layer after heat-treatment. The porosity, surface imperfections and flaws were reduced after heat treatment. The scanning electron microscopy (SEM) images taken over the modified and unmodified SS-316L after immersion test in simulated body fluid showed rapid apatite forming ability on the modified substrates. The apatite growth ability of the modified substrates was reduced after heat treatment performed at 700 °C due to a reduction in the amorphous phase and porosity contents.

1. Introduction

In the last few decades, owing to population aging and alteration of modern lifestyle by human beings, millions of persons have been gripped by the diseases like orthopedic, and maxillofacial [1]. Hence, solving these problems is the need of the hour so that human beings live a healthy and long life. For that purpose, medical implants were in demand as implant technology is growing day by day [2]. Many scientists/researchers have already predicted that human beings alter their way of living style. Due to these changes, in future, more persons will be plagued by orthopedic diseases. The treatment for these diseases associated economic burden will rise at a rapid pace annually [3]. Aided by advancements in the area of medical and biological sciences, the metallurgy and materials researchers have succeeded in past years by discovering different materials for an implant to repair human body tissues for several people all around the globe. Currently, materials like metals, polymers, and ceramics are being preferred clinically for the implants used in various dental and medical fields [4,5]. Among metallic implant materials, stainless steel is an extensively used material in biomedical applications throughout the world. Further, from the various grades of steel, austenitic stainless steel (SS-316L) is widely used in biomedical applications due to its characteristics like adequate strength and high corrosion resistance. The SS-316L has been extensively utilized in biomedical applications like fracture fixation plate, screws, pins, nails, femoral stems case for pacemakers and joints for fingers, knees, hips, ankles, elbows, shoulders and wrists [6]. Nevertheless, this material has limitations in terms of tissue growth in the biological environment. However, this limitation has been overcome by treating the surfaces of SS-316L by utilizing various surface altering techniques [7]. The bioactivity of the SS-316L can be achieved by depositing bioactive hydroxyapatite (HAp) on it by utilizing various surface alteration techniques like vapor deposition processes including plasma spraying [8], sol-gel method [9], thermal spraying [10] and laser-assisted surface modification [11]. Among various techniques, the plasma spray has been widely used for enhancing the bioactivity of SS-316L by depositing HAp coating on it due to its economic efficiency. This technique has also been approved by Food & Drug Administration USA. Although, this process produces coatings having a high deposition rate and homogenous dense layer. Nevertheless, this process required expensive equipment and high temperature for the deposition of the coating on the substrate surfaces. The coatings fabricated by using this technique exhibit a poor coating-substrate adherence. Moreover, the deposited

* Corresponding author.
E-mail address: amit.bansal978@gmail.com (A. Bansal).

https://doi.org/10.1016/j.surfin.2021.101701
Received 9 September 2021; Received in revised form 17 November 2021; Accepted 19 December 2021
Available online 23 December 2021

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

First and second order analysis of functionally graded composite material

Rajesh Sharma [a,*], Vijay Kumar Jadon [b], Balkar Singh [c], Rajneesh Kumar [a], Sanjeev Kumar [a]

[a] Department of Mechanical Engineering, Chandigarh Engineering College Landran, Punjab, India
[b] Department of Mechanical Engineering, Chitkara University, Rajpura, Punjab, India
[c] IKG-PTU, Jalandhar, Punjab, India

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Functionally graded material (FGM)
Abaqus
Transient analysis
First order element
Second order elements

ABSTRACT

This paper deals with the analysis of metal-ceramic (FGM) rectangular composite plate under transient loading conditions. Fully-Coupled Thermal-stress Transient analysis has been carried out and convergence study for peak stress and central deflection for various mesh size has been carried out and compared for both first and second order quad elements. Abaqus subroutine USDFLD has been used for spatially varying material properties of the FGM material. Volume fraction of the two constituents of the FGM is varied smoothly based on the power law for various values of porosity coefficient. Exponentially time varying temperature loading on the top and bottom surface of the FGM plate is considered with simply supported boundary conditions.

Selection and peer-review under responsibility of the scientific committee of the 3rd International Conference on Contemporary Advances in Mechanical Engineering.

1. Introduction

Functionally graded material (FGM) has found a profound use in recent times due to their ability to withstand high temperature environment. FGM are being used in aerospace, automotive and nuclear domains where there are harsh environmental conditions. FGM are created by varying the volume fraction of a ceramic and metal in their mixture in one or more directions. This makes FGM more suitable in high temperature environments like in electronics cooling, in air craft industry, gas turbine blades [1–5]; nowadays gun barrels are also made using functionally graded materials [6,7]. Steel can also be used as FGMs like SAE 1010 and other steels for enhancement of weldabilty and other mechanical properties [8].

In 1984, a group of scientist in Japan [9], for the first time introduced the concept of functionally graded material. FGM materials reduces magnitude of thermal and residual stresses while increasing the strength and fracture toughness. Subsequently, a large extent of research has been carried out. Lambros et al. [10], presented that by gradually varying the chemical structure of a thin polymer sheet, a smooth variation in the in-plane material properties of the FGM can be obtained. Study by Mahamood et al. [11] presents an overview on FGM, various fabrication methods were highlighted and different applications are also discussed.

Various analytical methods have been presented for the analysis of functionally graded material. Vel [12], Vangjian [13], Wei-qiu [14], and many others [15–21] have presented various analytical methods to analyze FGM plates under thermo-mechanical loading.

These analytical methods are good for analyzing small plates but using them to analyze real world structure realistically becomes a challenge. Complex structures results in complex equation which makes the calculation cumbersome and time consuming.

FEM (Finite element method) is a well-known technique for the calculating the response of these complex structures. Uysal [22] concluded that thermal analysis with a range of volume fraction parameter from 0.2 to 0.5 provides the optimum solution to thermally loaded plates. Alshorbagy et al. [23], presented first-order shear deformation plate model analysis using finite element method. But the scope of his work is limited only for steady state analysis of FGM plate under thermo-mechanical load.

Very little work on the transient analysis of FGM using FEM is done. No work on the comparison of results for first order and second order FGM quad element has been carried out.

* Corresponding author.
E-mail address: rajeshsharma@cgc.edu.in (R. Sharma).

https://doi.org/10.1016/j.matpr.2021.11.658

Selection and peer-review under responsibility of the scientific committee of the 3rd International Conference on Contemporary Advances in Mechanical Engineering.

materials

MDPI

Article

Experimental Investigation and Performance Optimization during Machining of Hastelloy C-276 Using Green Lubricants

Gurpreet Singh [1], Vivek Aggarwal [1], Sehijpal Singh [2], Balkar Singh [1], Shubham Sharma [3,4,*], Jujhar Singh [1], Changhe Li [5], R.A. Ilyas [6,7] and Abdullah Mohamed [8,*]

[1] Department of Mechanical Engineering, IKGPTU Main Campus, Kapurthala, Punjab 144603, India; gssingh410@gmail.com (G.S.); agarwalz_v@yahoo.com (V.A.); balkarsingh@ptu.ac.in (B.S.); jujharsingh2085@gmail.com (J.S.)
[2] Department of Mechanical Engineering, Guru Nanak Dev Engineering College, Ludhiana, Punjab 141006, India; mech@gndec.ac.in
[3] Department of Mechanical Engineering, University Centre for Research and Development, Chandigarh University, Mohali, Punjab 140413, India
[4] Department of Mechanical Engineering, Indian Institute of Technology, IIT-Ropar, Rupnagar, 140001, Punjab, India
[5] School of Mechanical and Automotive Engineering, Qingdao University of Technology, Qingdao 266520, China; sy_lichanghe@163.com
[6] School of Chemical and Energy Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Johor Bahru 81310, Johor, Malaysia; ahmadilyas@utm.my
[7] Centre for Advanced Composite Materials, Universiti Teknologi Malaysia, Johor Bahru 81310, Johor, Malaysia
[8] Research Centre, Future University in Egypt, New Cairo 11835, Egypt
* Correspondence: shubham543sharma@gmail.com (S.S.); mohamed.a@fue.edu.eg (A.M.)

Citation: Singh, G.; Aggarwal, V.; Singh, S.; Singh, B.; Sharma, S.; Singh, J.; Li, C.; Ilyas, R.; Mohamed, A. Experimental Investigation and Performance Optimization during Machining of Hastelloy C-276 Using Green Lubricants. *Materials* **2022**, *15*, x. https://doi.org/10.3390/xxxxx

Academic Editors: Grzegorz Królczyk, Pradeep Menezes and Itzhak Green

Received: 7 April 2022
Accepted: 13 June 2022
Published: date

Abstract: Smart manufacturing is the demand of industry 4.0, in which the mass production of difficult-to-cut materials is of great concern to fulfil the goal of sustainable machining. Presently, the machining of superalloy is of upmost interest because of its wide application. However, the limited data on the turning of Hastelloy C-276 highlights its challenges during processing. Hence, the machining performance of superalloy considering surface quality, thermal aspects and chip reduction coefficient was examined with minimum quantity lubrication of several oils to address the sustainable development goal (SDG-12). The output responses were optimized through response surface methodology along with analysis of variance. The research exhibited that the output responses were dominated by cutting speed and feed rate having a percentage benefaction of 24.26% and 60%, respectively, whilst the depth of cut and lubricant type have an influence of 10–12%. No major difference in temperature range was reported during the different lubrication conditions. However, a substantial variation in surface roughness and the chip reduction coefficient was revealed. The percentage error evaluated in surface roughness, temperature and chip reduction coefficient was less than 5%, along with an overall desirability of 0.88, describing the usefulness of the model used. The SEM micrograph indicated a loss of coating, nose and flank wear during all lubrication conditions. Lastly, incorporating a circular economy has reduced the economic, ecological and environmental burden.

Keywords: Hastelloy C-276; minimum quantity lubrication; sustainable development goals; response surface methodology; vegetable oil; synthetic oil; waste oil; SEM

1. Introduction

The machining of Hastelloy C-276 is quite difficult during dry machining conditions because of its low thermal conductivity. Nevertheless, its excellent strength along with a high heat carrying capacity makes it suitable for components of air craft, petro and chemical plants' check valves as well as nuclear reactor components. In addition, the

Materials Today: Proceedings 68 (2022) 1180–1186

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Effect of post coating processing on the morphological and mechanical properties of plasma Spray-reinforced hydroxyapatite coating

Gursharan Singh [a], Manoj Mittal [b], Jujhar Singh [b], Shubham Sharma [b,*], Jasgurpreet Singh Chohan [c], Raman Kumar [c]

[a] I.K. Gujral Punjab Technical University, Kapurthala, Punjab, India
[b] Department of Mechanical Engg., IK Gujral Punjab Technical University, Main Campus, Kapurthala 144603, India
[c] Department of Mechanical Engineering, University Center for Research & Development, Chandigarh University, Mohali, Punjab 140413, India

ARTICLE INFO

Article history:
Available online 4 November 2022

Keywords:
Plasma spray
Hydroxyapatite
Titanium alloy (Ti-6A-4V)
Tantalum carbide
Post thermal treatment
Surface morphology
Tensile bond strength

ABSTRACT

The biocompatible Hydroxyapatite (H.A.) coating helps titanium alloy recover and insulates implants from the body's environment. FDA recommends plasma spray to cover H.A. on body implants. H.A.'s poor mechanical properties limit its use in weight-bearing orthopaedic applications like hip and knee joints. This study examines the influence of H.A. reinforcement on plasma-sprayed coatings' microstructure and mechanical characteristics. The influence of thermal post-treatments on as-deposited (pure H.A. & reinforced H.A.) coatings was also examined. SEM images of as-deposited (pure H.A. & reinforced H.A.) coatings were taken before and after thermal processing (S.E.M.). The use of reinforcement improves as-sprayed coatings' microhardness and bond strength. After two hours at 700 °C in air, both substrates had ultrafine particles that may connect to bone and promote bone development.

Selection and peer-review under responsibility of the scientific committee of the Indo-US International Conferences on Materials & Sustainable Engineering in Chemical and Allied Industry.

1. Introduction

Medical science focuses on metals and alloys due to their good mechanical prop- erties in load bearings applications and orthopaedic implants [1]. Because of their excellent mechanical properties, titanium alloys are frequently used to repair artificial hip and knee joints [2,3]. The metallic implant used for replacement should have a young's modulus comparable to human bone. This helps decrease the effect of stress shielding and improve the quality of human life [4,5]. The metallic implants may release harmful ions, which lowers the quality of the biological response. To enhance the healing process and keep the implant safe from difficult situations in the human body, specific coatings have been applied to metallic implants [6]. Hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) is hydrated Calcium Phosphate (Ca-P) mineral that is the major constituent of bone. Hip and knee H.A. coatings are often employed in orthopaedic surgery for replacement joints due to their remarkable properties, such as biocompatibility in-vivo bioactivity, bio-restorability, and osteo-conductivity [7].

H.A. coating is applied on metallic implants such as titanium, and its alloys are used for orthopaedics applications due to their high biocompatibility [8]. Different methods have been developed to coat implant surfaces with HA such as sol- gel [9,10],electrophoresis deposition [11,12],pulsed laser deposition (PLD) [13], dip coating [14], spark plasma sintering [15], biomimetry [16,17] and thermal spray [18,19] such as high- velocity- oxy-fuel (H.V. O.F) [20] and plasma spray [21]. The F.D.A. has approved plasma spraying technology as a coating procedure for biocompatible medical implants from the list of techniques provided. Improved biocompatibility and bone adherence can be achieved by using H. A. coatings. Because these coatings need to be absorbed by the human body, their phases, quality, and control must be optimized and effectively managed [22,23].

However, the weak mechanical properties of H.A. limit its use in orthopaedic applications like hip and knee joints that must bear a load. Biocompatibility is pro- vided by H.A., while the inclusion of H.A. provides mechanical strength-reinforced reinforcement [24]. Reinforcing H.A. with bioinert materials can solve this problem with high mechanical characteristics. Coatings with reinforcements may be applied on bio-inert metallic surfaces such as tita-

E-mail address: jasgurpreet.me6@gmail.in (J. Singh Chohan)

https://doi.org/10.1016/j.matpr.2022.10.108
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the Indo-US International Conferences on Materials & Sustainable Engineering in Chemical and Allied Industry.

Available online at www.sciencedirect.com

jmr&t
Journal of Materials Research and Technology

journal homepage: www.elsevier.com/locate/jmrt

Original Article

Impact of post-heat-treatment on the surface-roughness, residual stresses, and micromorphology characteristics of plasma-sprayed pure hydroxyapatite and 7%-Aloxite reinforced hydroxyapatite coatings deposited on titanium alloy-based biomedical implants

Gursharan Singh [a], Shubham Sharma [b,c,*], Manoj Mittal [b], Gurminder Singh [d,**], Jujhar Singh [b], Li Changhe [e], Aqib Mashood Khan [f], Shashi Prakash Dwivedi [g], Ray Tahir Mushtaq [h], Sunpreet Singh [c,i]

[a] Research Scholar, IK Gujral Punjab Technical University, Kapurthala, Jalandhar - Kapurthala Highway, V.P.O - Ibban, Punjab, 144603 India

[b] Deptt. of Mechanical Engineering, IK Gujral Punjab Technical University, Kapurthala, 144603, India

[c] Department of Mechanical Engineering, University Centre for Research and Development and Chandigarh University, 140413, Punjab, India

[d] School of Mechanical and Materials Engineering, University College Dublin, Dublin, Ireland

[e] School of Mechanical and Automotive Engineering, Qingdao University of Technology, Qingdao, 266520, China

[f] Department of Mechanical Engineering, University of Engineering and Technology Lahore, Narowal Campus, Narowal 54890, Pakistan

[g] Department of Mechanical Engineering, G.L. Bajaj Institute of Technology and Management, Greater Noida, 201308, India

[h] Department of Industry Engineering, School of Mechanical Engineering, Northwestern Polytechnical University, Xi'an 710072, PR China

[i] Department of Mechanical Engineering, National University of Singapore, Singapore, 119077, Singapore

ARTICLE INFO

Article history
Received 14 February 2022
Accepted 8 March 2022
Available online 15 March 2022

Keywords:
Hydroxyapatite aloxite (Al_2O_3)

ABSTRACT

The biocompatible hydroxylapatite ($Ca_{10}(PO_4)_6(OH)_2$) (HA) coating is usually depositing on the titanium substrate to enhance the healing process of implant and to isolate it from the harsh body environment. However, poor mechanical properties of HA restrict its usage for orthopedic applications like hip and knee joints which have to bear the load. The biocompatibility is provided by HA and mechanical strength by the addition of reinforce with HA. Thermal post treatments have been mostly utilized to enhance the morphological and physicomechanical characteristics of as-deposition coatings. In the present research,

* Corresponding author.
** Corresponding author.
E-mail addresses: shubham543sharma@gmail.com, shubhamsharmaes.ric@gmail.com (S. Sharma), Gurminder.singh@ucd.ie (G. Singh).

https://doi.org/10.1016/j.jmrt.2022.03.065

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Study on the morphological and mechanical properties of TaC reinforced plasma spray coating deposited on titanium alloy

Gursharan Singh [a], Manoj Mittal [b], Jujhar Singh [b], Shubham Sharma [b,c,*], Amoljit Singh Gill [b], Jasgurpreet Singh Chohan [c], Raman Kumar [c], Abhishek Joshi [d]

[a] Research Scholar at I.K. Gujral Punjab Technical University, Kapurthala, Punjab
[b] Department of Mechanical Engg., IK Gujral Punjab Technical University, Main campus, Kapurthala 144603, India
[c] Department of Mechanical Engineering, University Center for Research & Development, Chandigarh University, Mohali, Punjab 140413, India
[d] Division of Research and Innovation, Uttaranchal University, Dehradun 248007, Uttarakhand, India

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Hydroxyapatite
Titanium alloy (Ti6A4V)
Tantalum carbide
Surface Morphology
Tensile bond strength

ABSTRACT

The biocompatible Hydroxyapatite (H.A.) coating is often placed on titanium alloy to aid in the healing process and insulate the implant from the hostile bodily environment. Plasma spray is one of the best techniques to coat H.A. on body implants per the Food and Drug Association (F.D.A.), U.S.A. However, the poor mechanical qualities of H.A. limit its use in orthopaedic applications that must bear weight, such as hip and knee joints. The present investigation studies the effect of the addition of reinforcement with H.A. on the microstructural and mechanical properties of plasma-sprayed coatings. Pure H.A. and reinforced HA-coated samples' surface morphology was investigated using a scanning electron microscope (S.E.M/EDAX). The results indicate that the coating has a homogenous dense microstructure with some un-melted and melted particles and tiny cracks. The addition of reinforcement enhances the microhardness and bond strength of the coating.

Selection and peer-review under responsibility of the scientific committee of the Indo-US International Conferences on Materials & Sustainable Engineering in Chemical and Allied Industry.

1. Introduction

Metals and alloys are becoming more popular in medical applications like load bearings and orthopaedic implants [1]. Because of their excellent mechanical (high fracture toughness, low density, and low Young's modulus) properties, titanium alloys (Ti-6Al-4 V) are frequently used to repair diseased bone tissues of artificial hip and knee joints [2,3]. The metallic implant used for replacement should have a similar young's modulus as that of human bone. Similar to Young's, modulus helps decrease the effect of stress shielding and improve the quality of human life [4,5]. The metallic implants may release harmful ions, which lowers the quality of the biological response. Specific coatings have been applied on metallic implants to accelerate the healing process and protect the implant from a hostile physical environment [6]. Hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) is hydrated Calcium Phosphate (Ca-P) mineral which is the major constituent of bone. Hydroxyapatite coatings are commonly used for hip and knee replacement joints due to their remarkable properties, such as biocompatibility in-vivo bioactivity, bio-restorability and osteoconductivity [7]. H.A. coating is applied on metallic implants such as titanium, and its alloys are used for orthopaedics applications due to their high biocompatibility [8]. Different methods have been developed to coat implant surfaces with HA such as sol–gel [9,10], electrophoresis deposition [11,12], pulsed laser deposition (PLD) [13], dip coating [14], spark plasma sintering [15], biomimetry [16,17]and thermal spray [18,19] such as high velocity oxy-fuel (HVOF) [20] and plasma spray [21]. Among the procedures described, the F.D.A. has approved plasma spraying for use as a coating process for biocompatible medical implants. Improved biocompatibility and bone adherence can be achieved by using H.A. coatings. Because these coatings need to be absorbed by the human body, their phases, quality, and control must be optimized and effectively managed [22,23].

In orthopaedic applications like knee and hip joints, H.A.'s poor mechanical qualities restrict its utilization [24]. This issue can be addressed by reinforcing hydroxyapatite with bio-inert materials

* Corresponding author.
E-mail address: shubham543sharma@gmail.com (S. Sharma).

https://doi.org/10.1016/j.matpr.2022.11.025

Selection and peer-review under responsibility of the scientific committee of the Indo-US International Conferences on Materials & Sustainable Engineering in Chemical and Allied Industry.

Materials Today: Proceedings 57 (2022) 650–656

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Microwave processing and characterization of alumina reinforced HA cladding for biomedical applications

Arun Sharma [a,*], Avtar Singh [a], Vikas Chawla [b], J.S. Grewal [a], Amit Bansal [b]

[a] Department of Production Engineering, Guru Nanak Dev Engineering College, Ludhiana 141006, India
[b] Department of Mechanical Engineering, IKGPTU Jalandhar, 144603, India

ARTICLE INFO

Article history:
Available online 18 February 2022

Keywords:
Microwave
Hydroxyapatite
SBF
Heat-treatment
Amorphous

ABSTRACT

The present work comprises of enhancing the bioactivity of the SS-316L substrate by Hydroxyapatite (HA) + 10 wt% Al_2O_3 (HA10AL) powder using microwave supported surface modifications techniques. The microwave supported surface modified layer has a thickness of around 0.8 mm with the exposure time of 15 min. The surface modified specimens were heat treated at different temperatures (400 °C, 600 °C and 800 °C) for 2 h. Various characterizations tools were employed to characterizing the microwave supported surface modified specimens (as-deposited along with heat-treated). The microstructural study revealed the presence of HA and reaction induced HA phases in the inter-dendritic regions of the Fe-based austenite dendrite matrix. It has been observed that porosity generally decreases after the heat treatments due to faster diffusion of atoms, which fills the pores and voids, whereas the hardness showed the increasing trends with heat-treatment temperature. XRD spectra shows the presence of HA and Al_2O_3 phases along with iron (Fe), calcium iron phosphate ($Ca_{19}Fe_2(PO_4)_{14}$), iron phosphide (Fe_2P), along with main iron nickel (Fe-Ni) based matrix at high temperature in all the microwave supported surface modified specimens. The apatite layer was successfully formed on the microwave supported surface modified specimens at all conditions after immersed in simulated body fluid (SBF) test. It was found that apatite formation was reduced with an increase in heat-treatment temperature due to reduction in porosity and amorphous phase (tri-calcium phosphate).

Selection and peer-review under responsibility of the scientific committee of the Third International Conference on Aspects of Materials Science and Engineering.

1. Introduction

In present days, the life of human enhances by development approach in medical science. The average life expectancy was about 69 years in 19 century, but the average life expectancy was enhanced to 80 years in 20 century. This improvement in life expectancy attributed to the development in medical science [1]. The density of bone and percentage of calcium in the bone decreases as age increases due to less growth of bone [2]. The human bone tissue which is a type of calcified that contains 30% organic component (proteins), 60% inorganic component (hydroxyapatite) and 10% water [3]. The structure of bone tissue is nano-scaled that contains Hydroxyapatite (HA) crystals within a matrix of collagen fibers and other proteins [4]. Biomaterials may be artificial or natural, used in the developing of implants or structures, to replace the diseased biological or lost structure to restore both form and function. Biomaterials are used in various parts of body like in the heart as artificial valves, in blood vessels as stents, replacement implants in human shoulders, elbows, knees, hips, and orodental structures (dental). The metallic materials are mainly used as biomaterials because they possess adequate strength and toughness e.g. Nickel, cobalt, molybdenum, chromium, zirconium and titanium alloys were used as orthopaedic implants, whereas stainless steel is used to fix the orthopaedic devices, such as screw plates [5]. The growth of bone tissue occurs by using medical implant. The mechanical fixation and mechanical stability of the metallic implant is enhanced by use of hydroxyapatite powder. The various materials such as of metals, polymers and ceramics used in orthopaedic bio-implant. Surgical grade material SS-316L is used as metallic biomaterial that is useful to replace knees, shoulder, and other parts of the body of the human being [6,7]. SS-316L is the cheapest alternative used for implant biomaterial, due to its better mechanical properties and better

* Corresponding author.
E-mail address: arunpandit2212@gmail.com (A. Sharma).

https://doi.org/10.1016/j.matpr.2022.02.069

Selection and peer-review under responsibility of the scientific committee of the Third International Conference on Aspects of Materials Science and Engineering.

ENERGY SOURCES, PART A: RECOVERY, UTILIZATION, AND ENVIRONMENTAL EFFECTS
https://doi.org/10.1080/15567036.2021.2022814

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Taylor & Francis Group

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Improved dynamic performance of permanent magnet synchronous generator based grid connected wind energy system

Preeti Rani[a], Ved Parkash Arora[a], and Naveen Kumar Sharma[b]

[a]Electrical Engineering Department, Maharaja Ranjit Singh Punjab Technical University(MRSPTU), Bathinda, Punjab, India; [b]Electrical Engineering Department, I. K. Gujral Punjab Technical University(IKGPTU), Jalandhar, Punjab, India

ABSTRACT

This comprehensive work investigates the reactive power control capability of a dynamic voltage restorer (DVR) for a permanent magnet synchronous generator (PMSG)-based grid-connected wind energy system (WES). Series compensation scheme-based DVR is employed to mitigate three-phase faults by injecting regulated voltage at the point of common coupling (PCC) bus through a series injection transformer. An improved hysteresis controller, a multi-loop-based controller consists of a hybrid system of the conventional PI controller, and feed-forward with feedback loop-based voltage-controlled DVR is the novelty of this article. DVR-modified hysteresis control highlights how grid-connected WES might increase their stability and dynamic performance. The suggested approach operates quickly, smoothly, and consistently, and it is designed and implemented in Matlab-Simulink software, and the performance of the proposed controller is validated with a comparative analysis between conventional synchronous reference frame controller DVRs. As a result, the total performance can demonstrate the efficiency of the recommended strategy. The suggested system produces very low THD values, 1.04% for grid-connected WES, when compared to the other approach. The instructive subject of this work, the clear choice of control method and electric circuit, ensures that the optimal fact of DVR topology meets the required power quality. This study also provides useful information to researchers in this sector.

ARTICLE HISTORY
Received 8 July 2021
Revised 23 November 2021
Accepted 20 December 2021

KEYWORDS
Dynamic voltage restorer; power quality

Introduction

Energy is a key component in economic growth. Because of the renewable energy sources (RESs), the use of decentralized energy resources (DERs) is of particular importance since it can power a local electrical grid or meet demand on its own (Chaudhary and Singh 2020). The small-scale power plant is made up of DERs based on their locations, increasing the number of factors and variables such as temperature, humidity, wind velocity, atmospheric temperature seasons, and so on (Kaushal and Basak 2020). In general, these factors and variables are responsible for low power quality (PQ) (Modesto, Da Silva, and de Oliveira Junior 2015). According to research conducted in the United States of America, about 70% of PQ disruptions are caused by customers, while 30% are induced by device manufacturers (Sharma, Rajpurohit, and Singh 2018).

WES is the most fundamental RES, and it is a rapidly developing technology. Wind energy should be interlinked with small-scale power plants to reduce environmental impact and mitigate climate change (Siva kumar and Linda 2020). As WES has distinct features w.r.t current power plants, such as the dynamic response of the wind loads and the pretty modern varieties of wind generators, it will introduce new challenges when integrated into power grids (Kim et al. 2003). The main obstacles to the integration of grid-connected WES are PQ problems, instability, and so on (Mishra et al. 2021). PQ

CONTACT PREETI Rani pretty.singla15@gmail.com Electrical Engineering Department, MRSPTU Bathinda, India

Ain Shams Engineering Journal 13 (2022) 101679

Contents lists available at ScienceDirect

Ain Shams Engineering Journal

journal homepage: www.sciencedirect.com

Modeling and sensitivity analysis of grid-connected hybrid green microgrid system

Sumit Sharma [a], Yog Raj Sood [a], Naveen Kumar Sharma [b], Mohit Bajaj [c], Hossam M. Zawbaa [d,e,*], Rania A. Turky [f], Salah Kamel [g]

[a] Electrical Engineering Department, National Institute of Technology Hamirpur, Hamirpur, H.P., India
[b] Electrical Engineering Department, I. K. G. Punjab Technical University, Jalandhar, India
[c] Electrical Engineering Department, National Institute of Technology Delhi, India
[d] Faculty of Computers and Artificial Intelligence, Beni-Suef University, Beni-Suef, Egypt
[e] Technological University Dublin, Dublin, Ireland
[f] Electrical Engineering Department, Faculty of Engineering and Technology, Future University in Egypt, Cairo 11835, Egypt
[g] Electrical Engineering Department, Faculty of Engineering, Aswan University, 81542 Aswan, Egypt

ARTICLE INFO

Article history:
Received 10 December 2021
Revised 22 December 2021
Accepted 30 December 2021
Available online 19 January 2022

Keywords:
TNPC
LCOE
Green microgrid
Hybrid Optimization Model for Electric Renewables (HOMER)

ABSTRACT

The demonstrated research work analyses the technoeconomic modelling and sensitivity analysis of the available resources for the rural community in India. The various resources used in this study are solar, wind, hydro, battery and utility grid-connected system. The usefulness of the on-grid system in the rural sector is that excess amount of electricity produced through renewable energy sources (RES) could be sold back to the utility grid. A total of 12 possible configurations of various resources with and without a grid-connected system was analyzed for minimum Levelized Cost of Energy (LCOE) and Total Net Present Cost (TNPC). Further, sensitivity analysis is accomplished for different sensitive variables to understand the nature of the system for wider application in rural communities. The solar-wind-hydro-based utility grid-connected network is observed to be the best optimal configuration with a minimum value of LCOE of 0.056 $/kWh. The simulation results reveal that the effective utilization of RES has been a cost-efficient and reliable system to the power supply in remote communities.

1. Introduction

Electrical energy has a huge impact on a country's overall growth. Rapid urbanization and population growth have resulted in a rise in per-capita energy consumption; as a result, the installation of energy sources must be expanded at the same rate across the world. In most developing countries like India, fossil fuels contribute the maximum percentage of electricity generation to meet the increasing demand. Coal-fired thermal power plants account for 54% of total power generation, while RES, such as wind, hydro, solar, etc., account for just 36.8 % of total power generation [1]. As India is a fast-moving economy country globally, electricity demand is likely to be increased. While the country has made significant progress in the energy sector in recent years, twenty-seven million households still have lack of electricity, as well as around seven hundred eighty million people depend on biomass for regular cooking. Electricity production through RES can play a critical role in ensuring a steady supply of electricity in rural areas, which also helps to meet the proposed emission reduction goal. To implement RES at large scale, there would be a problem of intermittent behavior of these sources. The intermittent problem can be avoided by configuring RES in hybrid mode in symbiosis with one another. As the system allows for the reliable utilization of all resources, hybrid renewable energy systems (HRES) have become a more feasible substitute to meeting the world's increasing electricity demand. Large research has been performed to pro-

* Corresponding author at: Technological University Dublin, Park House, 191 N Circular Rd, Cabra East, Grangegorman, Dublin D07 EWV4, Ireland.
E-mail addresses: sumitsharma8882@nith.ac.in (S. Sharma), yrsood@nith.ac.in (Y.R. Sood), mohitbajaj@nitdelhi.ac.in (M. Bajaj), hossam.zawbaa@gmail.com (H.M. Zawbaa), rania.turky@fue.edu.eg (R.A. Turky), skamel@aswu.edu.eg (S. Kamel).

Peer review under responsibility of Ain Shams University.

ELSEVIER Production and hosting by Elsevier

https://doi.org/10.1016/j.asej.2021.101679
2090-4479/

Head
Department of Electrical Engineering
I.K. Gujral Punjab Technical University
Kapurthala-144006

sustainability

MDPI

Review

A Topological Advancement Review of Magnetically Coupled Impedance Source Network Configurations

Arvind Yadav [1], Subhash Chandra [1], Mohit Bajaj [2], Naveen Kumar Sharma [3], Emad M. Ahmed [4,*] and Salah Kamel [5]

1 Department of Electrical Engineering, GLA University, Mathura 281406, India; arvind.yadav@gla.ac.in (A.Y.); subhash.chandra@gla.ac.in (S.C.)
2 Electrical Engineering Department, National Institute of Technology, Delhi 110036, India; mohitbajaj@nitdelhi.ac.in
3 Electrical Engineering Department, I.K.G. Punjab Technical University, Jalandhar 144603, India; naveen31.sharma@gmail.com
4 Department of Electrical Engineering, College of Engineering, Jouf University, Sakaka 72388, Saudi Arabia
5 Electrical Engineering Department, Faculty of Engineering, Aswan University, Aswan 81542, Egypt; skamel@aswu.edu.eg
* Correspondence: emamahmoud@ju.edu.sa

Abstract: Magnetically coupled impedance source networks provide a wide range of applications, such as dc to dc, dc to ac, ac to ac, ac to dc unidirectional or bi-directional power conversion. Various impedance source networks are reported in the literature to overcome the barriers of conventional voltage source inverters. They offer high boost with buck-boost capabilities and reduce power conversion stages. Thus, they provide an economical solution to expanding power systems, and are most suitable for renewable sources having low output. The goal of this study is to provide an in-depth comprehensive review of the major topologies of magnetically coupled impedance source networks. The review is more focused towards the fast-growing niche area, which has seen many advancements in the last few years. Best efforts are made to include relevant major topological advancements, with the aim of providing relevant and accessible information for researchers. This research provides a detailed comparison of essential factors and presents a full assessment of major topological improvements in MCIS networks.

Keywords: magnetically coupled impedance source network; Z-source; quasi z source; power conversion; voltage source inverter; Trans-Z source inverter; Y-source inverter

Citation: Yadav, A.; Chandra, S.; Bajaj, M.; Sharma, N.K.; Ahmed, E.M.; Kamel, S. A Topological Advancement Review of Magnetically Coupled Impedance Source Network Configurations. *Sustainability* **2022**, *14*, 3123. https://doi.org/10.3390/su14053123

Academic Editor: Luca Cioccolanti

Received: 30 January 2022
Accepted: 3 March 2022
Published: 7 March 2022

1. Introduction

In the last decade, renewable energy generation has achieved worldwide acclamation as it serves as a solution to the increasing energy demand. Photovoltaic (PV), wind, fuel cell, biomass geothermal, micro-hydro, ocean waves and tides are just a few of the promising renewable energy sources. The output produced by PV and fuel cell-based energy conversion systems is very low, and thus requires an intermediate converter for the boosting and conditioning of the source output, before feeding it to the load. There are many buck, boost, buck-boost, bidirectional and unidirectional converter topologies available in the literature [1–6]. Multilevel inverter topologies also offer high boost, and are explored for standalone and grid-connected applications [7–12]. An impedance source network with suitable switching configuration has very high boost capability. These networks can buck, boost and buck-boost the input with unidirectional and bidirectional power flow [13–15]. Theoretically, impedance source networks' gain can vary within 0-∞. Impedance source networks overcome the restrictions of conventional voltage source inverters (VSIs) and current source inverters (CSIs) [16–19], resulting in a higher output voltage than the dc link voltage. There is no need for additional boost

Head
Department of Electrical Engineering
I.K. Gujral Punjab Technical University
Kapurthala-144006

IEEE Access
Multidisciplinary | Rapid Review | Open Access Journal

Received August 28, 2021, accepted September 9, 2021, date of publication September 10, 2021,
date of current version September 21, 2021.

Digital Object Identifier 10.1109/ACCESS.2021.3112069

Hybrid Local-Global Optimum Search Using Particle Swarm Gravitation Search Algorithm (HLGOS-PSGSA) for Waveguide Selection

SIMARPREET KAUR[1], MOHIT SRIVASTAVA[2], NAVEEN KUMAR SHARMA[1], (Senior Member, IEEE), KAMALJIT SINGH BHATIA[3], (Senior Member, IEEE), FRIE AYALEW YIMAM[4], HARSIMRAT KAUR[5], AND MOHIT BAJAJ[6], (Member, IEEE)

[1]Department of Electrical Engineering, I. K. Gujral Punjab Technical University, Jalandhar 144603, India
[2]ECE Department, Chandigarh Engineering College, Landran, Punjab 140307, India
[3]Department of ECE, G. B. Pant Institute of Engineering & Technology, Pauri, Garhwal 246194, India
[4]School of Electrical and Computer Engineering, Woldia University, Woldia 67815, Ethiopia
[5]Department of ECE, CT Institute of Engineering and Technology, Jalandhar, Punjab 144623, India
[6]Department of Electrical and Electronics Engineering, National Institute of Technology Delhi, New Delhi 110040, India

Corresponding author: Frie Ayalew Yimam (frie.ayalew@aastu.edu.et)

ABSTRACT Multiple beam combination in optical interferometry with concurrent measurement of intricate visibilities, around each possible baseline, is a trending research area. In this work, a hybrid method is proposed for three different waveguide arrays and several waveguides are excited simultaneously in each array. Each waveguide array acts as a beam combiner, the output of which determines the field intensity of each waveguide mode. The output intensity depends on the waveguide selected for excitation. Thus, waveguide selection is the major factor that can affect the output intensity. The main goal of this research is to provide an effective solution for the selection of waveguides, to provide high visibility and intensity at the output of the multi-beam combiner. In addition to this, the use of metaheuristic optimization algorithms to solve the problem of waveguide selection is proposed. To accomplish this, firstly, an analytical study has been conducted to analyze the performance of optimization algorithms, including PSO, FA and GSA, and then the results of these algorithms have been compared with the conventional approaches. And finally, a model of Hybrid Local-Global Optimum Search Algorithm using Particle Swarm Gravitation Search Algorithm (HLGOS-PSGSA) has been developed for waveguide selection. The performance of the proposed hybrid model is examined in MATLAB simulation software. The simulated outcomes are determined for PSO, FA, and GSA-based models, as well as, for the proposed hybrid model, in terms of normalized intensity, visibility, and min-max 1/SNR values. The results obtained from simulation show that the PSO and GSA-based models are giving better results, followed by FA and conventional approaches. This worked as a motivation behind using PSO and GSA together in the proposed system, resulting in higher intensity and visibility values. Thus, the proposed hybrid model is concluded to be more efficient and convenient, for selecting optimum waveguides from the array, to attain an optimum output.

INDEX TERMS Interferometers, MZI, waveguide array, waveguide selection, PSO, intensity, visibility, SNR.

The associate editor coordinating the review of this manuscript and approving it for publication was Seyedali Mirjalili.

I. INTRODUCTION

Interferometers are devices that produce interference among two or more waves. Thus, they are used in the study of interference patterns generated by different light sources. They are

Economic evaluation of a hybrid renewable energy system (HRES) using hybrid optimization model for electric renewable (HOMER) software—a case study of rural India

Kamal Kant Sharma[1], Akhil Gupta[2], Raman Kumar[3], Jasgurpreet Singh Chohan[3], Shubham Sharma[4], J Singh[4], Nima Khalilpoor[5,*], Alibek Issakhov[6], Somnath Chattopadhyaya[7] and Shashi Prakash Dwivedi[8]

[1]Department of Electrical Engineering, Chandigarh University, Mohali, 140413, Punjab, India; [2]Department of Electrical Engineering, IK Gujral Punjab Technical University, Batala Campus, Gurdaspur, 143506, Punjab, India; [3]Department of Mechanical Engineering, Chandigarh University, Mohali, 140413, Punjab, India; [4]Department of Mechanical Engineering, IK Gujral Punjab Technical University, Main Campus, Kapurthala, 144603, Punjab, India; [5]Department of Energy Engineering, Graduate School of the Environment and Energy, Science and Research Branch, Islamic Azad University, Tehran, Iran; [6]Faculty of Mechanics and Mathematics, Department of Mathematical and Computer Modelling, Al-Farabi Kazakh National University, Almaty, Kazakhstan; [7]Department of Mechanical Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad, 826004, Jharkhand, India; [8]Department of Mechanical Engineering, G.L. Bajaj Institute of Technology and Management, Greater Noida 201308, India

Abstract

This paper unveils a sustainable energy plan for optimal utilization of available electrical energy resources for an energy-deficient village. The chosen village is Nangal, near Barnala, Punjab, India. Primarily, the requirements of electric energy are recorded and elaborated for around 450 households. Aiming this, the potential to harness electric power and its effective utilization has been identified from the available resources of energy: biomass, agriculture waste and solar photovoltaic (PV) technology. In order to achieve this, a hybrid renewable energy system (HRES) model is proposed whose performance is evaluated by implementing it in hybrid optimization model for electric renewable (HOMER) software. HOMER software provides optimal solution for a commercial biogas plant for catering cooking gas demand. Also, a coordinated solution for solar PV-operated water pumps used for irrigation, village water supply and solar PV street lights is presented and analyzed. In this way, the accurateness of proposed model is investigated by estimating the optimal electric power demand and its economic benefits. It has been revealed that the computed cost of energy and total net present cost are $0.032/KWh and $76,837, respectively, by the parametric assessment of proposed HRES system. It is envisaged that the proposed model can be a road map for future research engineers in designing an effective energy utilization for villages.

Keywords: energy; biomass; photovoltaic; rural electrification; HOMER; water pump

*Corresponding author: nimakhalilpoor@gmail.com

Received 8 October 2020; revised 16 January 2021; editorial decision 28 January 2021; accepted 28 January 2021

International Journal of Low-Carbon Technologies 2021, 00, 1–8

doi:10.1093/ijlct/ctab012 Advance Access publication 00 Month 0000

Energy 238 (2022) 121707

Contents lists available at ScienceDirect

Energy

journal homepage: www.elsevier.com/locate/energy

Power quality evaluation of photovoltaic grid interfaced cascaded H-bridge nine-level multilevel inverter systems using D-STATCOM and UPQC

Akhil Gupta

Department of Electrical Engineering, I.K. Gujral Punjab Technical University, Jalandhar-Kapurthala Highway, Kapurthala, Punjab, India

ARTICLE INFO

Article history:
Received 9 April 2020
Received in revised form
19 July 2021
Accepted 4 August 2021
Available online 11 August 2021

Keywords:
Multilevel
Inverter
Power quality
Photovoltaic
Custom power

ABSTRACT

The enhancement in Power Quality (PQ) becomes essential to increase the overall performance of equipment in utility-grid tied systems. To enhance PQ, this paper enumerates operational impact of Distribution Static Compensator (D-STATCOM) and Unified Power Quality Conditioner (UPQC) into a cascaded H-bridge Nine-Level Multi-Level Inverter (NL:MLI). The effectiveness of proposed topology is evaluated at a constant 200 V DC voltage and two SPV arrays of 100 kW each. A PQ comparative analysis is presented under faulted conditions at linear load. In order that the proposed system operates effectively under changing environment conditions, the implementation of a competent control techniques is dominant. Consequently, the control approach for D-STATCOM and UPQC compensates reactive power requirement of load and utility-grid. Total Harmonic Distortion (THD) and DC offset current are estimated, with distortion-less current-voltage waveforms obtained at coupling points. THD levels are validated in agreement with IEEE-519 standard. Indeed, the effectiveness of UPQC is demonstrated by feeding excess power through SPV arrays into variable DC link. Overall, the operation of UPQC interfaced with NLMLI is effective over D-STATCOM in alleviatin g harmonics, DC-offsets, and voltage-current imbalances during faulted conditions. The accurateness of simulation results and their comparative analysis is found to be satisfactory.

1. Introduction

Over the years, the multi-level grid connected inverters have played a pivotal role in Distributed Generation (DG) by integrating Solar Photovoltaic (SPV) technology into the utility-grid systems [1]. These inverters are being emerged as an enabling technology for electric power energy conversion systems [2]. The most presentable merit of these inverters is their ability to synthesize distortion-less output voltages with reduced harmonic content. Also, in recent research studies [3], multifarious algorithms and topologies for multi-level transformer-less grid connected inverters interfaced large scale SPV systems have been developed which optimize energy conversion, and control Power Quality (PQ) at utility-grid. These newly build inverters are controlled to perform low-cost operation with high efficiency to have high reliability over a wide power range. Whilst the conventional two-level inverters have reached sufficient maturity [4], Multi-Level Inverters (MLIs) are used in diverse applications. However, this necessitates quality of electric power to be improved significantly. The double-stage topology mentioned aforesaid operates with reduced efficiency and increases the level of harmonics significantly as compared to cascaded transformer topology. As compared to a three-phase H-bridge cascaded topology, the reported transformer-less and double-stage topology are less favourable for high power applications due to the high switching losses.

Recently, another research exploits grid connected inverters for large scale SPV installations has been investigated in Ref. [5]. Various control strategies for PQ control are reported in Ref. [6] where the impact of parameter variations of machines on PQ issues are explained. Also, the requirement of Maximum Power Point Tracking (MPPT) for extracting the maximum power of a SPV array is addressed in Ref. [7]. However, because of severity of PQ problems such as sag, swell, notch, flicker, and unbalance, several standards have been developed and are being enforced on consumers and utilities [8]. A difficult with these standards is that for several topologies reported for MLIs, the analysis and computation of PQ for any DG source becomes very complex. Thus to circumvent

E-mail addresses: akhilgupta1977@gmail.com, dr.akhilgupta@ptu.ac.in.

https://doi.org/10.1016/j.energy.2021.121707
0360-5442/

Head
Department of Electrical Engineering
I.K. Gujral Punjab Technical University
Kapurthala-144006

Energy Reports 7 (2021) 5034–5044

Contents lists available at ScienceDirect

Energy Reports

Journal homepage: www.elsevier.com/locate/egyr

Research paper

Power quality and transient analysis for a utility-tied interfaced distributed hybrid wind-hydro controls renewable energy generation system using generic and multiband power system stabilizers

Kamal Kant Sharma [a], Akhil Gupta [b], Gagandeep Kaur [c], Raman Kumar [d], Jasgurpreet Singh Chohan [d], Shubham Sharma [e,*], Jujhar Singh [e], Nima Khalilpoor [f,*], Alibek Issakhov [g]

[a] Department of Electrical Engineering, Chandigarh University, Mohali 140413, Punjab, India
[b] Electrical Engineering Department, I. K. Gujral Punjab Technical University, Main Campus, Kapurthala 144603, Punjab, India
[c] Department of Electrical Engineering, I.K. Gujral Punjab Technical University, Main Campus, Kapurthala 144603, Punjab, India
[d] Department of Mechanical Engineering, Chandigarh University, Mohali 140413, Punjab, India
[e] Deptt. of Mechanical Engg., IK Gujral Punjab Technical University, Main Campus Kapurthala 144603, India
[f] Department of Energy Engineering, Graduate School of the Environment and Energy, Science and Research Branch, Islamic Azad University, Tehran, Iran
[g] Faculty of Mechanics and Mathematics, Department of Mathematical and Computer Modelling, Al-Farabi Kazakh National University, Almaty, Kazakhstan

ARTICLE INFO

Article history:
Received 17 January 2021
Received in revised form 30 July 2021
Accepted 5 August 2021
Available online xxxx

Keywords:
Utility-grid
Distributed energy
Power system stabilizer
Wind
Power quality
Hydro

ABSTRACT

Due to its inherent ability of augmenting power system stability limit while maintaining good electric Power Quality (PQ), Power System Stabilizer (PSS) is envisaged to be an effective device in numerous Distributed Generation (DG) applications. It becomes a paramount work to maintain stable frequency, and alleviate the utility-grid collapse. Owing to this, this paper evaluates the performance of generic, and Multiband (MB)-PSSs for a hybrid 9 MW wind farm connected with mini/micro hydro power plant. The proposed system is interfaced with 200 MVA, 25 kV utility-grid system. A comparative analysis in the performance of a generic-PSS is presented with a MB-PSS at various voltage level points and power flows at various Point of Common Couplings (PCC) are analysed. Transient analysis is carried out during the presence of various unsymmetrical faults. It is envisaged that transients and unbalanced voltage sag-swells are mitigated at various PCCs while maintaining uninterruptable real and reactive power flows. The superiority of MB-PSS is established over generic-PSS in maintaining optimal PQ flow. Consequently, the reactive power requirement of the connected load is compensated by wind and mini/micro hydro controlling schemes using MB-PSS. Overall, the accurateness of the developed simulink models is demonstrated and satisfactory results are obtained in comparative analysis of both stabilizers.

1. Introduction

Most of the traditional/conventional electric power systems are based on central generation (Rau and Wan, 1994). Conventionally in these system(s), a series of high-power generators feed power through transformers to high voltage transmission network; aiming to transport power/energy over considerable distances of several kilometres (Rau and Wan, 1994). In recent times, grid failure and increase of load as compared to generation are frequent reasons for collapse of system, therefore a reliable system in a decentralized structure is proposed which evolve around Distributed Generation (DG) (Ramakumar et al., 1995; Chattopahyay et al., 1996). Generally, the term DG refers to any electric power production technology that is integrated within distribution systems, close to the point of use (Ramakumar

Abbreviations: DG, Distributed Generation; LLG, Double Line to Ground; HTG, Hydraulic Turbine Governor; LG, Line to Ground; MB, Multiband; PQ, Power Quality; PSS, Power System Stabilizer; PCCs, Point of Common Couplings; LLLG, Triple Line to Ground; WT, Wind Turbine; WPPs, Wind Power Plants; WTG, Wind Turbine Generator

* Corresponding authors.
E-mail addresses: sharmakamal2002@gmail.com (K.K. Sharma), akhilgupta1977@gmail.com (A. Gupta), gaganpitk@gmail.com (G. Kaur), ramankakkar@gmail.com (R. Kumar), jaskhera@gmail.com (J.S. Chohan), shubham543sharma@gmail.com, shubhamsharmacsirclri@gmail.com (S. Sharma), jujharsingh2085.2085@gmail.com (J. Singh), nimakhalilpoor@gmail.com (N. Khalilpoor), alibek.issakhov@kaznu.kz (A. Issakhov).

https://doi.org/10.1016/j.egyr.2021.08.031

Head
Department of Electrical Engineering
I.K. Gujral Punjab Technical University
Kapurthala-144006

Hindawi
International Journal of Chemical Engineering
Volume 2021, Article ID 5536221, 10 pages
https://doi.org/10.1155/2021/5536221

Hindawi

Research Article

Management of Cattle Dung and Novel Bioelectricity Generation Using Microbial Fuel Cells: An Ingenious Experimental Approach

Gagandeep Kaur,[1] Yadwinder Singh Brar,[1] Jaspreet Kaur,[2] Akhil Gupta,[1] Kamal Kant Sharma,[3] Jasgurpreet Singh Chohan,[4] Raman Kumar,[4] Shubham Sharma,[5] Somnath Chattopadhyaya,[6] Shashi Prakash Dwivedi,[7] Alibek Issakhov,[8] and Nima Khalilpoor[9]

[1]*Electrical Engineering Department, I. K. Gujral Punjab Technical University Jalandhar, Kapurthala 144603, Punjab, India*
[2]*Electronics and Communication Engineering Department, Beant College of Engineering & Technology, Gurdaspur, Punjab, India*
[3]*Electrical Engineering Department, Chandigarh University, Mohali 140413, Punjab, India*
[4]*Department of Mechanical Engineering, Chandigarh University, Gharuan, Mohali, Punjab 140413, India*
[5]*Department of Mechanical Engineering, I. K. Gujral Punjab Technical University, Main Campus-Kapurthala, Jalandhar, Punjab 144603, India*
[6]*Department of Mechanical Engineering, Indian Institute Technology (Indian School of Mines), Dhanbad, Jharkhand, India*
[7]*G. L. Bajaj Institute of Technology & Management, Greater Noida, Gautam Buddha Nagar, U. P. 201310, India*
[8]*Faculty of Mechanics and Mathematics, Department of Mathematical and Computer Modelling, Al-Farabi Kazakh National University, Almaty, Kazakhstan*
[9]*Department of Energy Engineering, Graduate School of the Environment and Energy, Science and Research Branch, Islamic Azad University, Tehran, Iran*

Correspondence should be addressed to Nima Khalilpoor; nimakhalilpoor@gmail.com

Received 11 February 2021; Revised 21 March 2021; Accepted 8 October 2021; Published 31 October 2021

Academic Editor: Sébastien Déon

Microbial fuel cells (MFCs) are the rising modern equipment for the generation of bioelectricity from organic matters. In this study, MFCs in two formats are assembled and concurrently operated for a 30-day period in a batch mode manner. Natural biowaste cattle dung slurry with mediators is used as a substrate persistently for the enhancement of electron transfer rate and additionally for the augmentation of required electrical parameters. Under similar conditions, the MFC setups are experimented with a variety of anode-cathode material combinations, namely carbon-carbon, copper-carbon, and zinc-carbon. The performance of these MFCs during the testing period is evaluated independently and compared by plotting polarization data generated by them. It is revealed that maximum current and power densities are achieved from all these MFCs and the best attained values are 1858 mA/m^2 and 1465 mW/m^2, respectively, for the novel single-chamber zinc-carbon electrode MFC. The corresponding findings present that the MFC with zinc-carbon electrodes has the better power density than other MFCs. Being conductive and higher standard potential metal electrodes have improved the capability to act in place of carbon family electrodes for MFC-based power applications. Although the MFC power generation is low, but modifications in configurations, electrodes, microbe-rich biowaste, mediators, and power management may enhance the power output to a significant level for commercialization of this technology. The unique feature of this research is to explore the pertinent use of conductive metal electrodes to enhance the power generation capability of MFCs through biowaste as an alternative power source for small applications. The novelty of this research is presented through usage of conductive metal electrodes for the performance analysis of MFCs.

Head
Department of Electrical Engineering
I.K. Gujral Punjab Technical University
Kapurthala-144006

Available online at www.ijpe-online.com

International Journal of Performability Engineering

vol. 18, no. 2, February 2022, pp. 79-91
DOI: 10.23940/ijpe.22.02.p2.7991

Coupled Field Magnetostatic Analysis for Free Buckling in Double Layer Helical Winding of a Distribution Transformer

Vibhuti Rehalia[a,*], Deepika Bhalla[b], and Genius Walia[a]

[a]*Guru Kashi University, Talwandi Sabo, Punjab, 151302, India*
[b]*IK Gujral Punjab University, Kapurthala, Punjab,155603, India*

Abstract

Hoop stresses are produced due to the electromagnetic forces in the winding. Free buckling of winding turns can lead to failure of the transformer. Design issues are a major reason for the catastrophic failure of 11kV/433kV distribution transformers. In a distribution transformer (DT), the LV winding is generally of helical type and is asymmetrical. Asymmetry in the transformer design causes change in the direction and magnitude of the forces. In this work, a comprehensive analysis of the short-circuit forces has been done for a DT with a double-layer helical winding with all three of the limbs modelled and phases energized. The forces are computed using magnetostatic analysis of a 315kVA DT. The transformer has been modelled in 3D CAD software and forces are computed using 3D finite element method (FEM) and the results obtained are compared to that obtained from first principals. The windings are assessed for the presence of hoop stresses in its turns, and along with it the safety factor is computed for free-bucking using von-Mises equivalent. The intent is to find the weak section of the double layer helical winding from short circuit forces a transformer is designed to withstand. Such simulations of energy conversion create a robust and sustainable design, which can prevent catastrophic failure and reduce the environmental impact due to major repairs or replacement of equipment.

Keywords: distribution transformer; electromagnetic forces; free buckling; hoop-stress; radial forces; safety-factor.

1. Introduction

The transformer is an important component in a power distribution system. The failure rate of DTs lies between 12-15% in developing countries and in developed countries the failure rate is less than 1%. About 70% of transformers that fail are repaired while the rest are replaced. Design is a major reason for the failure of 11kV/433kV DTs. The failure of DTs causes additional cost to the distribution company/agency which is passed on to the consumer as an increase in the per-unit cost of power charged. The replaced transformers are a total burden for the manufacturer. The processes involved with repairs or replacement with a new one definitely has an impact on the carbon emissions and subsequently on the environment.

The low magnitude current in High Voltage (HV) winding and high magnitude current in Low Voltage (LV) winding induce electromagnetic forces. The LV winding experiences the radial forces towards the core and HV winding experiences radial force towards the transformer tank. Thus, circumferential forces are experienced in the inner diameter of LV winding and the outer diameter of the HV winding. The axial forces in both LV and HV winding are such that the upper-half of the winding experiences an upward thrust while the lower-half experiences downward thrust. These are the direction of the electromagnetic forces that are produced when there is no other asymmetry in the transformer design. High current flows through the transformer windings during a short-circuit fault, and this results in electromagnetic forces in windings that have a very large magnitude. These forces exerted in the axial and radial direction induce mechanical stresses in the windings that damage the insulation covering them and can lead to a breakdown of the transformer. A transformer should be designed to withstand the forces produced during both internal and external faults.

Radial forces cause buckling of the transformer windings, leading to the analysis of buckling strength, bending stiffness of disk type, and of the circumferential stress that led to plastic deformation along with the effect on the supporting spacers has been done [1]. A 3D-finite element code was developed for the comparison of different type of helical windings: single-

* Corresponding author.
E-mail address: vibhu18rehalia@gmail.com

Head
Department of Electrical Engineering
I.K. Gujral Punjab Technical University
Kapurthala-144096

Bharti Koul*, Kanwardeep Singh and Yadwinder Singh Brar

Improvements in deviation settlement mechanism of Indian electricity grid system through demand response management

https://doi.org/10.1515/ijeeps-2021-0241
Received June 13, 2021; accepted October 21, 2021; published online December 1, 2021

Abstract: This paper proposes the improvements in deviation settlement mechanism of Indian electricity grid system through demand response management (DRM) with the objective to minimize real-time under-injection/over-drawl or maximize real-time over-injection/under-drawl with respect to scheduled injection/drawl such that the deviation settlement charge (DSC) is minimum, subject to the network power flow equations, transmission line capability constraints, DRM constraints and bounds on variables. The mechanism to settle the unscheduled transactions, commonly named as deviation settlement mechanism (DSM), has been implemented to achieve grid frequency stability by imposing penalties and paying incentives, also known as DSC, for over- and under-drawls from the scheduled transactions. In this paper, the improvements in DSM have been solved as an optimization problem to minimize the DSC for a time period of 96 time-blocks (each of 15 min duration). The proposed improvement in DSM has been tested on modified IEEE 9-Bus system. It has been assumed that the generators installed at bus numbers 1, 2 and 3 are the central generating stations, which are monitored and controlled by the regional load dispatch center (RLDC). The simulation results are obtained (with varying percentages of shifting and different participating patterns of prosumers) for which the remarkable benefits of the proposed improvement in DSM (in terms of DSC minimization and improvement in the voltage profile and power flow) have been presented.

Keywords: demand response management (DRM); deviation settlement charge (DSC); deviation settlement mechanism (DSM); regional load dispatch center (RLDC).

1 Introduction

Demand response management (DRM) is one of the most promising fields of today's competitive world, which improves the efficiency, affordability and reliability of real life systems. The simple and practical concept of DRM in smart electricity grid systems is to encourage the consumers to modify their load consumption patterns (specifically for short-term gains) so as to transfer energy usage from peak to off-peak durations, which leads to flattening and normalization of the consumer load curve. The application of DRM in a multi-utility electricity grid system is very beneficial for consumer payment reduction, power generation costs reduction, demand-supply balancing and improvement of grid stability through relieving loads under peaking hour constraints [1]. The Indian electricity grid system [2] performs its functioning by being distributed into five regional grids which are classified as Northern-grid, Western-grid, Eastern-grid, Southern-grid, and North Eastern-grid. Each regional grid has its specific load dispatch Centre, named as Regional Load Dispatch Centre (RLDC). All state grids of India are connected with each other through various regional grids based on their topographical vicinities [3]. Each state grid has its own State Load Dispatch Centre (SLDC). The integrated planning, operation and stability of power system in India is ensured through close coordination of RLDCs and SLDCs. For stable power system operation, the various grids work in synchronism based on the concept of "one nation-one grid-one frequency" within the allowable frequency band of 49.9–50.05 Hz [4].

The grid indiscipline (i.e. deviation of the real time transactions from scheduled transactions) by the state grids can lead to variations in grid frequency, which poses a threat to the stable power system operation [5]. In order to

*Corresponding author: Bharti Koul, Department of Electrical Engineering, IKG Punjab Technical University Kapurthala, Punjab, India, E-mail: bharti.nith@gmail.com, https://orcid.org/0000-0003-1825-4650
Kanwardeep Singh, Department of Electrical Engineering, Guru Nanak Dev Engineering College, Ludhiana, IKG Punjab Technical University, Kapurthala 141006, India, E-mail: kds97dee@gmail.com
Yadwinder Singh Brar, Department of Electrical Engineering, IKG Punjab Technical University, Kapurthala 144603, India, E-mail: ysbrar@yahoo.com

Electric Power Components and Systems, 50(3): 101–119, 2022
© 2022 Taylor & Francis Group, LLC
ISSN: 1532-5008 print / 1532-5016 online
DOI: 10.1080/15325008.2022.2135637

Robust and Comfortable Day-Ahead Demand Side Management of Residential, Industrial and Commercial Consumers for Demand Normalization

Bharti Koul ,[1] Kanwardeep Singh,[1] and Yadwinder S. Brar[2]
[1]Department of Electrical Engineering, Guru Nanak Dev Engineering College, Ludhiana (I K Gujral Punjab Technical University, Kapurthala), India
[2]Department of Electrical Engineering, IKG Punjab Technical University, Kapurthala, India

CONTENTS

Abstract—This paper proposes the robust and comfortable day-ahead demand side management (DSM) methodology with an aim to normalize the demand curve pertaining to residential, industrial and commercial consumers. The ideal normalized demand curve is one in which demand follows the inverse relation to the respective price. In this paper, the demand curve normalization problem is formulated as an optimization problem which minimizes the square of the error between the demand curve obtained after DSM and ideal demand curve. The constraints of the optimization problem include the modeling of demand shifting from high to low price periods, local generation and working habits of consumers. Due to the probabilistic nature of the forecasted day-ahead hourly prices, these can exhibit variability from the mean values; hence a robust optimization technique has also been incorporated such that the proposed DSM methodology remains robust under worst case of price variability. The simulation results are obtained (with varying degrees of discomfort and robustness) for an aggregator, which involves shiftable devices belonging to residential, commercial and industrial consumers. The intuitive and interesting benefits of the proposed methodology are presented and compared with existing approaches pertaining to the non-robust, un-comfortable, comfortable, demand flattening, and demand normalization based DSM.

Keywords: consumer comfort, demand normalization, price variability, smart grid
Received 11 March 2020; accepted 1 February 2022
Address correspondence to Bharti Koul, Department of Electrical Engineering, Guru Nanak Dev Engineering College, Ludhiana (I K Gujral Punjab Technical University, Kapurthala), India. E-mail: bharti.nith@gmail.com

1. INTRODUCTION

The modernization and rising living standards have aided the significant increase in magnitude and variations in electricity consumers' load demand throughout a specified period of time. The electric utilities have to reinforce the existing resources in order to cater to the needs of the increase in the number of consumers and their load demand. DSM is one of the vital mechanisms of the conventional as well as the modern smart electricity grids, by means of which the utility is able to regulate the energy consumption at the consumers' locations, and get the most out of existing assets). Gellings in [1] has discussed the evolution of DSM and explored that it is the best remedy that plays a

Contents lists available at ScienceDirect

Renewable Energy Focus

Journal homepage: www.elsevier.com/locate/ref

Real-time multi-objective solar-thermal power dispatch using different photovoltaic materials

Sunimerjit Kaur [a,*], Yadwinder Singh Brar [b], Jaspreet Singh Dhillon [c]

[a] Research Scholar, I.K. Gujral Punjab Technical University, Kapurthala 144603, Punjab, India
[b] Electrical Engineering Department, I.K. Gujral Punjab Technical University, Kapurthala 144603, Punjab, India
[c] Electrical and Instrumentation Engineering Department, Sant Longowal Institute of Engineering and Technology, Sangrur 148106, Punjab, India

ARTICLE INFO

Article history
Received 28 June 2022
Revised 25 August 2022
Accepted 27 August 2022
Available online 11 September 2022

Keywords
Polycrystalline silicon
Copper Indium Gallium Selenide
ɔ-constrained simplex method
Boundary mutations
ɔ-level comparisons
Multi-simplexes

ABSTRACT

The present universal energy framework and expenditure rate are considerably more startling because of the massive increase in electrical power demand. Comprehensive generation through conventional fossil fuels is one of the fundamental causes and contributors to several environmental problems. Therefore, there has arisen a necessity for ecologically sound and sustainable alternative energy sources. Renewable energy resources (RER) may be extremely functional for environmental and economic goals. Solar energy is the most auspicious of RER and this industry has flourished enormously during the last decade. Photovoltaic cells are spreading in popularity because they are sustainable, clean, and efficient modes of power generation. Researchers are endeavoring meticulously to select superior photovoltaic materials. In this paper, a real-time multi-objective solar-thermal power dispatch problem is framed and optimized for two different photovoltaic materials by using the novel ɔ- constrained simplex method (ACSM). The presented problem is developed to satisfy cost and environmental objectives for Tirumala in the Andhra Pradesh state of India, for two test systems. In the first test system, polycrystalline silicon is used as the photovoltaic material, whereas Copper Indium Gallium Selenide is employed in the second test system. The results of both test systems are compared with each other to procure the finer material. Also, the outturns attained by using ACSM are collated with particle swarm optimization (PSO) and the evolutionary method (EM). The results reveal the precedence of ACSM over PSO and EM.

1. Introduction

The gradation of advancement is the measure of the energy utilization for human evolution. The energy demand of the world is growing nearly daily, which ensues in energy adversity. Solar power generation systems have immense potential, but their huge initial cost is a big obstacle to the growth of this sector. Over the last few decades, current research has significantly dropped the solar power generation cost. The present exploration in this direction is in progress to detect the best replacement materials to upgrade the execution of photovoltaic cells.

Several photovoltaic materials have been designed so far, like-monocrystalline silicon (mono c-Si), polycrystalline silicon (pc-Si), copper indium gallium selenide (CIGS), amorphous silicon (a-Si), cadmium telluride (CdTe), thin-film solar cell (TFSC), etc. Researchers are servicing conscientiously to reduce the initial cost and improve efficiency by designing and testing different photovoltaic (PV) materials.

In the past, Hudedmani et al. [1] have proposed a study of photovoltaic materials like- mono c-Si solar cell, pc-Si solar cell, TFSC, a-Si solar cell, CdTe solar cell, and CIGS solar cell for photovoltaic technologies like-building-integrated photovoltaic, nano-crystals in solar cell technologies, and organic/ polymer solar cells. Miles [2] has produced different photovoltaic cells and modules to (i) generate large-scale power in building-integrated photovoltaic, (ii) supply electrical power to rural areas and suburban areas that have not been attached to a grid, in the developing countries, (iii) supply power in remote locations, (iv) supply power to space vehicles and satellites, (v) supply power to consumer products. Lotfi et al. [3] and Zindarec et al. [4] have presented the performance evaluation of photovoltaic systems by employing the principal component analysis technique and the capacity evaluation method, respectively. Sharma et al. [5] have worked on the performance evaluation of dissimilar solar PV technologies under alike outdoor conditions. Zdyb and Gulkowski [6] have worked on the

* Corresponding author
E-mail address: [redacted] (S. Kaur)

1755-0084/

Head
Department of Electrical Engineering
I.K. Gujral Punjab Technical University
Kapurthala-144006

AIMS Energy, 10(4): 943-971.
DOI: 10.3934/energy.2022043
Received: 06 June 2022
Revised: 24 July 2022
Accepted: 29 July 2022
Published: 11 August 2022

http://www.aimspress.com/journal/energy

Research article

Multi-objective real-time integrated solar-wind-thermal power dispatch by using meta-heuristic technique

Sunimerjit Kaur[1,*], Yadwinder Singh Brar[2] and Jaspreet Singh Dhillon[3]

[1] Research Scholar, I.K. Gujral Punjab Technical University, Kapurthala 144603, Punjab, India
[2] Electrical Engineering Department, I.K. Gujral Punjab Technical University, Kapurthala 144603, Punjab, India
[3] Electrical and Instrumentation Engineering Department, Sant Longowal Institute of Engineering and Technology, Sangrur 148106, Punjab, India

* **Correspondence:** Email: sunimerriar@yahoo.co.in; Tel: +91 9855153770.

Abstract: The elevated demand for electrical power, expeditious expenditure of fossil fuels, and degradation of the environment because of power generation have renewed attentiveness to renewable energy resources (RER). The rapid augmentation of RER increases the convolutions in leveling the demand and generation of electrical power. In this paper, an elaborated α-constrained simplex method (ACSM) is recommended for multi-objective power dispatch problems. This methodology is devised after synthesizing the non-linear simplex method (SM) with the α-constrained method (ACM) and the evolutionary method (EM). ACSM can transfigure an optimization technique for the constrained problems by reinstating standard juxtapositions with α-level collations. The insertion of mutations and multi-simplexes can explore the periphery of the workable zone. It can also manage the fastness of convergence and therefore, the high precision solution can be obtained. A real-time multi-objective coordinated solar-wind-thermal power scheduling problem is framed. Two conflicting objectives (operating cost and emission) are satisfied. The case studies are carried out for Muppandal (Tamil Nadu), Jaisalmer (Rajasthan), and Okha (Gujarat), India. The annual solar and wind data are analyzed by using Normal Distribution and Weibull Distribution Density Factor, respectively. The presented technique is inspected on numerous archetype functions and systems. The results depict the prevalence of ACSM over particle swarm optimization (PSO), simplex method with mutations (SMM), SM, and EM.

Keywords: α-constrained simplex method; α-level comparisons; multi-simplexes; mutations;

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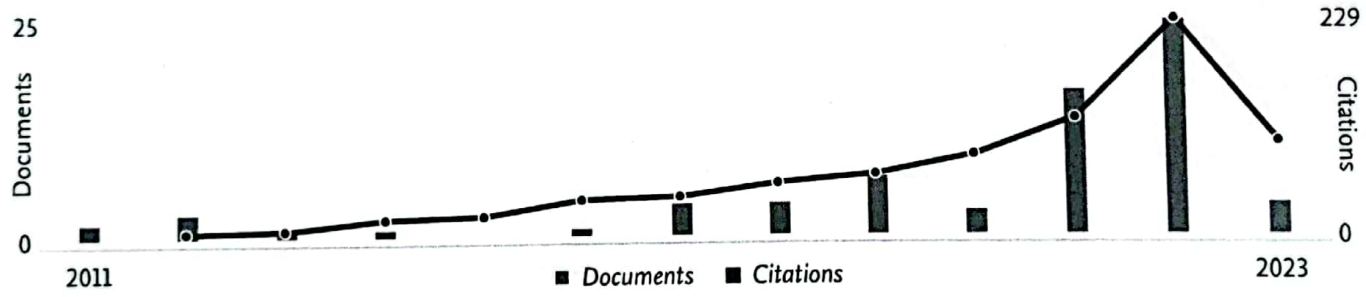

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Head
Department of Electrical Engineering
I.K. Gujral Punjab Technical University
Kapurthala-144006

Optimization of Performance Parameters of Doped Ferrite-Based Microwave Absorbers: Their Structural, Tunable Reflection Loss, Bandwidth, and Input Impedance Characteristics

Jasbir Singh[1], Charanjeet Singh[2], Dalveer Kaur[3], Sukhleen Bindra Narang[4], Rajshree B. Jotania[5], Amrin Kagdi[5], Rajat Joshi[6], Antonio Sergio Bezerra[7], Di Zhou[8], Sergei Trukhanov[9,10,11], Larrisa Panina[12], and Alex Trukhanov[9,10,11]

[1]Department of Electronics and Communication Engineering, Yadavindra College of Engineering, Punjabi University Guru Kashi Campus, Talwandi Sabo 151302, India
[2]School of Electronics and Electrical Engineering, Lovely Professional University, Phagwara 144411, India
[3]I.K. Gujral Punjab Technical University, Main Campus, Kapurthla 144603, India
[4]Department of Electronics Technology, Guru Nanak Dev University, Amritsar 143005, India
[5]Department of Physics, University School of Sciences, Gujarat University, Ahmedabad 380 009, India
[6]Adesh Institute of Technology, Mohali 140413, India
[7]Department of Physics, Telecommunications and Materials, Science and Engineering Laboratory (LOCEM), Federal University of Ceara-UFC, Fortaleza 60440900, Brazil
[8]School of Electronic Science and Engineering, Xi'an Jiaotong University, Xi'an 710049, China
[9]Department of Technology of Electronics Materials, National University of Science and Technology (MISiS), 119049 Moscow, Russia
[10]Laboratory of Single Crystal Growth, South Ural State University, 454080 Chelyabinsk, Russia
[11]Scientific and Practical Materials Research Centre of NAS of Belarus, 220072 Minsk, Belarus
[12]Institute of Novel Materials and Nanotechnology, National University of Science and Technology (MISiS), 119991 Moscow, Russia

In this study, M-type barium strontium hexagonal ferrite was prepared with CoSn doping. The crystallographic structure of ferrite compositions was explored using X-ray diffraction (XRD). The microwave absorption characteristics were investigated on a vector network analyzer as a function of the doping of Co^{2+} and Sn^{4+}, frequency, and thickness of the samples. Analysis of measured XRD patterns confirmed the M-phase in the prepared samples. The electromagnetic parameters accompanied by permeability/magnetic loss, dielectric constant/loss, were increased with CoSn content. The obtained results revealed that microwave absorption was enhanced by doping with Co^{2+} and Sn^{4+} ions. The absorption was increased from −15.2 dB in compositions $x = 0.0$ to −51.09 dB in $x = 0.6$ composition; −10 dB bandwidth = 2.43 GHz was displayed in $x = 1.0$ composition at 1.7 mm thickness. Both input impedance and $\lambda/4$ criterion based on thickness doping govern the mechanism of microwave absorption. $x = 1.0$ composition owes a large bandwidth to thickness ratio of 3.52 at the frequency of 10.88 GHz and a percentage bandwidth of 22.33 % at a thickness of 1.7 mm. The observed absorption peaks were tuned to the desired frequency by exploiting the composition thickness and input impedance through doping with Co^{2+} and Sn^{4+} ions. The wide bandwidth with optimized absorption find applications in the field of wireless communication such as isolators, circulators, and radar application.

Index Terms—**Bandwidth, ceramic method, hexaferrites, input impedance, $\lambda/4$ criterion, microwave absorption, reflection loss (RL).**

I. Introduction

NOWADAYS, the entire world is surrounded by an invisible web of wireless signals with the development of Wi-Fi and the Internet of things (IOT)-based on electrical/electronic devices [1]–[3], for example, mobile phones, ac motors, refrigerator, printer, computer, an modem. These wireless/microwave signals are used in industrial, military, and medical applications [4], [5]. Apart from particular use during signal transmission, these applications of devices altogether create electromagnetic interference/stray field (EMI) which can interfere with the working of other electrical/electronic devices that lie in its vicinity.

M-type hexagonal ferrites are multifunctional materials that are incorporated as a potential microwave absorber [6] to mitigate this undesirable EMI owing to their significant properties like high resistivity, high losses, tunable bandwidth, and impedance [7]. Apart from this, absorbers are used to damp oscillations due to cavity resonance and in an anechoic chamber to create a free space virtual environment. Absorption characteristics of M-hexagonal ferrites by doping of different valency ions have been widely investigated.

Feng *et al.* [8] prepared Ca-doped $BaFe_{12}O_{19}$ hexaferrite and explored absorption characteristics in the domain of

Manuscript received August 2, 2020; revised December 14, 2020; accepted February 17, 2021. Date of publication March 2, 2021; date of current version June 23, 2021. Corresponding author: C. Singh (e-mail: rcharanjeet@gmail.com; charanjeet2003@rediffmail.com).
This article has supplementary material provided by the authors and color versions of one or more figures available at https://doi.org/10.1109/TMAG.2021.3063175.
Digital Object Identifier 10.1109/TMAG.2021.3063175

Journal of Alloys and Compounds 855 (2021) 157242

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Development of doped Ba–Sr hexagonal ferrites for microwave absorber applications: Structural characterization, tunable thickness, absorption peaks and electromagnetic parameters

Jasbir Singh [a], Charanjeet Singh [b, *], Dalveer Kaur [c], Sukhleen Bindra Narang [d], Rajshree B. Jotania [e], Ebtesam Ateia [f], Amrin Kagdi [e], Rajat Joshi [g], A.S.B. Sombra [h], Di Zhou [i], Sergei Trukhanov [j, k, l], Larrisa Panina [m]

[a] Department of Electronics and Communication Engineering, Yadavindra College of Engineering, Punjabi University Guru Kashi Campus, Talwandi Sabo, Punjab, India
[b] School of Electronics and Electrical Engineering, Lovely Professional University, Phagwara, Punjab, India
[c] Department of Electronics and Communication Engineering, I.K.G. Punjab Technical University, Kapurthla, India
[d] Department of Electronics Technology, Guru Nanak Dev University, Amritsar, Punjab, India
[e] Department of Physics, University School of Sciences, Gujarat University, Ahmedabad 380 009, India
[f] Physics Department, Faculty of Science, Cairo University, Giza, Egypt
[g] Adesh Institute of Technology, Ludhiana-Chandigarh Road, National Highway - 95, Mohali, Gharuan, Punjab 140413, India
[h] Department of Physics, Telecommunications and Materials, Science and Engineering Laboratory (LOCEM), Federal University of Ceara-UFC, Fortaleza, Brazil
[i] School of Electronic Science and Engineering, Xi'an Jiaotong University, Xi'an 710049, China
[j] National University of Science and Technology MISiS, Leninsky Av 4, Moscow, 119049, Russian Federation
[k] South Ural State University, Lenin Av 76, Chelyabinsk, 454080, Russian Federation
[l] Scientific-Practical Materials Research Centre of NAS of Belarus, P. Brovki str 19, Minsk, 220072, Belarus
[m] Institute of Novel Materials and Nanotechnology, National University of Science and Technology (MISiS), Moscow 119991, Russia

ARTICLE INFO

Article history:
Received 7 August 2020
Received in revised form
15 September 2020
Accepted 16 September 2020
Available online 23 September 2020

Keywords:
Hexagonal ferrites
Microwave absorber
Impedance
Thickness

ABSTRACT

In this work, we report microwave absorption characteristics of $Ba_{0.5}Sr_{0.5}(CoCr)_xFe_{(12-2x)}O_{19}$ hexaferrite prepared by a two route ceramic technique. The effect of Co^{2+}-Cr^{3+} content on structural, complex permittivity/permeability and reflection loss properties in $Ba_{0.5}Sr_{0.5}Fe_{12}O_{19}$ ferrite has been studied. X-ray diffraction confirmed the magnetoplumbite phase in the compositions. The dual absorption peaks were revealed in $x = 0.8$ composition with reflection loss of −52.09 dB at 8.78 GHz and 5.6 mm thickness. The absorption peaks were found to shift to low frequency with an increase in thickness. Composition $x = 0.6$ displayed the bandwidth to thickness ratio of 6.5 and a percentage bandwidth of 32.37% at 1.7 mm thickness and 10.13 GHz. The doping of Co^{2+} and Cr^{3+} reduced thickness, increased absorption, and bandwidth which is attributed to electromagnetic parameters, input impedance, quarter wavelength theory, and eddy current loss. The investigated performance parameters of prepared compositions indicate good scope for absorber applications.

1. Introduction

For a few decades, M-type hexagonal ferrites have become a good choice for researchers in the field of absorbers at gigahertz (GHz) frequency region [1,2] due to their economical manufacturing, temperature resistant behavior and large losses [3–5]. Their major areas of absorber application include stealth devices, reduction in radar cross-section area (RCS), waveguide components, and passive filters [6,7]. The absorption in M-hexagonal ferrites can be tuned at the desired frequency by controlling the doping level of ions. The doping changes the intrinsic property accompanied by electromagnetic/material parameters. The doping of different ions for M-hexagonal ferrites is reported by various investigators.

H. Sozeri at el [8]. prepared Cr^{3+} doped M-type Barium

* Corresponding author.
E-mail address: rcharanjeet@gmail.com (C. Singh).

https://doi.org/10.1016/j.jallcom.2020.157242
0925-8388/

Materials Science and Engineering B 281 (2022) 115679

Contents lists available at ScienceDirect

Materials Science & Engineering B

journal homepage: www.elsevier.com/locate/mseb

Role of phase, grain morphology and impedance properties in tailoring of Barium Strontium hexaferrites for microwave absorber/attenuator applications

Jasbir Singh [a], Charanjeet Singh [b,*], Yang Bai [c], Dalveer Kaur [d], Sukhleen Bindra Narang [e], K.C. James Raju [f], Preksha N. Dhruv [g], Rajshree Jotania [g], Andrew Joseph [f], Rajat Joshi [h]

[a] Department of Electronics and Communication Engineering, Yadavindra Department of Engineering, Punjabi University Guru Kashi Campus, Talwandi Sabo, Punjab, India
[b] School of Electronics and Electrical Engineering, Lovely Professional University, Phagwara, Punjab, India
[c] School of Materials Science and Engineering, University of Science and Technology Beijng, Beijing 100083, China
[d] Department of Electronics and Communication Engineering, I.K.G. Punjab Technical University, Kapurthla, India
[e] Department of Electronics Technology, Guru Nanak Dev University, Amritsar, Punjab, India
[f] Centre for Advanced Studies in Electronics Science and Technology (CASEST), School of Physics, Electronics Block, University of Hyderabad, India
[g] Department of Physics, University School of Sciences, Gujarat University, Navrangpura, Ahmedabad, Gujarat, India
[h] Adesh Institute of Technology, Mohali, Gharuan, Punjab, India

ARTICLE INFO

Keywords:
Ferrites
Microwave absorption
Reflection loss
Bandwidth
Eddy currents
Bandwidth to thickness ratio
Percentage bandwidth

ABSTRACT

This work investigated the microwave absorbing characteristics of Co-Y doped BaSr Hexaferrites prepared by the ceramic method. X-ray analysis confirmed M-phase at low doping level compositions x = 0.0, 0.2 and traces of spinel phase for x > 0.2, and micrographs depicted the increase in grain size with dopants. The electromagnetic parameters were measured by a vector network analyzer at 8.2–12.4 GHz frequency band. Doping reduced the geometrical thickness of composition and increased the bandwidth/microwave absorption. The obtained results depicted that x = 0.2 composition has reflection loss (RL) of −28.72 dB at 11.64 GHz and 1.5 mm thickness and −10 dB absorption bandwidth of 3.11 GHz at 1.6 mm. x = 0.8 revealed a bandwidth to thickness ratio of 3.6 at 10.55 GHz. The role of the secondary phase and morphology in absorption enhancement has been discussed. The obtained results have the potential of compositions for designing a lightweight and wide bandwidth electromagnetic noise suppressor/absorber.

1. Introduction

Microwaves are electromagnetic waves that fall in the 300 MHz to 300 GHz frequency band. The potential communication applications of microwaves are confined to 1–40 GHz for example wireless networks, Wi-Fi, cellular communication, military applications. Nevertheless, microwaves are imposing a threat to our surrounding habitat through unwanted radiation. The RF or microwave absorbers can absorb/attenuate the unwanted/spurious electromagnetic wave. The utility of absorbers mitigates electromagnetic interference and the electromagnetic compatibility problem in different fields. Microwave radar absorbing materials (MRAM) are being used in stealth technology and are useful to mitigate radar cross-section and false images in the radar. The various materials have been explored for efficient absorber application such as ferrites, carbon products, lossy dielectrics, chiral materials, etc.

M-type ferrites are primarily used for microwave absorber applications and in other electronic devices [1–7]: good bandwidth, small geometrical thickness, and tunable frequency range of interest are their key performance parameters. The wide range of properties in ferrites makes them a unique magnetic material with extensive applications in satellite communication and microwave devices such as radar, memory cores of computers, audio-video and digital recording, [8–15] flyback transformer, broadband transformer, ultrasonic generator, isolators, low-noise amplifiers, impedance matching networks, radar absorbing materials (RAM), EMI/RFI shielding like electromagnetic protective devices. Tyagi et al. [16] explored absorption properties in Nd-based M-type Barium Ferrite at the *X*-band frequency range. The high-frequency

* Corresponding author.
E-mail addresses: charanjeet2003@rediffmail.com, rcharanjeet@gmail.com (C. Singh).

https://doi.org/10.1016/j.mseb.2022.115679
Received 25 May 2021; Received in revised form 20 January 2022; Accepted 2 March 2022
Available online 26 April 2022

Fluctuation and Noise Letters
Vol. 20, No. 4 (2021) 2150033 (8 pages)

DOI: 10.1142/S0219477521500334

Analysis of Nonlinear Active Noise Behavior of Fuzzy Controller Using Non-Perturbation Methods

Monika Rani*,‡, Rakesh Goyal† and Vikramjeet Singh†
*Kanya Maha Vidyalaya
Jalandhar, Punjab, India
†I K Gujral Punjab Technical University
Kapurthala, Punjab, India
‡gargnitk24@gmail.com

Received 4 October 2020
Accepted 11 November 2020
Published 26 December 2020

Communicated by He Wen

In this paper, a Fuzzy controller model has been converted into a time-dependent nonlinear model and then quadratic Riccati differential equation was analyzed to satisfy the solution of the nonlinear active noise behavior of Fuzzy controller. Further, the approximate solutions of this equation using non-perturbation methods i.e., adomian decomposition method (ADM), variational iterational method (VIM) and homotopy perturbation method (HPM) were investigated. A comparison of these methods has also been given with tabular and graphical presentations. Our results reveal that VIM provides the closest approximate solution and fast convergence for the proposed model as compare to ADM and HPM.

Keywords: Quadratic Riccati differential nonlinear differential equation; adomian decomposition method (ADM); variational iterational method (VIM) and homotopy perturbation method (HPM); Fuzzy controller.

1. Introduction

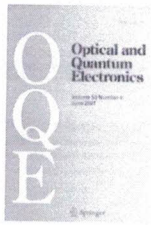
Most of the nonlinear systems have the problem of the stability and computational complexity. These problems can be reduced by splitting the system into a number of local linear systems. Various methods have been proposed to find the common stability of these local linear systems by the researchers. The fuzzy controller can be analyzed by designing differential equations. These equations have been widely used in optical, network synthesis, medical, controllers, quantum mechanics, trajectory tracking, modeling, means, financial mathematics, multi-input–multi-output (MIMO) systems, spacecraft attitude control fields of physical sciences, mathematics, chemistry, engineering, etc. [1–8]. The Riccati differential equation

01-06-2021

Performance evaluation of SS-FSO communication system incorporating different line coding

Authors: Aditi Thakur, Amit Gupta, Harbinder Singh, Surbhi Bakshi, Rakesh Goyal, Gurpreet Singh, Neeraj Mohan, Ankur Singhal

Published in: Optical and Quantum Electronics | Issue 6/2021



Abstract

In this research paper, high-speed Free-space optical connectivity is explored for the longdistance of data transfer in various weather conditions. The

Head
Department of Electronics & Communication Engineering
IK Gujral Punjab Technical University
Main Campus, Kapurthala (Punjab)-144603

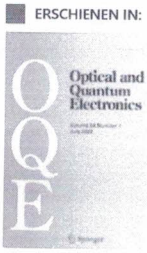
← Optical and Quantum Electronics

01.07.2022

Bidirectional TWDM Optical access network with novel dynamic bandwidth allocation and scheduling algorithm

verfasst von: Ankur Singhal, Amit Gupta, Rakesh Goyal, Harbinder Singh, Tarun Singhal

Erschienen in: Optical and Quantum Electronics | Ausgabe 7/2022



Received: 27 October 2021
DOI: 10.1002/mop.33171

RESEARCH ARTICLE

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Impact of higher-order dispersion on crosstalk in hybrid OWC access systems for next-generation communication networks

Ankur Singhal[1] | **Amit Gupta**[2] | **Surbhi Bakshi**[3] | **Harbinder Singh**[4] | **Tarun Singhal**[1]

[1]Department of Electronics & Communication Engineering, Chandigarh Engineering College, Landran, Punjab, India

[2]Department of Electronics & Communication Engineering, I.K. Gujral Punjab Technical University, Kapurthala, Punjab, India

[3]Department of Electrical Engineering, Chandigarh University, Mohali, Punjab, India

[4]Department of Electronics & Communication Engineering, Chandigarh University, Mohali, Punjab, India

Correspondence
Harbinder Singh, Department of Electronics & Communication Engineering, Chandigarh University, Mohali, Punjab, India
Email: harvinder90@gmail.com

Abstract

In today's pandemic environment where most of the work is managed from the premises of home, high bandwidth internet connectivity with superior signal quality is essential. Hybrid technologies based on optical wireless communication (OWC) are a better candidate for such requirements of next-generation communication networks. Such systems, also suffer from transmission impairments like crosstalk and dispersion affect the quality of the transmitted signals. In this article, the impact of crosstalk in the presence of higher-order dispersion (HOD) on a hybrid OWC access network is assessed. Coupled expressions have been employed for estimating crosstalk due to HOD in hybrid access systems. The mathematical model for XPM induced crosstalk has been introduced. Further, the impact of different system parameters on SRS and XPM induced crosstalk has been observed, so that the quality of communicated signals may be improved.

KEYWORDS

crosstalk, higher-order dispersion, nonlinear effects, OWC access systems

1 | INTRODUCTION

In today's pandemic environment, most of the works are executed from home which is instrumental in increased demand for online services. It has put a lot of strain on the access network infrastructure. Till recently, Access networks are based on guided transmission media like copper cables that provide lower bandwidth resulting in a bottleneck. Thus the end subscriber is unable to have access to various multimedia services. These are the reasons why in the last decade a lot of research is done in the development of low-cost fiber systems so that they may be installed in the access networks.[1,2]

In optical networks, fiber cables are installed up to the customer premises with a provision of higher bandwidth so that subscribers can perform various online works at a higher speed. Recently, Passive optical network (PON) based fiber solutions have been suggested that interconnects the end-user with the central office (CO) of the service provider through a fiber and a splitter/combiner configured in a point-to-multipoint topology. The various PON standards are based on time division multiplexing (TDM) concept in which end users share the channel infrastructure including feeder line and splitter/combiner to provide low-cost solutions for access networks. But medium access control (MAC) based TDM upstream communication faces multiple challenges, making it essential to look for alternate techniques.[3,4]

Networks based on wavelength division multiplexing (WDM) technology exploit the large bandwidth of the optical characteristics so that a point to point connection may be established between each end-customer and the CO and thereby making them MAC independent. The end delay is reduced by using a unique but spectrum utilization is not optimal. To avoid the deficiencies of both TDM and WDM PON networks, several approaches are suggested in the literature, one of them is a hybrid technique employing the features of both TDM and WDM and referred hybrid TDM-WDM PON systems,[5] optical wireless communication (OWC) is another alternative that helps in fulfilling the higher speed requirements of IP enabled multimedia

Optical and Quantum Electronics (2021) 53:698
https://doi.org/10.1007/s11082-021-03358-0

A novel dynamic bandwidth allocation algorithm in optical access systems

Ankur Singhal[1] · Amit Gupta[2] · Harbinder Singh[3] · Tarun Singhal[1] · Surbhi Bakshi[3]

Received: 12 August 2021 / Accepted: 30 October 2021

Abstract
With the emergence of differentiated service applications, optical access networks have developed as the most promising reliable technology for broadband access systems. One of the most critical characteristics of the access system is dynamic bandwidth allocation (DBA) which facilitates sharing of a common upstream channel for diverse categories of bursty data. It is expected that an ideal DBA mechanism shall reserve transmission resources for higher prioritized real-time applications along with a fair allocation of best effort (BE) services. This requires a provision of prioritized service class transmission on multiple uplink wavelengths in a cost-effective manner. This paper proposes a novel improved hybrid slot size/rate (IHSSR) DBA scheme that allows data traffic with three diverse priority classes to be communicated on multiple upstream wavelengths. The transmission cycle is segmented equally into two segments, in which the first section is reserved exclusively for the highest priority-expedite forwarding data traffic. On the other hand, the remaining part of the time cycle is further distributed between two services namely assured forwarding and best effort (BE) traffic. Furthermore, the proposed IHSSR algorithm computes the minimum scheduled channel length to achieve higher channel utilization. The proposed DBA mechanism is comprehensively evaluated in terms of quality of service metrics like average frame delay, throughput, average jitter, and channel utilization on varying traffic load. The simulation results indicate an improved performance from 4 to more than 20% in comparison with similar existing schemes. The range of congestion-free traffic load is also prolonged in the proposed algorithm. Thus it can be visualized that the proposed mechanism outperforms other schemes and met its objective.

Keywords Optical access systems · Dynamic bandwidth allocation · Tunable wavelength ONU · Multiple service class traffic · Quality of service

✉ Amit Gupta
amitguptacgc@gmail.com

[1] Chandigarh Engineering College, Landran, Punjab, India

[2] I.K Gujral Punjab Technical University, Kapurthala, Punjab, India

[3] Chandigarh University, Mohali, Punjab, India

Published online: 09 November 2021

electronics

MDPI

Article

Metamaterial Integrated Folded Dipole Antenna with Low SAR for 4G, 5G and NB-IoT Applications

Harbinder Singh [1], Nitin Mittal [1], Amit Gupta [2], Yogesh Kumar [3], Marcin Woźniak [4,*] and Amtul Waheed [5]

[1] Department of Electronics and Communication Engineering, Chandigarh University, Mohali 140413, Punjab, India; harbinder.ece@cumail.in (H.S.); nitinmittal.me@cumail.in (N.M.)
[2] Department of Electronics and Communication Engineering, I.K Gujral Punjab Technical University, Jalandhar 144603, India; dr.amitgupta@ptu.ac.in
[3] Indus Institute of Technology & Engineering, Indus University, Rancharda, Via Thaltej, Ahmedabad 382115, India; yogeshkumar.ce@indusuni.ac.in
[4] Faculty of Applied Mathematics, Silesian University of Technology, 44-100 Gliwice, Poland
[5] Department of Computer Science, College of Arts and Science, Prince Sattam Bin Abdul Aziz University, Wadi Ad-Dwasir 11991, Saudi Arabia; w.amtul@psau.edu.sa
* Correspondence: marcin.wozniak@polsl.pl

Abstract: The fast growth of wireless technology for mobile communication devices requires broad bandwidth, high data rate facilities and compact device size. The solution to the next generation user equipment is high data rate 4G/5G technologies. In this research, wideband antenna design was analyzed and evaluated for 4G, 5G and NB-IoT applications. CST microwave studio was used for simulations and investigations of the performance parameters. The antenna was designed as a folded dipole with a tunable bandwidth and resonates for 5G NR n78, NR-IoT bands B1, B2, and B25, and eleven TDD LTE frequency bands with a bandwidth percentage and minimum scattering loss of 69.02% and −42 dB respectively. Additionally, the designed antenna is small ($35 \times 48 \times 1.62$ mm^3) and planar in structure and can be easily integrated with radio equipment. The antenna design was also investigated for SAR minimization and gain enhancement using metamaterial integration. For all operating frequency bands, the antenna design results in a considerable gain improvement. The metamaterial was shown to be an excellent absorber of radiation, particularly in high frequency regions. This research also included a SAR examination with and without metamaterial integration. SAR values were found to be significantly reduced throughout all operating bands. The results were validated by fabricating the design prototype on FR-4 substrate for 4G, 5G and IoT bands. The antenna will be possibly used for communication in high data rate applications.

Keywords: 4G; 5G; FDD; IoT; LTE; NR; TDD

Citation: Singh, H.; Mittal, N.; Gupta, A.; Kumar, Y.; Woźniak, M.; Waheed, A. Metamaterial Integrated Folded Dipole Antenna with Low SAR for 4G, 5G and NB-IoT Applications. *Electronics* **2021**, *10*, 2612. https://doi.org/10.3390/electronics10212612

Academic Editor: Reza K. Amineh

Received: 2 September 2021
Accepted: 22 October 2021
Published: 26 October 2021

1. Introduction

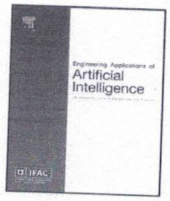
The continuous escalation in the number of wireless users is estimated to be expanded ten-fold by the end of 2025. There will be a need for more efficient technology, enhanced data rates and better spectrum utilization techniques. The 5G (Fifth Generation) is the latest generation to roll out the extremely high data rate services, such as enhanced mobile broadband (eMBB), massive machine type communications (mMTC), ultra-reliable, and low-latency communications (URLLC), in addition to vehicle to everything (V2X) communications in the near future [1]. The 5G networks will significantly improve the performance over the current 4G (Fourth Generation) systems and will also offer seamless connectivity to numerous devices by integrating different technologies, intelligence and flexibility. By comparison, 4G technology provides high quality video and audio services only. The Long Term Evolution (LTE) standard for 4G uses DSP (Digital System Processor) in addition to the modulation techniques to increase the data rates, and is incompatible with the 2G (Second Generation) and 3G (Third Generation) network. Thus, a separate

Engineering Applications of Artificial Intelligence 103 (2021) 104304

Contents lists available at ScienceDirect

Engineering Applications of Artificial Intelligence

journal homepage: www.elsevier.com/locate/engappai



Entropy based designing and analysis of a compact single layer double negative metamaterial with oblique incidents

Harbinder Singh [a], C.P. Gandhi [b,*], Amit Gupta [c], Surbhi Bakshi [d]

[a] Department of Electronics & Communication Engineering, Chandigarh University, Mohali, Punjab, India
[b] Department of Mathematics, University School of Sciences, Rayat Bahra University, Mohali, Punjab, India
[c] Department of Electronics & Communication Engineering, IK Gujral Punjab Technical University, Punjab, India
[d] Department of Electrical Engineering, Chandigarh University, Mohali, Punjab, India

ARTICLE INFO

Keywords:
Fuzzy sets
Symmetric cross entropy
Double negative metamaterial
Negative refractive index

ABSTRACT

The underlying study investigates a novel fuzzy cross entropy based methodology for enhancing the designing and analysis of a compact single layer double negative metamaterial with varying oblique incidents. Materials having a refractive index greater than unity may slow down the propagation of waves in comparison to the vacuum. A material with zero refractive index can boost the speed and wavelength of the wave to infinity. Nevertheless, metamaterials with a negative index of refraction have the necessary capability for controlling the wave velocity, although, mimicking zero index property in materials is quite difficult in real practices. Based on experimental observations and data visualizations, the lower bound of each measured indiscriminative index of refraction is extracted at various oblique incidents and then rehabilitated into the form of normalized and idealized fuzzy index sets (FISs). Thereafter, the proposed fuzzy cross entropy measure is deployed for identifying the most negative indiscriminative refractive index along with the desired wave velocity, intended to obtain the best incident angle and desired transition frequency. The experimental results suggest that the structure is behaving as a double negative metamaterial for all the azimuth angles with transition frequency fluctuating near to 7 GHz with different negative levels. The lowest transition frequency for the designed structure is observed at 0°azimuthal and increases thereafter with augmenting incident angle up to 90°. Although, the observed transition frequency decreases thereafter with further augmentation of incident angle (from 90° to 180°) and exhibits approximate symmetry in terms of transition frequency with the center of symmetry at 90°. Subsequently, the minimum (maximum) fuzzy cross entropy value between normalized and idealized fuzzy index sets is deployed to obtain the highest (lowest) wave velocity, which is observed at 135° (157.5°) azimuthal angle. The underlying fuzzy cross entropy-based methodology is capable of handling double negative metamaterial with oblique incidents and can effectively be applied for achieving the desired wave velocity as well as indiscriminative refractive index, depending upon the application requirements.

1. Introduction

Metamaterials are artificially built composite structures that can be intended to display explicit electromagnetic properties especially negative permittivity, negative permeability and negative refractive index. The term "metamaterial" was first coined by V.S. Veselago in 1968 (Veselago, 1968). Metamaterials with a negative index of refraction can be realized by combining the Epsilon negative (ENG) and Mue negative (MNG) structures within a common unit cell. The first realization of artificial metamaterial consists of two different resonator structures (Split Ring Resonators and thin wire resonators) combined in such a manner to get a negative response of refractive index over a common frequency range (Smith et al., 2000). The frequency at which the refractive index of test material is shifting from the double negative (DNG) range to double positive (DPS) range is known as transition frequency. Efforts from information theory can be accomplished, because of its huge potentiality, for improving the realization of metamaterials (Fang et al., 2006; Mittra, 2007; Rajkumar and Kommuri, 2018; Wang et al., 2007) and their performances in electromagnetic devices such as microwaves, antennas, optics, mechanics, cloaking, perfect lens etc. (Tao et al., 2020) incorporated short term finite Fourier transform and Categorical Generative Adversarial Networks, intended to develop an intelligent defect identification methodology for rolling bearing. For achieving higher identification accuracy, the authors deployed Shannon's probabilistic entropy for maximizing the conditional entropy of the data distribution, consisting of fake samples (generated by the generator) and true samples (generated by the classifier). Zhang

* Corresponding author.
E-mail address: cchanderr@gmail.com (C.P. Gandhi).

https://doi.org/10.1016/j.engappai.2021.104304
Received 3 January 2021; Received in revised form 20 April 2021; Accepted 13 May 2021
Available online xxxx

Future Foods 4 (2021) 100039

Contents lists available at ScienceDirect

Future Foods

journal homepage: www.elsevier.com/locate/fufo

In vitro study to evaluate anti-inflammatory properties of sorghum extract supplemented bread

Seemab Afrin, Shabir Sidhu*

Department of Food Sciences and Technology, IK Gujral Punjab Technical University, Kapurthala-144603, India

ARTICLE INFO

Keywords:
Bio-accessibility
Bio-efficiency
Celiac Disease
Gluten
Sorghum

ABSTRACT

Currently, a gluten-free diet is the mainstay in the management of celiac disease patients but it leads to malnutrition of the patients due to omission of wheat. Inflammation triggered by gluten is an important hallmark of the disease. With this background, an *in-vitro* study was planned to develop wheat-based bread by blending wheat flour and sorghum flour in the ratio 60: 40. Using this flour ratio two breads were prepared one supplemented with sorghum leaf extract and another supplemented with sorghum bran extract as anti-inflammatory agents. The extracts were added in the dose of 2.24 g per 300 g of flour. The extracts were prepared using ethanol and water (50:50). In-vitro digestion and absorption of prepared bread samples was done to evaluate bio-accessibility index and bio-efficiency index of anti-inflammatory compounds. Result shows that breads supplemented with sorghum bran and leaf extract has significantly higher bioaccessibility index ($p<0.05$) and bioefficiency index ($p<0.05$) of the anti-inflammatory and antioxidant compounds as compared to control bread. In conclusion bread supplementation with sorghum bran extract and sorghum leaf extract significantly improved the bioaccessibility and bioefficiency of anti-inflammatory compounds of the breads.

1. Introduction

In celiac disease (CD) patients some dietary proteins trigger an immune-mediated inflammatory response. CD patients show specific auto-antibody response leading to intestinal inflammation and other clinical symptoms (Fasano and Catassi, 2012). The hallmark of the disease is a chronic inflammatory reaction triggered by gluten intolerance in the small intestine. CD involves both innate and adaptive immune systems and is predominantly a T-cell-mediated disorder.

Currently, no therapeutic intervention is available to treat this disorder except for strict compliance to a gluten-free diet (GFD) which gives symptomatic relief. GFD eventually results in mucosal recovery (Green and Cellier, 2007). As a consequence, commercialization of gluten-free products has recently increased manifold. Gluten-free breads and cookies have been developed from rice or maize flour. The major drawback of these flours is poor quality and low content of proteins. Moreover, additives are also required to improve visco-elastic properties for baking (de la Barca et al., 2010). Gluten-free product formulation remains to be a challenge for nutritionists and technologists as substitute ingredients utilized in the formulation have inferior nutritional and functional properties (Anton and Artfield, 2008). Since wheat-based foodstuffs are a major source of energy intake, studies have shown that CD patients maintained on strict GFD are undernourished and this is particularly true for children (Penagini et al., 2013). Malabsorption is a hallmark of CD which leads to deficiency of calcium and other minerals. Consumption of GFD adds to the problem because of the low content of micronutrients in flours/ingredients used in GFD formulations. Thus, it is very important to develop foodstuffs with acceptable nutritional value for CD patients.

As CD is an inflammatory disease, an alternate approach could be incorporation of anti-inflammatory agents in traditional wheat-based food products to suppress the local inflammatory reaction. Sorghum (*Sorghum bicolor* L. Moench) is one of the world's most essential cereal crops. Sorghum is considered as an important human food in Africa and Asia. However, countries such as the USA and Australia mainly use sorghum for cattle feed. Sorghum is rich in phytochemicals, predominantly polyphenolic compounds. These polyphenolics impart anti-inflammatory and antioxidant properties to sorghum (Awika and Rooney, 2004). Apart from antioxidant properties, sorghum bran and leaves have shown anti-inflammatory properties (Benson et al., 2013). Sorghum is gluten-free and therefore considered a safe grain for development of GFD. Sorghum has been evaluated for its use in gluten-free diets and has proven to be a potential alternative to wheat (Ciacci et al., 2007). Though sorghum has the advantage of being gluten-free, it has

Abbreviations: CD, Celiac disease; LD_{50}, Lethal Dose 50; OD, Optical Density.

Corresponding author. Department of Food Sciences and Technology, IK Gujral Punjab Technical University, Kapurthala-144603, India. Ph. +91-9478098064; Fax 01822-662573.
E-mail address: sidhushabir@rediffmail.com (S. Sidhu).

https://doi.org/10.1016/j.fufo.2021.100039
Received 26 January 2021; Received in revised form 14 April 2021; Accepted 14 April 2021

Current Drug Safety, 2022, *17*, 335-343

RESEARCH ARTICLE

Retrospective Observational Study to Evaluate Causality, Preventability and Severity of Adverse Drug Reaction Associated with Anticancer Drugs in a Tertiary Care Hospital in Northern India

Ravi Thakur[1], Jagminder Kaur Bajaj[2], Archana Dutta[3] and Shabir Sidhu[1,*]

[1]*Department of Food Science and Technoloogy, Main Campus IK Gujral Punjab Technical University, Kapurthala, Punjab, India;* [2]*Department of Pharmacology, Punjab Institute of Medical Sciences, Jalandhar, Punjab, India;* [3]*Department of Medicine, Punjab Institute of Medical Sciences, Jalandhar, Punjab, India*

ARTICLE HISTORY

Received: August 24, 2021
Revised: November 22, 2021
Accepted: January 12, 2022

DOI:
10.2174/1574886317666220216100515

Abstract: ***Background*:** Chemotherapy has high efficacy, but it is associated with several adverse drug reactions (ADRs).

***Objectives*:** A retrospective observational study to explore the prevalence, causality, and preventability of ADRs of anticancer agents was conducted.

***Methods*:** The study was carried out at Punjab Institute of Medical Sciences Jalandhar, Punjab after obtaining IEC approval. The data was collected from cancer patients undergoing treatment at the hospital. The causality assessment of the collected data was done by using WHO causality assessment criteria. The preventability and severity of the reported ADRs were also assessed.

***Results*:** From 50 medical records, a total of 47 ADRs were recorded among 25 patients, out of which 16 were females and the rest were males. The cancer cases observed were breast carcinoma, leukaemia, lung, colon, and ovarian cancer. The highest number of ADRs were observed with alkylating agents, followed by taxanes, antimetabolites, kinase inhibitors, and monoclonal antibodies. The most affected organ systems were the gastrointestinal system, blood, and lymphatic system. According to the causality assessment, the majority of the ADRs were of the "possible" category. Preventability analysis showed that 85.11% of ADRs were unavoidable reactions, while 14.89% of ADRs were possibly avoidable. Severity analysis of ADRs showed that 87.23% of ADRs were mild and 12.77% were of moderate severity. The majority of the ADRs were unavoidable and mild to moderate in severity.

***Conclusion*:** Since the majority of the ADRs were of the unavoidable category, it indicates that the treatment regimens are acceptable as per the current clinical management of cancer patients.

Keywords: Pharmacovigilance, causality assessment, adverse drug reactions, chemotherapy, preventability assessment, severity assessment.

1. INTRODUCTION

Cancer is a disease that is increasing in incidence every year. The use of chemotherapy is the most promising approach to treat cancer. Patients derive benefits from the use of anticancer agents but, at the same time, are at risk of developing adverse drug reactions (ADRs) [1]. Low systemic toxicity is expected to occur with the introduction of these new drugs. According to WHO, ADR is defined as "a response to a drug which is noxious and unintended, which occurs at doses normally used in man for prophylaxis, diagnosis or therapy of the disease or for modification of physiological function excluding failure to accomplish the intended purpose" [2].

Nowadays, advancements in pharmaceutical sciences have dramatically changed the practice of chemotherapy or cancer medicine. Adjuvant chemotherapy has proven to improve the quality of life and prevent recurrence in cancer patients. Despite these therapeutic successes, many chemotherapeutic agents show a narrow therapeutic index and have greater potential for causing ADRs. In oncology practice, the ADRs of chemotherapy have become common synonymous with treatment [3]. The low therapeutic index of chemotherapeutic agents is considered a common reason for ADRs. The common ADRs include nausea, vomiting, diarrhoea, constipation, hypersensitivity reactions, alopecia, anaemia,

*Address correspondence to this author at the Department of Food Science and Technoloogy, Main Campus IK Gujral Punjab Technical University, Kapurthala, Punjab, India; E-mail: sidhushabir@rediffmail.com

2212-3911/22 $65.00+.00

BJPS

Brazilian Journal of Pharmaceutical Sciences

http://dx.doi.org/10.1590/s2175-97902020000118665

Use of microalgal biomass as functional ingredient for preparation of cereal based extrudates: impact of processing on amino acid concentrations and colour degradation kinetics

Laxmi Ananthanarayan[1], Vikas Kumar[2], Anil Panghal[2], Barinderjit Singh[3], Roji Waghmare[4], Yogesh Gat[1, 2,*], Narinder Kaur[1, 2]

[1]Department of Food Engineering and Technology, Institute of Chemical Technology, Matunga, Mumbai, India, [2]Department of Food Technology and Nutrition, Lovely Professional University, Jalandhar, India, [3]Department of Food Technology and Nutrition, IK Gujral Punjab Technical University, Jalandhar, India, [4]School of Biotechnology and Bioinformatics, Dr. D. Y. Patil University, Navi Mumbai, India

Suitability of developing Spirulina incorporated cereal based low cost nutritious extrudates was analysed against extrusion processing parameters. Most significant extrusion processing parameters considered for present study were feed moisture (20-25%), die temperature (100-120 °C) and screw speed (50-100 rpm). Different extrusion conditions were used to obtain most acceptable rice: Spirulina blend extrudates. In present study before extrusion processing different additives (citric acid and sodium bicarbonate) were added in rice: Spirulina blend and checked its effect on colour degradation kinetics at varied packaging and storage conditions. Higher screw speed (100 rpm) indicating less residence time of feed material inside the barrel resulted in higher colour retention of rice: Spirulina (97:03) blend extrudates. Kinetics for rice: Spirulina (97:03) blend extrudates indicates faster rate of colour degradation in terms of lightness (half-life of 4 days) when packed in metalized polyethylene at 50°C with 65% relative humidity. Increased concentration of Spirulina (1-3%) in raw formulations resulted in increase in concentration of all amino acids. Impact of extrusion processing has shown non-significant ($p \leq 0.05$) effect on amino acid concentrations of rice: Spirulina blend extrudates. Also, all the spirulina added samples showed good consumer acceptability with the score of 6.7.

Keywords: Extrusion processing. Spirulina. Storage stability. Colour degradation kinetics.

INTRODUCTION

There is wide spread prevalence of nutritional (protein, vitamins and minerals) deficiency in all risk groups especially among children and women throughout the world. Nutrient deficiencies in developing countries are particularly concerning as these countries are home to more than two-third of the world's total population with a high burden of nutrition-related disease. To address these nutritional deficiencies and prevent their sequelae, extrudates can be used as a medium for incorporating nutrients that have functional importance (Camire, 2011). Snack foods products can be of great economic importance to sustainable agriculture in countries having ever-increasing population pressure and facing resource constraints as well as rapid diminution of natural resources. Potential of extrusion cooking technology for the production of snack foods has long been recognised by food processors globally. It is more effective, cleaner and less expensive with a product of the same quality or even better than manufactured with traditional technologies.

***Correspondence:** Y. Gat. Department of Food Technology and Nutrition. Lovely Professional University. Jalandhar-144411. Tel: +91 9855285153. Email: yogeshcft10@gmail.com

J Food Sci Technol
https://doi.org/10.1007/s13197-022-05364-w

ORIGINAL ARTICLE

Manufacturing and characterization of whey and stevia-based popsicles enriched with concentrated beetroot juice

Aayushi Jain[1] · Rahul Mehra[1] · Renu Garhwal[1] · Shafiya Rafiq[1] · Seema Sharma[2] · Barinderjit Singh[3] · Shiv Kumar[4] · Krishan Kumar[5] · Naveen Kumar[1] · Harish Kumar[1]

Revised: 18 October 2021 / Accepted: 10 January 2022

Abstract The beet-root (*Beta vulgaris*) and whey powder together, can potentially use as a multifunctional ingredient in the manufacturing of the "Popsicles", due to their biochemical composition that can enhance the concentration of bioactive compounds. In the present study, beet-root juice concentrates were prepared at different time/temperature treatments viz 45 °C, 55 °C, and 65 °C for 120, 80 and 45 min. The effect of different time/temperature treatments on physicochemical composition, colour, antioxidant activity (%), bioactive compounds, spectral data and sensory acceptance were evaluated. The physicochemical parameters of popsicles (PTI, PT2, PT3) including protein, total phenols, betalain, radical scavenging activity %, colour and melting values were significantly affected ($p \leq 0.05$) by the different time/temperature treatments. The concentration of betalain and protein in all the popsicles ranged from 1134 to 1299 mg/L and 1.92 to 1.54 g/100 g respectively. The reduction of bioactive components viz betacyanins, betaxanthins, betanin, oxalic and syringic acid was also observed in popsicle (PTI) as compared to control. Furthermore, popsicle (PT1) was prepared with beet-root juice concentrated at 45 °C showed maximum sensory acceptance. The physicochemical and organoleptic attributes of processed popsicles encourage the commercial usage of whey powder and concentrated beetroot juice.

Keywords Popsicle · Beetroot · Whey powder · Bioactive · Colour

Introduction

In the last few years, consumers have progressively favoured the functional foods due to their intensifying concern about food consequences on their wellbeing. As a result, consumers are shifting towards the foods being prepared to form the nature-based bioactive constituents (Peres et al. 2012; Brown et al. 2015; Kurtuldu and Ozcan 2018). Research and markets also traced this trend of the global demand for functional foods, which used to be around $168 billion in 2013, will surpass $300 billion by 2020 (Terpou et al. 2019).

In the era of globalization, food manufacturers are constantly working on developing innovative food items prepared from natural ingredients that offer numerous therapeutic applications beyond basic nourishment (Sachdeva et al. 2015; Mehra et al. 2020). Popsicles, a sweetened, coloured, and flavoured portion of ice comprising dairy or non-dairy ingredients, which is consumed globally, regardless of age, culture, socioeconomic standing, or financial position (Balthazar et al. 2017). Frozen-fruits based popsicles are marketed throughout the world, with different labelling were freezing pop, paleta, ice lolly, ice pop, ice pole, ice block, ice drop and ice candy are

✉ Harish Kumar
harishkanwar3@gmail.com

[1] Amity Institute of Biotechnology, Amity University, Jaipur, Rajasthan, India

[2] Department of Food Technology, Jaipur National University, Jaipur, India

[3] Department of Applied Agriculture, Central University of Punjab, Bathinda, India

[4] Department of Food Science and Technology, Institute of Hotel Management, Maharishi Markandeshwar University, Mullana, Ambala, Haryana, India

[5] Department of Food Technology, Eternal University, Baru Sahib, Himachal Pradesh, India

Published online: 05 February 2022

Journal
of the
Oriental Institute
M.S. University of Baroda
ISSN: 0030-5324

TELEVISION VIEWING HABITS OF THE TEENAGERS AND EARLY ADULTHOODS

Narinder Kaur Department of Journalism and Mass Communication, I.K. Gujral Punjab Technical University, Kapurthala, Punjab, India : narinder.k.dhillon@gmail.com,
Ranbir Singh Department of Journalism and Mass Communication, I.K. Gujral Punjab Technical University, Kapurthala, Punjab, India : ranbirsingh@ptu.ac.in,
Barinderjit Singh Department of Food Science and Technology, I.K. Gujral Punjab Technical University, Kapurthala, Punjab, India : barinderjitsaini@gmail.com,

Abstract

Among the behaviors associated with food intake, exposure to television is particularly critical. The objective of this study was to examine the television viewing habits of teenagers and early adulthoods. A cross-sectional evaluation was carried out with 495 respondents, including variables (gender, age, and area), and results were administered using the Pearson chi-square test. Results showed significant variation in sports programs per week, time spent on watching television per day and watching primetime per week within gender, area, and age, respectively. Evaluation illustrated that male respondents prefer to watch more sports channels than females. Still, as a whole, female respondents spend more time watching television with a leading interest in primetime television. Considering eating habits while watching television, both demographic variables (gender and age) displayed significant differences with a higher variation. This study presents an integration of critically associated variables in a surveying framework highlighting a better understanding of the television viewing habits of teenagers and early adulthoods and might be used for future research in this area.
Keywords: Television, teenagers, early adulthood, prime time, cartoons, sports

Introduction

Media technology has advanced rapidly in the 21st century. Television is a vital and inescapable part of any mainstream media. Television is a powerful tool for social transformation. Television viewing is an everyday activity across the lifespan, generally connected with other screen-based media consumption and sedentary behavior exposure. Many studies are interested in how television affects people at any age. It significantly impacts children, teenagers, and adulthood development and behavior due to the combined audio-visual effect. Children watch a lot of television; however, the time spent is further either increased or decreased in teenage and early adulthood for many reasons (Strasburger, 1992). Television seems to be the mainstay of today's young leisure time. Many of their essential rights to life, health, growth, and protection from others and their own actions may be violated.

During watching television, they are also watching a lot of advertisements. These television advertisements promote high-calorie foods and beverages, increase meal frequency, boost fast-food restaurants, and reduce consumption of fiber-rich fruits and vegetables (Chaput et al., 2008; Coon, and Tucker, 2002; Folta et al., 2006; Guran et al., 2010; McNeal, 1999; Vijayapushpam et al., 2014). It will lead to adverse health outcomes such as obesity, poor fitness, sleeping problems, poor eyesight, increased risk of depression, anxiety, and high cholesterol in the teenager and early adulthood (Armstrong et al., 1998; Bickham et al., 2015; Hernández et al., 1999; McAnally et al., 2019; Maras et al., 2015; Primack et al., 2009; Robinson, 1999; Wong et al., 1992).

Apart from this, watching more television can cause many problems such as behavioral issues, adjustment issues in society, and academic difficulties in teenagers and early adulthoods. Therefore,

5/5

Mobile shopping adoption by Indian consumers: an examination of extended technology acceptance model

Jaspreet Kaur* and Harmeen Soch

Department of Management,
I.K.G. Punjab Technical University, India
Email: jaspreet.jrf@gmail.com
Email: harmeensoch@yahoo.com
*Corresponding author

Abstract: The purpose of the study is to investigate the factors influencing intentions of Indian consumers to adopt mobile shopping. The current study is using extended technology acceptance model by incorporating flow theory and its dimension intrinsic interest in to it. The study proposes that perceived usefulness and perceived ease of use is significantly affecting flow experience. Further perceived ease of use of mobile shopping is significantly affecting perceived usefulness. The study also state that perceived usefulness is directly influencing intentions to adopt mobile shopping. Data for the study is collected from 577 eligible responses via structured questionnaire from students of I.K. Gujral Punjab Technical University. All the items of the study are measured on seven-point Likert scale ranging from 7 'very strongly agree' (VSA) to 1 'very strongly disagree' (VSD). Confirmatory factor analysis is used to examine the validity of the measurement model. The proposed model was supported by the collected empirical data. The findings of the study provide several important implications for marketers, retailers and particularly mobile shopping companies.

Keywords: technology acceptance model; flow theory; intrinsic interest; intentions; attitude; mobile shopping.

Reference to this paper should be made as follows: Kaur, J. and Soch, H. (2021) 'Mobile shopping adoption by Indian consumers: an examination of extended technology acceptance model', *Int. J. Technology Transfer and Commercialisation*, Vol. 18, No. 1, pp.109–127.

Biographical notes: Jaspreet Kaur is a Research Scholar at I.K. Gujral Punjab Technical University, Kapurthala. She has teaching experience of three years. Her research interest areas are adoption of new technologies, mobile technologies, mobile commerce, mobile shopping, online shopping and consumer behaviour.

Harmeen Soch is an Associate Professor at I.K. Gujral Punjab Technical University, Kapurthala. She has research experience of more than 15 years. She has published many research articles in journals of repute. Her research area includes customer relationship management, adoption of mobile technologies, scale development and validation, customer loyalty and service recovery. Her teaching interest areas are marketing research, research methodology and advertising management.

(2)

Interaction between brand trust and customer brand engagement as a determinant of brand equity

Priyanka Kaushik* and Harmeen Soch

Department of Management,
IK Gujral Punjab Technical University, India
Email: kaushik.priya90@gmail.com
Email: harmeensoch@yahoo.com
*Corresponding author

Abstract: The objective of this study is to examine the role of brand trust and customer brand engagement (CBE) in determining brand equity. Built on the customer relationship marketing theory, we propose that brand trust has a significant relationship with customer brand engagement, which in turn determines the brand equity for a brand. Based on the data collected from 423 mall shoppers at different brand outlets, the proposed framework was tested by using structural equation modelling (SEM). Results reveal that there is a significant and positive relationship between the proposed constructs. All the hypotheses were supported except for the impact of cognitive processing on brand equity. The study concludes with the managerial implications and issues for future research.

Keywords: brand trust; customer brand engagement; CBE; cognitive processing; affection; activation; brand equity.

Reference to this paper should be made as follows: Kaushik, P. and Soch, H. (2021) 'Interaction between brand trust and customer brand engagement as a determinant of brand equity', *Int. J. Technology Transfer and Commercialisation*, Vol. 18, No. 1, pp.94–108.

Biographical notes: Priyanka Kaushik is a Research Scholar at Department of Management Studies at I K Gujral Punjab Technical University, India. She has presented papers at national and international conferences. Her research interests are in the areas of customer engagement, customer brand engagement and service-dominant logic.

Harmeen Soch is an Associate Professor of Marketing at IK Gujral Punjab Technical University in India. Her research interests are in the area of customer loyalty, service recovery, customer citizenship behaviour and customer engagement. She teaches marketing research, strategy and advertising. She has published papers in national and international journals of repute like *Vikalpa*, *Journal of Global Marketing*, *Journal of Indian Business Research* and *Global Business Review*.

This paper is a revised and expanded version of a paper entitled 'Interaction between brand trust and customer brand engagement (CBE) as a determinant of brand equity' presented at International Conference on Sustainable Development & Social Innovation in Business (ICSSB-2019), University School of Business, Chandigarh University, 25–26 February 2019.

Copernican Journal of Finance & Accounting

2021, volume 10, issue 4

e-ISSN 2300-3065
p-ISSN 2300-1240

Kumar, A., & Gupta, K. (2021). Examining the Impact of Structural Breaks on Price Discovery Efficiency: Evidence from the Indian Equity Futures Market. Copernican Journal of Finance & Accounting, 10(4), 79–96. http://dx.doi.org/10.12775/CJFA.2021.016

ADISH KUMAR*
I.K. Gujral Punjab Technical University

KAPIL GUPTA**
I.K. Gujral Punjab Technical University

EXAMINING THE IMPACT OF STRUCTURAL BREAKS ON PRICE DISCOVERY EFFICIENCY: EVIDENCE FROM THE INDIAN EQUITY FUTURES MARKET

Keywords: structural breaks, global financial crisis, change in government, demonetization, COVID-19 and price discovery.

J E L Classification: C1, C5, G13, G14, G17.

Abstract: The current study aims to examine the impact of structural breaks on price discovery efficiency of Indian equity futures market. Global financial crisis, change of Government, demonetization and COVID-19 are identified as significant events. Data is divided into sub-samples of pre and post event period to study the impact of these events on price discovery efficiency of the Indian equity futures market. Unit root test is used to check stationarity of data. Granger causality test, Johansen's cointegration test and Vector error correction methodology (VECM) are used for analysis. During full

Date of submission: July 16, 2021; date of acceptance: October 3, 2021.

* Contact information (corresponding author): adishbansal8@gmail.com, Dept. of Management, I.K. Gujral Punjab Technical University, Main Campus, Kapurthala, Pin Code-144603, India, phone: +91-904-156-1827; ORCID ID: https://orcid.org/0000-0002-8737-3162.

** Contact information: kapilfutures@gmail.com, Dept. of Management, I.K. Gujral Punjab Technical University, Main Campus, Kapurthala, Pin Code-144603, India, phone: +91-947-809-8074; ORCID ID: https://orcid.org/0000-0003-3817-1772.

ISSN 2277 - 7083

आधुनिक साहित्य

Aadhunik Sahitya

साहित्य, संस्कृति एवं आधुनिक सोच की त्रैमासिकी

UGC Approved Care Listed Journal

अक्टूबर-दिसम्बर / Oct.-Dec., 2021

वर्ष/Year-10 अंक/Vol.-40

द्विभाषी/Bilingual

संपादक

डॉ. आशीष कंधवे

AN ANALYSIS OF PUBLIC DISCLOSURES OF TECHNICAL UNIVERSITIES IN INDIA

–Deepak Jain
–Dr. Mandeep Arora

Di clo re i ba icall he ac ion of a ailabili of informa ion in he p blic domain hich i req ired for deci ion making b differen akeholder . I i a broadca or declara ion of informa ion, hich o her i e i no a ailable o p blic. Di clo re help o ake deci ion efficien l in b ine organi a ion , companie and go ernmen agencie . So, i can be concl ded ha di clo re i an ac of gi ing ne or ecre informa ion, ome hing ha a no pre io l kno n or he ac of gi ing ch informa ion o he p blic.

Public information in the form of disclosures plays on important role in case of universities as receivers are users of public resources. Not with standing the social significance of universities and their importance as beneficiaries of public assets, barely any study exists about disclosures of technical universities. A scarce research in this area is related to foreign universities and there is shortage of Indian universities disclosures study. This study targets the analysis of disclosures of technical universities in India. These disclosures are measured on the basis of selected parameters of academics, research, student corner and financial information. Content analysis has been used for scoring of disclosures and information has been collected from the websites of universities. It has been found that Indian Technical universities are disclosing information on the parameters of student corner and academics in a limited manner. Financial information and research information is an ignorant area and require lot of improvement.

Keywords: Academic disclosures, Research disclosures, Financial disclosures, Students related disclosures, Content analysis, State technical universities.

Introduction

Disclosure is basically the action of availability of information in the public domain which is required for decision making by different stakeholders. It is a 'broadcast' or 'declaration' of information, which otherwise is not available to public. Disclosure helps to take decision efficiently in business organizations, companies and government agencies. So, it can be concluded that disclosure is an act of giving new or secret information, something that was not previously known or the act of giving such information to the

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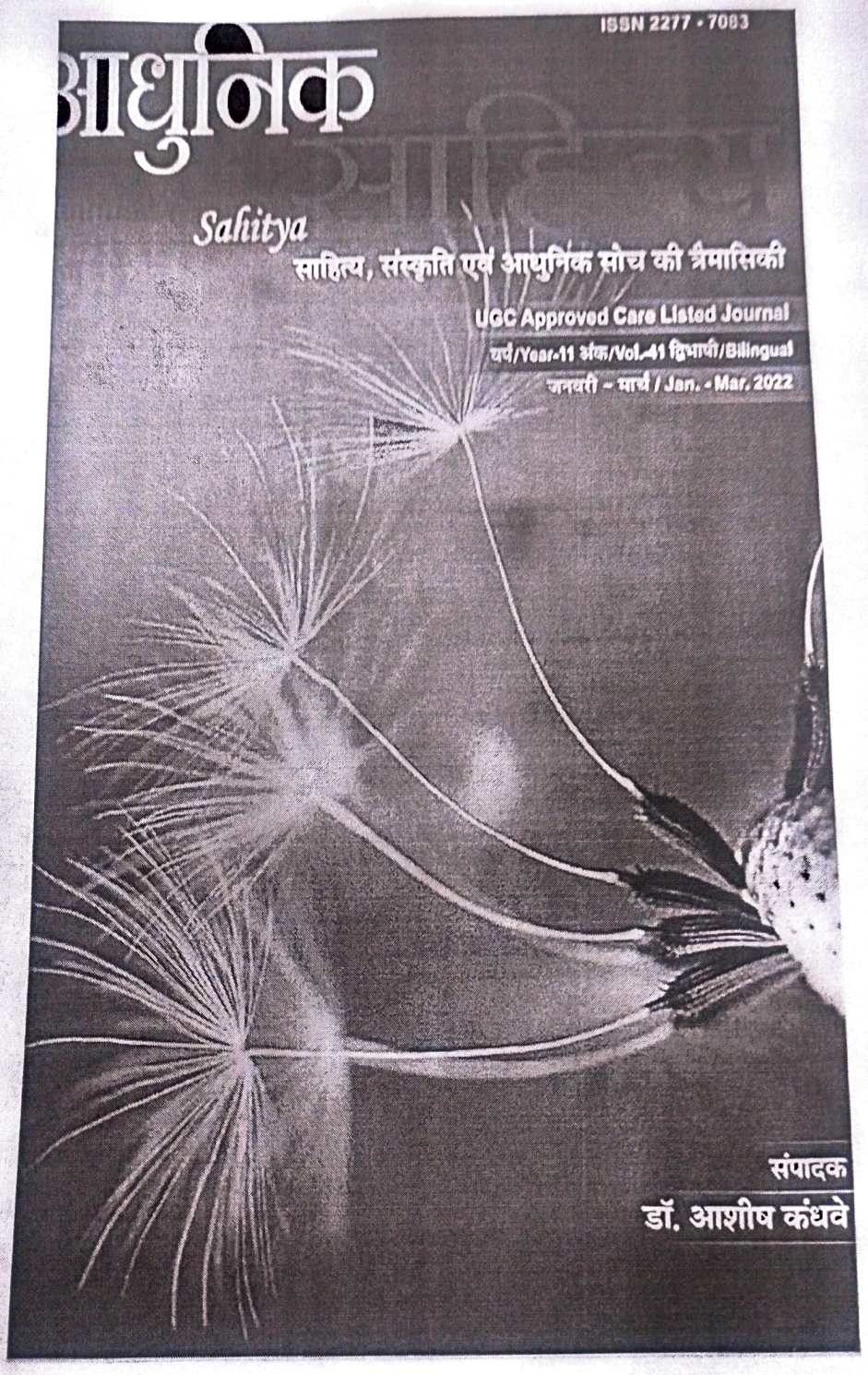


An empirical investigation of Indian Technical universities disclosures on the basis of selected parameters

–Deepak Jain
–Dr. Mandeep Arora

Disclosure has been made on the basis of selected criteria for improving the education system of the university and enrollment of students in order to help in furthering the field of education. As the university library, which is a part of the university establishment, plays a major role in daily life. Each library program supports the overall progress of the university. It reflects the character of the university. But our education system is under a lot of force and stress and the university library is equally affected as an integral part of the university system. University libraries in India have to deal not only with the growing number of users, but also with users in new areas of study, teaching and research.

The importance of disclosure to ensure transparency in universities, operations and management makes it easier for students to make informed decisions so that students can decide which university they should enroll in. Every university needs to have competitive advantage in recruiting and funding students in which university background, library information and administration play a major role. In this study, we target technical universities in India based on the analysis of the disclosures of some selected parameters. Past research has suggested that students' backgrounds and other factors correlate to the performance of their tertiary education. The number of universities that participated in the analysis is relatively small and the study mainly considers the extent of disclosures. Such disclosure practices are computed on the ground of parameters such as administration, admission information, and background information of universities and libraries information. Content analysis is employed for measuring the disclosure score and information is drawn from the Universities' websites. It has been observed that the Indian Technical universities have disclosed low information on administration parameters and universities' background information. Admission information and library information is an unknown field and needs to be greatly improved. So, that the students get maximum information whether the universities have adequate means of imparting education or not.

Key words:- "State technical universities", "Indian", "Disclosure".

Introduction

Disclosure of information is an indication of the University's support for the development of science and education by providing open information to society. Awareness as a public body is the basis for providing responsible information to universities. The use of descriptive research and qualitative approach in

Consumer attitude towards green products: revisiting the profile of green consumers using segmentation approach

Pooja Mehta
Department of Management, I.K. Gujral Punjab Technical University, Kapurthala, India, and
Harpreet Singh Chahal
Department of Business Management and Commerce, GNDU, Regional Campus, Gurdaspur, India

Received 2 July 2020
Revised 18 October 2020
19 January 2021
5 March 2021
Accepted 7 March 2021

Abstract

Purpose – Over the last few decades, there has been a substantial increase in environmentally conscious consumers' willingness to switch their preferences from mainstream products to green products. Hence, it becomes essential for academicians and marketers to understand the notion, attributes and a comprehensive profile of green consumers. Since consumer attitude towards green products is not widely studied in developing countries, the present study aims at exploring the profile of green consumers in India (Punjab State) based on the same in the Indian context.

Design/methodology/approach – The study used the survey method, and a sample of 400 respondents was selected from the Punjab State of India. Initially, principal component analysis was employed to reduce the dimensions. Following this, cluster analysis was applied to segment consumer market in distinctive segments. Results of cluster analysis were validated with discriminant analysis and finally, differences amongst the segments of green and non-green consumers were examined to build on the profile of green consumers.

Findings – The study segmented the consumer market based on consumer attitude towards green products. Results of the study revealed four distinct segments. "Dynamic Green", the largest cluster, presents truly green consumers who exhibit a positive attitude towards green products. Finally, the study highlighted the attitudinal profile of green and non green consumers and differences amongst the segments were explained.

Research limitations/implications – Similar study should be conducted in other developing/developed countries. Furthermore, cross-cultural studies can be undertaken to contrast consumer attitude towards green products. The study may also be extended to probe the connection between consumers' attitude and actual behaviour towards green products.

Originality/value – The study examined the role of consumer attitude towards green products in identifying the distinct segment of green consumers and determining different configurations of consumer characteristics to build on the profile of green consumers.

Keywords Profile of green consumers, Consumer attitude towards green products, Perceived benefits for the environment, Trust in green products, Willingness to use, Willingness to pay

Paper type Research paper

1. Introduction

Ever since the rise of green marketing discussion, research on green consumers has become focal. The green consumer is the one who believes that the purchase and consumption of products are strongly related to environmental preservation (Akehurst *et al.*, 2012). Green consumers prefer products that are less likely to damage the environment or endanger the health of human beings (Zhu and Sarkis, 2016). Due to the rising ecological concern of consumers, the world experienced a sudden increase in the demand for environmentally

The present research work was not funded by any organization.

Management of Environmental Quality: An International Journal
© Emerald Publishing Limited
1477-7835
DOI 10.1108/MEQ-07-2020-0133

Pacific Business Review International
Volume 13 Issue7 January 2021

Determining the Impact of Demographics on Perceived Ethical Values of Teachers

Venus
I.K.Gujral Punjab Technical University, Kapurthala,Punjab

Dr.Pooja Mehta
I.K.Gujral Punjab Technical University, Kapurthala ,Punjab

Abstract

The Purpose of this paper is to study and examine the perceived ethical values of teachers from selected higher education setting of North India in relation to demographics, i.e. gender, age, income and education and this study also make stakeholders to work on effective teaching in context to teaching ethics. A self-administered survey was conducted of 120 teachers at HEI (Higher Education Institute) to determine ethical perceptions on 28 ethical values. Study demonstrates that ethical values Justice, Respect, Knowledge, Self- Motivation, Honesty, Compassion, Gratitude, Decision Making ,Love and Integrity comes out to be very high among all ethical values which further reveals that teachers overwhelmingly find these values to have contributed significantly to the ethical practices. The study further found that perceived ethical values of teachers in relation to their demographics, i.e. gender, age, income and education do not differ significantly. This study provides fruitful evidence that teachers possess ethical values meaningful to their profession. As the sample was small so results could not be generalized. The present study is therefore helpful for the teachers and educational policy makers to understand the nature and importance of ethical teaching, ethical behavior, and professionalism in an academic setting.

Keywords: Ethics, Perceived Ethical Values, Ethical perceptions and Higher Education Institute

Introduction

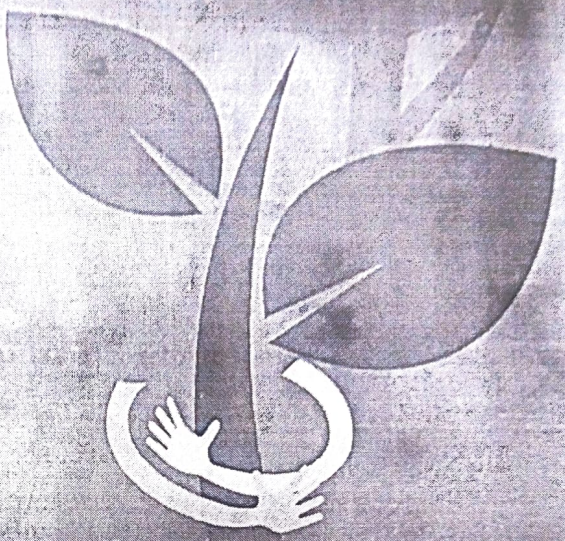
With an expanding pattern in violation, subject of ethics has turned into a debatable issue, picking up the consideration of scholastic, administrators, business stakeholders and even the government officials. It has been one of the most sensitive issues of any organization. Besides, with such huge numbers of instances of scams, money laundering blunders, fumble, extortion, and criminal rupture of trust, it seems auspicious to look at the moral impression of principal employees or administrators in any organization whether it is public or private.

Perception has been very important dimension of a person. Having perceptions to certain things varies from person to person. It could be belief which developed and retained in individual behaviour by virtue of various circumstances or instances of life. Impact of environment, life situations do work in modifying perceptions. Perceived Ethical

THE MANAGEMENT ACCOUNTANT

ISSN 0972-3528

June 2022 | VOL 57 | NO. 06 | Pages - 124 | ₹ 100



REVOLUTIONIZING AGRICULTURE FOR ENHANCING FOOD SECURITY

Journal of

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ARTIFICIAL INTELLIGENCE (AI) BASED SMART AGRICULTURE FOR SUSTAINABLE DEVELOPMENT

Abstract

Agriculture plays a significant role in the economic growth and development. Over the years, AI-based technological improvements have profoundly impacted farming and transformed the business. These technologies could help farmers to be proactive rather than reactive in their farming practices. These technologies allow farmers to boost agricultural yield, soil analysis, pest attack monitoring, water management, seed management, crop rotation, better control of harvesting conditions and timing, nutrition management, and reduced waste. However, in order to reap all these benefits, effective collaboration between Government, science, and business is also vital. This article attempts to outline the significant AI based smart agricultural technologies, their significance and the challenges confronting Indian agriculture with potential solutions.

Gurwinder Kaur
Research Coordinator
Department of Food Science and Technology
I.K. Gujral Punjab Technical University, Kapurthala
gurwinder04011994@gmail.com

Dr. Barinderjit Singh
Assistant Professor
Department of Food Science and Technology
I.K. Gujral Punjab Technical University, Kapurthala
barinderjitsaini@gmail.com

Dr. Anil Kumar Angrish
Associate Professor (Finance and Accounting)
Department of Pharmaceutical Management
National Institute of Pharmaceutical Education and Research, Mohali
anilkangrish@gmail.com

CMA (Dr.) Sanjeev K.Bansal
Assistant Professor
Department of Management
I.K. Gujral Punjab Technical University, Kapurthala
commerce.ptu@gmail.com

"AI and Big Data will play major roles in the agriculture sector in coming years since data is key to targeted development".

-Sh.Sanjay Agarwal
Secretary, Ministry of Agriculture & Farmers' Welfare
Government of India

PIMT Journal of Research
Volume-13, No-4 (c) (July-Sept) 2021
PP: 28-39

UGC Care Listed Journal
ISSN No: 2278-7925

FARMERS' OPINION TOWARDS AGRICULTURE CREDIT SANCTIONED BY VARIOUS FINANCIAL INSTITUTIONS IN PUNJAB

*Munish Malhotra **Sanjeev K. Bansal

*PG Department of Commerce, DAV College Hoshiarpur.

**Assistant Professor, Assistant Professor, Department of Management, IKG Punjab Technical University, Main Campus, Kapurthala

ABSTRACT

The agriculture is the pillar of Indian economy. The development of the country resides upon the agriculture sector. Within the Indian economy, agriculture contributes around 1/3rd of total GDP value. Agricultural credit is defined as the amounts of investible funds are obtainable for farming business, and farmer's domestic needs. The main objective of the study was to analyse the opinion of beneficiaries and bank managers regarding agriculture sector lending and identify the difficulties faced by farmers in receiving agricultural finance by financial institutions in Punjab. For the study, a sample of 400 beneficiaries in all with 50 each from eight districts of Punjab was selected. The data is measured on the five Likert Scale and I had applied the factor analysis tool for further statistical analysis. For the testing of Reliability analysis of data, I have applied Cronbach's alpha, KMO and Bartlett's test of spherically for measures of sampling adequacy, Sum of Square loading and variance, Correlation Matrix, Eigen Values, Scree Plot. It shows the S.D., Cronbach's α value 0.441 and 0.864 which shows the better reliability of the data responses. The results of these are as the chi- square test value is 3092 and D.O.F is 300 at 5% level of significance. The p value under significance is <.001 which shows that the sample is adequate. The overall MSA is 0.859. There are four factors which are affected the agriculture finance decision of the farmers i.e., Security, Awareness, Communication and Time Period.

Key Words: KMO, MSA, EFA, NABARD etc.

INTRODUCTION

The agriculture is the pillar of Indian economy. The development of the country resides upon the agriculture sector. Within Indian economy, agriculture contributes around 1/3rd of the total GDP value. Agricultural credit can be defined because the sum of investable funds made available for farm business, and farmer's domestic needs. Macro finance contracts with diverse sources of raising funds for farming as an entire economy. It's concerned with the advancing way, rules, regulations, monitoring and controlling of various farming credit societies. The agricultural finance is required for the strengthening and modification of farming. Intensive agriculture needs huge capital. Farmers' financial sickness is subject to frequent on slaughter of flood, drought, starvation etc. In India, about all of the farming strategies has gone timely evaluate to remembrance drive with the moving circumstances of the agriculture sector.

MEANING OF AGRICULTURE FINANCE

Agricultural credit can be defined because the sum of investable funds made accessible for farm business, and farmer's domestic needs. It's worried with the lending way, rules, guidelines, monitoring and governing of various agricultural credit societies.

Warren F Lee et al; defined agricultural finance is the economic study of the acquisition and use of capital in agriculture. It deals with the availability of and demand for funds within the agricultural sector of an economy.

John B. Penson, agricultural finance is that the study of financing and liquidity services credit to farm borrowers. It's also considered because the study of these financial intermediaries who offer loan funds to agriculture and so the financial markets during which these intermediaries get their loan able funds.

Vol. 13 No. 67, March 2021 ISSN: 0975-1386

Wesleyan Journal of Research

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Vol. 13 No. 67 March 2021 (ISSN: 0975-1386) | Impact Factor: 6.50

Articles

Structural Equation Modeling Approach to Corporate Social Responsibility (CSR) Activities of Private Sector Banks and Public Sector Banks

*Dr. Roopali Batra, **Aman Bahri

*Assistant Professor, Department of Management, I. K. Gujral Punjab Technical University Main Campus, Kapurthala

**Assistant Professor, Post Graduate Department of Commerce, D. A. V. College, Hoshiarpur.

amanbahri426@gmail.com, roopalibatra@rediffmail.com

Abstract:

The paper focuses on the prospects for differences in corporate social activity indulgence across public and private sector banks. The study leveraged structural equation modeling to ascertain the scope and prospects for quantifying the differences across public and private sector bank manager's perceptions. The outcomes vindicated the assumption and lead to mapping the subsequent differences.

Key Words: SEM, Public banks, Private banks, Mangers, CSR, India

Article History

Received: 18/03/2021; Accepted: 28/03/2021

Corresponding Author: Dr. Roopali Batra E-Mail: roopalibatra@rediffmail.com

1 Introduction

The CSR operationalization at bank's level often places considerable emphasis on manager's role and participation. The logic behind consideration of themes was to illustrate the influences on bank's corporate reputation and performance vis a vis CSR indulgence. CSR conceptualization (Eliasson, 2020) across banking industry has witnessed influx of influences across multiple stakeholders and actors from within and outside the banking organization. The study across CSR indulgence in Indian banking sector is needed as the research on

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A bi-annual journal

Vol. 52, No.1 (I) January – June 2022

Sardar Patel Institute of Economic and Social Research
Thaltej Road, Ahmedabad – 380 054, India
Website: www.spiesr.ac.in, Email: info@spiesr.ac.in

ANVESAK
ISSN : 0378 – 4568 UGC Care Group I Journal

OPPORTUNITIES AND CHALLENGES OF CRYPTOCURRENCIES IN MODERN FINANCE

Manjit Kaur
Research Scholar, I.K Gujral Punjab Technical University, Jalandhar.

Dr. Rajpreet Kaur
Assistant Professor, Department of Management, I.K Gujral Punjab Technical University, Jalandhar.

Abstract: The cryptocurrencies are gaining great momentum in both the and finance sector. The currencies are used more widely in various areas and there is a need to prioritise the opportunities and challenges with reference to various research areas. The results from the various studies shows that cryptocurrencies offer businesses and individuals lower transaction costs, higher efficiencies, increased security and privacy, meaningful diversification benefits, alternative financing solutions, and financial inclusion. Though still there is lack of regulatory control, security issues, criminal activities, etc. Enabling crypto payments, such as bitcoin, without bringing it onto the company's balance sheet may be the easiest and fastest entry point into the use of digital assets. It may require the fewest adjustments across the spectrum of corporate functions and may serve immediate goals, such as reaching a new clientele and growing the volume of each sales transaction. This paper focus on the emerging phenomenon of cryptocurrencies in modern finance. Moreover, the paper presents a systematic literature review (SLR) of research articles published on the adoption of cryptocurrency from 2014 to 2021. The results of the study reveals that there is a lack of study focusing on the factors that are significantly influenced on the acceptance of cryptocurrency in modern finance. Further, there is also a lack of technology acceptance models used in addressing the issues. The research paper also covers the new revolutionary models those are emerging out of symbiosis relationship between the crypto-currency and e-commerce services and their respective impacts, challenges and futures over the one another.

Keywords: Cryptocurrency, Blockchain, Distributed Ledgers, Modern Finance.

Introduction

Cryptocurrency, sometimes called crypto-currency or crypto, is any form of currency that exists digitally or virtually and uses cryptography to secure transactions. Cryptocurrencies don't have a central issuing or regulating authority, instead using a decentralized system to record transactions and issue new units. Cryptocurrencies are digital assets people use as investments and for online purchases. Right now, cryptocurrencies fall under the jurisdiction of the SEC for investments, the CTFC for any crimes involving interstate commerce, and the IRS, making it subject to either income or capital gains tax. The SEC recently approved one Bitcoin futures ETF over the CBOE and one over the CME. The cryptocurrency was invented in 2008 by an unknown person or group of people using the name Satoshi Nakamoto. The currency began use in 2009 when its implementation was released as open-source software. A cryptocurrency is a digital or virtual currency that is secured by cryptography, which makes it nearly impossible to counterfeit or double-spend. Many cryptocurrencies are decentralized networks based on blockchain technology—a distributed ledger enforced by a network of computers. A definining feature of cryptocurrencies is that they are generally not issued by any central authority, rendering them theoretically immune to government interference or manipulation. Decentralized digital assets, currencies, and tokens have garnered attention from academics and practitioners in nearly every scholarly discipline. Cryptocurrencies, and related areas of interest, have wide-ranging business, economic, environmental, legal, political, and regulatory implications. The Cryptocurrency Research Hub presents interdisciplinary scholarship covering all aspects of cryptocurrencies, from the technical platforms, solutions, and tools related to user identity, authentication, and the encryption empowering it, to the regulatory policies it intersects. Cryptocurrencies run on a distributed public ledger called blockchain, a record of all transactions updated and held by currency holders.

Units of cryptocurrency are created through a process called mining, which involves using computer power to solve complicated mathematical problems that generate coins. Users can also buy the currencies from brokers, then store and spend them using cryptographic wallets.

Asian Journal of Organic & Medicinal Chemistry ISSN Online: 2456-8937

Vol. 7 No. 2 (April - June, Special Issue - III 2022) UGC CARE APPROVED JOURNAL

Asian Journal of Organic & Medicinal Chemistry

Asian Journal of Organic & Medicinal Chemistry
Vol. 7 No. 2 (April - June, Special Issue - III 2022)
ISSN Online: 2456-8937
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Crypto-Currency- Legality and Restriction in India

Manjit Kaur and Rajpreet Kaur
I.K Gujral Punjab Technical University, Jalandhar, India

ABSTRACT

This paper encapsulates the scope of crypto currency trade, usage and its legal status in India. Latest decisions taken so far regarding the governance of crypto-currency evaluates the turbulent time ahead for the nation's nascent, however digital industry is on boom. During 2018, India completely banned trade of all crypto currencies, strictly prohibiting the banks to not provide service to customers in respect to exchanging digital currencies. [1] Although the nations Supreme Court overturned the ban by 2020, the government, led by the Reserve Bank of India (RBI), continued to make no secret of its discomfort with the trade of crypto in India. This paper examines the regulatory drive of crypto-currency in India from its ban to its regulation to date. Since from complete ban on crypto-currencies during the year 2016 to an forthcoming bill for its regulation, the government's mindset on digital assets has changed significantly over the precedent few years. The approaching Crypto-currency and Regulation of Official Digital Currency Bill, 2021 seems to be entirely is different year from the previous ones comparing with 'Banning of Crypto-currency and Regulation of Official Digital Currency Bill, 2019.' Where the older regulations was introducing and imposing a complete ban on all crypto-related activities which involves mining, buying, selling, holding and dealing, the later one is consider to make a clear peculiarity in terms of its often use of purposefulness as a currency. [2][1]

Keywords: Crypto-currency, legal status, trade, regulations and governing

I. PREVIOUS SEARCH AND HISTORY

There is a lot work that is to be done when it comes to the legal aspect of this trade. Though article had been published demonstrating ups and downs in context to both supporting and criticizing the venture in India however, the consolidated information on the topic and its future is the motivation and hence this paper. The rapid developments and advancements in the area of technology in India, especially during the challenges posed amid spread of COVID-19, the fintech sector has shown tremendously promising outcomes. There has been exceptional growth, propelled largely by inquisitiveness and popularity, among the India population towards usage and trade of crypto currency such as Bitcoin, Binance, Ripple, Dogecoin, many other Alt-coins, which ultimately lead large number of people to started investing a perceptible part of their time and money in these virtual currencies ventures. [2]

In India, the supreme financial authority and governing body, the Reserve Bank of India ("RBI"), recognized virtual currency, more specifically and securely defined form of digital currency created as a result of a series of written computer instructions using cryptography /encryption and is thus free of central issuing authority per se in case if any. Crypto-currency backed through block chain technology, which establishes a person-to-person issuance system that utilizes private and public keys allowing encryption and authentication for secure and highly safe transactions. [3]

The Reserve Bank of India (RBI) issued a circular warning the public against the use of virtual currencies in the year 2013. The bank also warned users, investors, and traders of crypto currencies about the potential risks involved in, operational, financial, legal, customer protection, and security-related concerns they are divulging themselves to.

II. OBJECTIVES OF THE STUDY

1. To study journey of the crypto currency in terms of its legal status in India
2. To study future aspects related in context to legality of crypto currencies in India

III. Legal Status Jounrey So Far And Present Scenario

The growing popularity of crypto currency and being an unattended and unregulated market holding huge potential of over a trillion dollars, India also witnessed a exponential surge of crypto-currency trade in crypto exchange. Advocating the increasing reputation of the use and trade of crypto-currency within such a short span of a year and the potential revenue loss to the Government of India; the regulators and governing authorities started to take notice and as a consequence, in 2013 the Reserve Bank of India (RBI) issued a press release, warns the public against dealing and trading in virtual currencies. [4]

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Elucidating the role of gender differences via TAM in e-recruitment adoption in India: a multi-group analysis using MICOM

Davinder Kaur and Rajpreet Kaur
Department of Management, I.K. Gujral Punjab Technical University, Jalandhar, India

Received 22 December 2021
Revised 20 April 2022
20 May 2022
Accepted 20 May 2022

Abstract

Purpose – This paper aims to answer two research questions: first, to study the factors that directly and indirectly influence the intentions of job-seekers and second, to examine the moderating role of gender differences in e-recruitment adoption through the application of technology acceptance model (TAM) in India.

Design/methodology/approach – A convenience sampling technique was used to collect online data via GoogleDocs through various online channels such as social media, LinkedIn and email. The final data was collected from 364 final-year graduates and postgraduate students to confirm the impact of female and male differences, measurement invariance in composite models (MICOM) and multi-group analysis (MGA).

Findings – The results indicated that perceived usefulness (PU) and perceived ease of use (PEOU) have a direct impact on attitude (AT), whereas PU influenced behavioral intentions (BI) of job-seekers, but PEOU did not. AT directly leads to the BI. The outcomes of mediation analysis show that AT partially mediates the relationships between PU to BI and PEOU to BI. Further, the findings of MICOM and MGA showed that gender significantly moderates all the relationships between the constructs except for the influence of AT on BI.

Research limitations/implications – This study contributes to the current literature, revealing that the original TAM model is still pertinent and effective in prevailing periods in emerging markets. The significance of PEOU and PU on AT and BI implies that job-seekers will strongly adopt e-recruitment when it is user-friendly and assist them to accomplish their tasks easily and efficiently. Moreover, gender has a vital moderating influence in e-recruitment adoption. In the case of females, the effect of PEOU is stronger, and for males, PU has a substantial impact on adoption.

Practical implications – Developers and recruiters should provide significant information related to salary, location and job profile on e-recruitment to enhance the adoption rate of online recruitment. Further, the usefulness of e-recruitment systems was more significant for males compared to females, whereas female job-seekers prefer the e-recruitment system, which is easy to use and operate.

Originality/value – This research fills a gap in the literature by examining the essential factors affecting the BI of job-seekers as well as empirically testing the impact of gender differences to adopt TAM for e-recruitment – an under-explored subject in developing countries like India.

Keywords E-recruitment, Technology acceptance model (TAM), Gender, Multi-group analysis (MGA), MICOM, PLS-SEM

Paper type Research paper

There is no funding provided for this research. The authors would like to thank the editors and anonymous reviewers for their valuable suggestions.

The Bottom Line

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Source details

Management Research Review

Formerly known as: Management Research News

Scopus coverage years: from 2009 to Present

Publisher: Emerald

ISSN: 2040-8269

Subject area: Business, Management and Accounting: General Business, Management and Accounting

Source type: Journal

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Does electronic word-of-mouth influence e-recruitment adoption? A mediation analysis using the PLS-SEM approach

Davinder Kaur and Rajpreet Kaur
Department of Management, IK Gujral Punjab Technical University Jalandhar, Kapurthala, India

Received 28 April 2021
Revised 16 July 2021
10 January 2022
28 January 2022
Accepted 4 March 2022

Abstract

Purpose – E-recruiting has been a powerful tool for reaching the majority of job applicants around the world. Even though, previous literature has scarcely shed light on the factors responsible for the adoption of e-recruitment among job candidates. Originated from the technology acceptance model (TAM), this study aims to empirically examine the influence of online word-of-mouth in shaping job-seekers' intentions for using e-recruitment websites.

Design/methodology/approach – A Google Docs-based online questionnaire was distributed via social media, LinkedIn and email to 740 participants, out of which 397 final responses were received. The partial least squares structural equation modeling using SmartPLS 3 was applied for evaluating the theoretical model.

Findings – This study empirically indicated that electronic word-of-mouth (eWOM) has a significant impact on perceived usefulness (PU), perceived ease of use (PEOU) and attitude. Whereas, PU and attitude fully mediate the relationship between eWOM and behavioral intentions (BI) of job-seekers towards e-recruitment.

Practical implications – This research contributes to the understanding of the relevance of eWOM in e-recruitment adoption. eWOM provides job-related information that plays a significant role in the usage of online recruitment systems such as LinkedIn, job portals and company websites. This study offered a valuable contribution to the existing body of literature on e-recruitment, developers and Web-based hiring service providers.

Originality/value – This investigation was the first attempt in the e-recruitment literature to explore the influence of eWOM on job-seekers' intentions to adopt online recruitment platforms, including the mediating role of PU, PEOU and attitude in the association between eWOM and BI.

Keywords Human resource management, PLS-SEM, Technology acceptance model, Attitude, Electronic word-of-mouth, E-recruitment, Job-seekers' intentions

Paper type Research paper

1. Introduction

Recruitment is the approach of targeting a reservoir of potential candidates for a particular work position (Brandão *et al.*, 2019). With the advancement in information technology in the early 1990s, the change from traditional methods of recruiting applicants to internet recruitment was dramatic (García-Izquierdo *et al.*, 2010; Kashi and Zheng, 2013). Both job-seekers and recruiters have moved toward e-recruitment platforms (Sylva and Mol, 2009). Electronic recruitment has not only changed the point of view of job-seekers regarding

The authors would like to thank the editors and anonymous reviewers for their valuable suggestions.
Declaration of conflicting interest: The author(s) declare(s) that there is no conflict of interest.

Management Research Review
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2040-8269
DOI 10.1108/MRR-04-2021-0322

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Journal of Human Resources in Hospitality and Tourism

CiteScore 2020: 3.2

Scopus coverage years: 2002, from 2004 to Present

Publisher: Taylor & Francis

ISSN: 1533-2845 E-ISSN: 1533-2853

SJR 2020: 0.730

Subject area: Business, Management and Accounting: Organizational Behavior and Human Resource Management

Business, Management and Accounting: Tourism, Leisure and Hospitality Management

Source type: Journal

SNIP 2020: 1.326

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Do high-performance work practices moderate the influence of job content plateau on job attitudes of frontline hotel employees?

Harleen Kaur & Rajpreet Kaur

Published online: 18 Aug 2021

Download citation https://doi.org/10.1080/15332845.2021.1959818

Abstract

To get a more nuanced picture job content plateau and its effects, the present study test if high-performance work practices (HPWPs) moderate the relationship between job content plateau and job attitudes (job satisfaction and organizational commitment). A two-wave longitudinal data was collected from 404 frontline hotel employees in India. The results of the study indicate that HPWPS is positively associated with job attitudes. The findings further reveal that the adverse influence of job content plateau on job attitudes becomes positive when employees perceive more of HPWPs or vice versa. This study provides discussions of both theoretical and practical implications.

Keywords:

Introduction

Head
Department of Management & Hosp
I.K. Gujral Punjab Technical Univ
Kapurthala-144603

Source details

Higher Education, Skills and Work-based Learning

Scopus coverage years: from 2010 to Present
Publisher: Emerald
ISSN: 2042-3896 E-ISSN: 2042-390X
Subject area: Social Sciences: Education | Social Sciences: Life-span and Life-course Studies
Source type: Journal

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Career adaptability and job outcomes: a moderated mediation model of proactivity and job content plateau in educational sector

Harleen Kaur and Rajpreet Kaur
I K Gujral Punjab Technical University, Jalandhar, India

Received 5 July 2020
Revised 12 August 2020
11 September 2020
5 October 2020
18 October 2020
6 November 2020
23 November 2020
1 December 2020
3 December 2020
5 December 2020
12 December 2020
Accepted 27 December 2020

Abstract

Purpose – Very little research has examined how adaptivity, adaptability resources, adapting responses and adaptation results are interlinked with each other. The current research aims to investigate whether career adaptability influences job outcomes via job content plateau. Taking career construction theory (Savickas, 2005) as a base, the research model of this study posited that employee's favorable job outcomes, i.e. job satisfaction and performance depend upon their psychosocial meta-capacities (career adaptability) and job content plateau. Further, the study is the first to examine the moderating role of proactivity among career adaptability, job content plateau and job outcomes relationship.

Design/methodology/approach – It is a two-wave longitudinal study, quantitative in nature and has collected data from 357 faculty members of Indian universities. The hypotheses have been empirically tested through the structural equation modeling technique.

Findings – The moderated mediation model was supported, and as predicted, (1) career adaptability was positively related to job outcomes and (2) the mediated relationship between career adaptability and job outcomes via content plateau was stronger for individuals with high levels of proactivity.

Practical implications – The study encourages career management practitioners and counselors to integrate proactive behaviors and career adaptability into counseling techniques to equip clients with necessary skills and deal with unfavorable job experiences, thereby engendering favorable job outcomes.

Originality/value – The current study is the first to test the intervening effect of proactivity in career adaptability and job outcomes relationships via job content plateau.

Keywords Proactivity, Career adaptability, Job content plateau, Job satisfaction, Job performance, Career construction theory

Paper type Research paper

Introduction

Career includes the development over time of an individual's work-related attitudes (Chay and Aryee, 1999). Individuals construct their career by engaging themselves in their workplace roles and thereby accumulating occupational experiences. However, with the advent of the 21st century, there have been immense changes in the career world of each individual, for instance, the prevailing conditions of protean and boundary-less careers (Sullivan and Arthur, 2006). These conditions require individuals to possess new psychological resources to endure in such a dynamic work environment. In this context, career construction theory proposed by Savickas (1997, 2005, 2013) posits that individuals in their endeavor of career development develop several self-regulatory resources to adapt themselves to the changing work environment. Based on this theory, Savickas (1997) conceptualizes the concept of career adaptability comprising such abilities and attitudes that enable individuals to manage their work-related tasks effectively. This study contributes to knowledge of career adaptability by examining the impact of one such work-related issue, i.e. job content plateau as a mediator of career adaptability and job outcomes (job satisfaction and job performance) relationship.

Higher Education, Skills and Work-Based Learning
Vol. 11 No. 4, 2021
pp. 929-945
© Emerald Publishing Limited
2042-3896
DOI 10.1108/HESWBL-07-2020-0150

(Kala Sarovar Quarterly
Journal Approved by UGC Care List)

कला एवं धर्म शोध संस्थान,
लोक कल्याणकारी ट्रस्ट, वाराणसी

कला सरोवर

KALA SAROVAR

(भारतीय कला एवं संस्कृति
की विशिष्ट शोध पत्रिका)

प्रधान सम्पादक
डॉ० प्रेमशंकर द्विवेदी

कला सरोवर

कला सरोवर (त्रैमासिक)

भारतीय कला एवं संस्कृति की विशिष्ट शोध पत्रिका

कला एवं धर्म शोध संस्थान, लोक कल्याणकारी ट्रस्ट, वाराणसी द्वारा संचालित

(Kala Sarovar Quarterly Journal Approved by UGC Care List)

कला सरोवर (त्रैमासिक) एक दृष्टि

1. भारतीय कला एवं संस्कृति के अगणित सोपान पर एवं उसके विभिन्न आयामों का, वर्ष 1987ई0 से दिग्दर्शन कराता हुआ 'कला सरोवर' (त्रैमासिक) का यह अंक आपके समक्ष प्रस्तुत है। संस्कृति का उज्जवल प्रकाश है नवचेतना; जिसको आभास कहते हैं आभासित का दर्शन ही कला दर्शन है। दर्शन का अर्थ है जो दिखायी पड़े, इसलिए उसको कलाभास कहना ही उचित होगा। दर्शन भावों का संवेद, मोहक क्षण, व्यथा, टीस एवं व्याकुलता। चोट की पीड़ा का अहसास दर्शन में होता है, और हमने कला सरोवर के माध्यम से सांस्कृतिक दिग्दर्शन का कार्य अनुशासित सेवक की भाँति स्वीकार कर लिया है।
2. सीमित साधनों के बावजूद कला सरोवर का विगत् कई वर्षों से निरन्तर कला, धर्म, साहित्य, विज्ञान एवं संस्कृति विषयक उच्चकोटि के शोधपरक निबन्धों का प्रकाशन, पाठकों एवं कला प्रेमियों के प्रेरणादायी सुझावों से बिना किसी अवरोध के अपने निश्चित समय पर होता रहा है।
3. U.G.C. Cate Listed 'कला सरोवर' में प्रकाशनार्थ आये हुए शोध-पत्रों का अंतिम चयन प्रक्रिया में सामान्यतः एक माह का समय लगता है साथ ही चयनित किये गये शोध-पत्रों के स्वीकृति संबंधी सूचना शोधार्थी या लेखक को उसके दिये गये दूरभाष/ई-मेल पते पर दिया जायेगा।
4. 'कला सरोवर' पत्रिका में प्रकाशनार्थ आये हुए किसी शोध-पत्र को प्रधान संपादक/संपादक मण्डल/संपादकीय सलाहकार मंडल (Advisory Board) के माध्यम से सभी शोध-पत्रों को Review करके गहन चिंतन के बाद केवल उत्कृष्ट एवं मौलिक शोध-पत्रों का प्रकाशनार्थ अंतिम चयन किया जाता है। पत्रिका में प्रकाशनार्थ आये हुए शोध-पत्रों का विषय क्षेत्र के अंतर्गत Multi-disciplinery यथा साहित्य (हिंदी, संस्कृत, आंग्ल), भारतीय संस्कृति, पुरातत्व, संगीत, कला-इतिहास, धर्म दर्शन, प्राच्य अध्ययन मानविकी विज्ञान, अभियांत्रिकी एवं अन्य 'विविध क्षेत्रों से जुड़े उच्च कोटि के मौलिक शोध-पत्र आमंत्रित किये जाते हैं।
5. कला सरोवर अपने पुस्तक समीक्षा अनुभाग के माध्यम से नवीन प्रकाशित कला एवं संस्कृति विषयक पुस्तकों के गुण दोषों का मूल्यांकन करती है।
6. पत्रिका में प्रकाशनार्थ आपके शोध परक निबन्ध सादर आमंत्रित हैं। कला सरोवर (त्रैमासिक) शोध पत्रिका में प्रकाशनार्थ शोध-पत्र ए0पी0एस0-डी0वी0 प्रियंका रोमन अथवा कृती देव 010 में ही कराकर भेजे। शोध पत्र टाईपिंग 15 प्वाइंट लेटर में पेजमेकर अथवा वर्ड में 6 × 9 '' साईज में कराकर भेजे।
7. कला सरोवर (त्रैमासिक) शोध पत्रिका का शोध-पत्रों के साथ अपना ईमेल एवं मोबाईल नं. अवश्य भेजें।

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प्रबन्ध सम्पादक 'कला सरोवर'

डॉ. प्रेमशंकर त्रिवेदी

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(Vol. 24-No.-4-2021) RNI No- 46269/87 ISSN-0975-4520 IMPACT FACTOR : 4.015

A Study on Perception of Aamir Khan's Movies on College Going Students in Jalndhar

★ Prethivaraj.P ★★ Dr. Ekta Mahajan

Abstract:

Amir Khan is one of the multitalented, proficient and inspiring actors of Bollywood. His movies have powerful messages and motivation elements for the students to excel in life. Very few studies have been done on him and his movies that are pertinent to the youth. This study is based on a survey in four colleges in Jalandhar, Punjab. A close ended-ended questionnaire was administered 100 College going students. The purpose of this research was to study the perception of Amir Khan's movies on college going students and explore the several significant effects of his movies on the youth. The outcome of the research shows that there are many inspiring and motivating elements in many of Aamir Khan's movies. his commitment towards hard work, discipline and love for the nation is worth imitating. He approaches acting career as a mission to bring in social change, along with commercial success.

Keywords : Aamir Khan,collegestudents, inspire, movies.

INTRODUCTION:

Cinema is an extremely popular source of entertainment, information and education. Bollywood movies have illustrious history of more than a century and growing as the largest entertainment industry in the world. Bollywood movies are a dynamic medium which rejuvenate, inspire, persuade and motivate cinemagoers' minds. Movies have their effects on the audience for more than a century. In this century-long journey of movies, Aamir Khan's movies have made tremendous impact on the Indian society, younger generation and especially on degree students.

The students are the future of our nation, so it is essential that they develop their talents along with their degrees. Hence, watching quality movies that fosters holistic growth and guides towards reliable and productive citizens. Aamir Khan's movies have essential ingredient and catalyst to inspire and motivate the students to sharpen their talents.

College students are those who study, investigate, or examines thoughtfully in order to earn a degree, (www.dictionary.com). In India youth are defined as those aged 15 to 29 in the national youth policy (2014), 12th Five-Year Plan Vol. II (2013), Youthpolicy.org. During the life of students, college years are one of crucial stages in their academic journey. There are several internal and external factor that shape and mould them. With this idea about who are the college students, the research articles studied the perception of college going students on Aamir Khan's movies.

For more than three decades he has been in the Bollywood that produces around 1000 films every year, which is almost double the output of Hollywood. Every year Bollywood creates at least 800 films and sells four billion tickets. And Bollywood is just one sector of the Indian film industry (www.trafalgar.com). It is estimated that about 14 million Indians go to the cinema every day, which equates to 1.4% of the entire population. They pay around a day's wage to watch a Bollywood film. This shows how much we prefer cinemas in India. About 50% of the cinemagoers, mostly youth, are affected by what they watch in movies as compared to what they see in real lives (www.tutorialride.com).From the best movies to the best actors, the best stories, the best dialogues, the best music and several other the best attractive and larger than life imaginations are available with mere swipe on mobile phones of the students.

★ **Research Scholar,-, Department Of Journalism and Mass Communication, IKG Punjab Technical University. Kapurthala, Punjab.**

★★ **Assistant Professor, Department of Journalism and Mass Communication, IK Gujral Punjab Technical University, Kapurthala, Punjab.**

Influence of Twitter on Politician's Popularity Around the World

★ Ritika Goenka ★★ Dr. Ekta Mahajan

Abstract

The popularity of social media as effective communication tools has created shifts in the relationship between political leaders around the world and their followers. This study seeks to examine usage of Twitter and popularity levels of politicians around the world. Data is collected from official Twitter accounts of prominent political leaders. Through regression method, impact of two variables- duration, and frequency of usage- upon number of followers acquired by political leaders has been analysed. The findings indicate that there is a positive relationship between Twitter usage and popularity of a politician, as seen by rise in the number of followers subsequently gained by a politician.

Keywords: Social Media, Twitter, Politics, Popularity, Followers, International.

Introduction

Over the past decade, immense popularity of social media sites has marked the biggest impact of the growth of internet. Today, social media platforms have been adopted as effective tools of mass media. At the moment, there are projected 2.95 billion individuals making use of social media networks worldwide, and this number is only increasing. As per estimates, with growth in digital infrastructure, the number of social media users can rise to 3.43 billion in 2023 (Statista, 2020). This research aims at understanding the influence of Twitter on popularity accumulated by principal political leaders internationally. The study investigates the relationship between Twitter usage and popularity through the variables of time and frequency of Twitter use.

Review of Literature

Boulianne (2015) notes the increasing use of new-age social media among the youth. Pardo (2013) and Owusu-Ascheaw (2015) highlight its role in the field of academics, while Meyer and Tang (2015) discusses the impact of social media on journalism. AntonSon and Christopher (2014) have studied the vast differentiation and multi-facedness between various social media platforms.

Several research studies in the recent past have emphasized the association amid social media and politics. Studies by McAllister (2016), and Curry (2018), establish that internet use, political awareness, and political participation are closely associated.

Chadwick (2015) points out that the bi-directional model of communication offered by social media between politicians and public is the cause behind its significant impact upon politics. On the other hand, Mico and Casero - Ripolles (2014) attribute the success of social media to its lack of official media filter, which allows politicians to be quicker and more responsive, granting them better approachability. According to a study by Parmelee (2014), social media has earned its place in establishing direct connections with the following targeted by a political leader or candidate.

Previous literature thus shows to us that online interactions now present significant shifts in political dynamics, especially so in developing countries with a politically-aware youth (Ittefaq and Iqbal, 2018; Eijaz, 2013). While the existing research provides us with some

★ **Research Scholar, Department of Journalism and Mass Communication, IKG Punjab Technical University, Kapurthala, India.**

★★ **Assistant Professor, Department of Journalism and Mass Communication, IKG Punjab Technical University, Kapurthala, India.**

JUNI KHYAT

जूनी ख्यात

(सामाजिक विज्ञान, कला एवं संस्कृति की शोध पत्रिका)

वर्ष : 11 • अंक 2

जनवरी-जून 2022

A Peer-Reviewed and Listed in UGC CARE List

ISSN 2278-4632

मरुभूमि शोध संस्थान

संस्कृति भवन

एन.एच. 11, श्रीडूँगरगढ़ (बीकानेर) राजस्थान

सावधान

जूनी ख्यात (अर्द्ध वार्षिक) दिसम्बर 1994 ई. से नियमित Print Form में प्रकाशित हो रही है। जून 2019 में 'UGC Care List' (S.N. 220) में सामाजिक-विज्ञान की श्रेणी में सम्मिलित करली गई है। हमारी पत्रिका Online प्रकाशित नहीं होती है।

जूनी ख्यात नाम से ही एक फर्जी पत्रिका (Cloned Journal) ऑन लाइन निकाली जा रही है जो हमारे ही ISSN एवं यू.जी.सी. केयर लिस्ट की संख्या को उपयोग में ले रही है। इस सम्बन्ध में **यू.जी.सी.** ने 23-7-2020 को 'Cloned Journal' की एक सूची जारी की है उसमें अन्य पत्रिकाओं के साथ **जूनी ख्यात** का भी नाम है। यह पत्रिका निम्न वेबसाइट पर प्रत्येक विषय के शोध पत्र आमंत्रित करती है।

Juni khyat Journal		
Language	:	English & Hindi
Publisher		NA
ISSNo.		2278-4632
URL http	:	www.junikhyat.com

हमारी पत्रिका **मरुभूमि शोध संस्थान, श्रीडूँगरगढ़** द्वारा प्रकाशित की जाती है। अब 'नकली पत्रिका' बी.एल. भादानी, संपादक के नाम का भी उपयोग कर रही है जो एक आपराधिक कृत्य है।

इसमें तथाकथित रूप से प्रकाशित आलेख का कोई महत्त्व भी नहीं है। इसलिए शोधार्थियों से सावधान रहने की अपील की जाती है।

बी.एल. भादानी
संपादक

Sl.No.	Journal No.	Title	Publisher	ISSN
220		**JUNI KHYAT**		**2278-4632**

UGC Journal Details

Name of the Journal : **JUNI KHYAT (Print Form)**
ISSN Number : 2278-4632
e-ISSN Number : NA
Source : **UGC**
Discipline : **Social Science**
Subject : **Social Sciences (all)**
Focus Subject : Cultural Studies
Publisher : Marubhumi Shodh Sansthan, Sri Dungargarh (Bikaner)

COMMUNICATION PATTERNS AND TECHNOLOGIES FOR THE PRISONERS IN JAILS IN INDIA

Preetinder Kaur • Dr. Ekta Mahajan

Abstract

The communication policies of Prison system in India concerns the aspect of how people who are in the prison receive information and communicate with people outside of the Institutions where they are confined. Incarceration adversely impacts the life of not only the individual but of the whole family. Empirical research shows that the regular communication with the family of the incarcerated person not only improves family stability but also helps him/her to reintegrate with the social system at their release. However, the current Prison rules in India create a barrier that significantly impacts the ability of inmates and their families to communicate. There are traditional and newly developed communication tools that have inherited advantages and disadvantages. In this paper we have discussed how various Prison systems around the world that have adopted Communication tools, that can be engaged with a regulated approach for better communication services to effectively reduce barriers and improve outcomes in Prison system in India.

This research work opens with a **brief review of the History of Prisons in India and of the communication technologies being in use and are useful in future, taking into account the emphases on correction, reformation and rehabilitation.**

The further study describes the Prison reforms before and

allowing doctors to treat inmates in prisons. Michael Ollove, State Prisons Thrn to Telemedicine to Improve Health and Save Money, PEW CHARITABLE TR. (Jan. 21, 2016), http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/ 2 016 /01/21/state-prisons-turn-to-telemedicine-to-improve. This reduces costs because prisons are often in remote areas where doctors, especially specialists, are not available. Id.

- See, e.g., Sophia D., Virtual Prison Visits Mean Some Prison Inmates Never See Family in the Flesh, VC DAILY (Sept. 20, 2017), https://www.videoconferencingdaily.comltrending/virtual-prison-visits-meanprison-inmates-never-see-family-flesh/.
- For example, the Arizona Prison Visitation Project offers "a new way to study visitation through the use of a mixed-method design." Melinda Tasca et al., Moving Visitation Research Forward: The Arizona Prison Visitation Project
- See, e.g., HOLLIHAN & PORTLOCK, supra note 24, at 73 (listing survey questions evaluating video visitation for inmates, visitors, and employees).
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Preetinder Kaur
Research Scholar, Department of Journalism and Mass Communication, Punjab Institute of Technology, IKGPTU, Kapurthala

Dr. Ekta Mahajan
Assistant Professor, Department of Journalism and Mass Communication, Punjab Institute of Technology, IKGPTU, Kapurthala

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JOURNAL OF MANAGEMENT & ENTREPRENEURSHIP
ISSN : 2229-5348
UGC Care Group 1 Journal

IMPACT OF SOCIAL MEDIA ON WOMEN EMPOWERMENT REFERRING TO PUNJAB

Rama Sharma Research Scholar, IKG Punjab Technical University, Kapurthala
Dr.Ranbir Singh Head of Journalism Department, IKG Punjab Technical University, Kapurthala

Abstract

Now-a-days, social media is the era whose presence & active involvement spread the ideologies for women empowerment. It has become the social change agent that aids and supports for women empowerment in every aspect namely mobilizing global community attention towards rights and challenges of women and challenges discrimination & stereotypes globally. Through online campaign, blogs, online communities and chats, many platforms have been given by social media for discussing women issues & challenges that isn't propagated or disseminated by mainstream media. This paper mainly focuses on the way social media is used for empowering and encouraging women empowerment from the rural and urban parts of Punjab, India. In addition, it discusses the impacts of social media usage on women empowerment that aids and encourages government & policy makers for stepping up commitments as well as formulating policies for gender equality. This paper helps to understand the digital literacy of women. The research method undertaken is quantitative with the sample of 600 respondents and data is collected using questionnaire survey.

Keywords: social media, women, empowerment, role, impact, social media usage

Introduction

For greater technological innovation & connectivity, tremendous opportunities are brought by the fourth industrial revolution. Yet, some of the innovations have associated challenges. The lives of larger populations have been permeated by social media that have the positive & negative contributions to the connectivity goals. A transformative impact has been had by social media on the way people live, work and engage with one another. Yet, it can remain as one of the double-edged swords since as it evolves constantly due to modern technological innovation. In fact, it can't be true for the women all over the world such as social, political and financial empowerment are given by social media, since dearth of safety concerns, access and language barriers are battled . This paper aims to investigate the impact of social media usage on women empowerment in Punjab.

An overview of women and social media

Actually, thee remained a fair women proportion that present across the platforms of the most popular social media in countries such as the US in the early years of the social media growth. It was found by a study which done by the Pew Research Centre that the platform "several times of day" is used by more than 50% of Facebook users in the certain age groups from 18-48 (Maeve Duggan, 2013). It showed that women were more likely to use social networking sites when compared to men in the time of December 2009 & December 2012 which is resulted from the nine out of ten surveys conducted. Women proportion who employed social media was 10% which is higher than men on average during this period. There is a fall in average difference to 8% which is indicated from 2008 to 2013. Social networking sites were used by three-quarters (74%) of women by the year 2013.

A fair proportion of women have been under-represented on social media platforms that implying both men and women where men are indicated as social media platforms and women remain invisible or unimportant, even though in the US like countries. In addition, wo/men are portrayed in many stereotypical ways by which the endorsed gender views are reflect and sustained socially. The traditional roles are emphasized by the relationship depictions between men & women and the violence have been normalised against women. Many concerns regarding the imagery & representation issues in traditional media and the new social media landscape.

தொகுதி-9 எண்-2
Vol. 9 No. 2

பங்குனி-ஆனி 2052
April - June 2021

ISSN : 2321-984X

நவீனத் தமிழாய்வு

(பன்னாட்டுப் பன்முகத் தமிழ் காலாண்டு ஆய்விதழ்)

Journal of Modern Thamizh Research

(A Quarterly International Multilateral Thamizh Journal)

Arts and Humanities (all), Language Literature and Literary Theory, Tamil
UGC Care Listed (Group-I) Journal

Published by
RAJA PUBLICATIONS
No. 10 (Upstair), Ibrahim Nagar, Khajamalai,
Tiruchirappalli - 620 023, Tamil Nadu, India.
Mobile : 9600535241
Website : www.rajapublications.com

28 பகுதி-2 Part -2

USES AND EFFECTS OF ICT IN HIGHER EDUCATION SYSTEM WITH SPECIAL REFERENCE TO 'SWAYAM' (A SURVEY BASED STUDY OF I.K.G PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA)

POOJA SHREE
Journalism and Mass Communication Department, M.Phil student,
I.K. Gujral Punjab Technical University, Jalandhar, Punjab

SHIVA A RAJA
Journalism and Mass Communication Department, Assistant professor,
I.K. Gujral Punjab Technical University, Jalandhar, Punjab

Dr. SARABJEET SINGH
Journalism and Mass Communication Department, Assistant professor,
I.K. Gujral Punjab Technical University, Jalandhar, Punjab

Abstract

This study is significant in contributing to the underdeveloped area of Mooc Learning research related to the effect on learner interactions by adding voluntary mobile access to an informal, open online course. Additionally, the analysis of this study will give rise to strategies suggesting how a MOOC can be optimized to increase learner interactions. The study also formulates future research in this area based upon its findings. The main significance of this study is the fact that no existing studies explored the learner interactions that access SWAYAM MOOCs with mobile devices. Knowledge and understanding of the factors affecting learner participation in ubiquitous learning environments provided additional insight into ubiquitous MOOC design to create an optimal learner course environment. Research of this kind could be significant to instructional designers and course coordinators contemplating on constructing an informal, open, online course or MOOC that is ubiquitous in access. It can also be significant to active learners themselves, both with regard to necessary skills to take into account as well as possible options for increased interaction. Knowing the impact of ubiquitous access to learners participation, results in possible guidelines for the learners to increase their success rate for completing such courses. From the methodological perspective, this study added to mixed methods research by elaborating procedural issues of the sequential explanatory design, and connecting the qualitative data within a study.

KEYWORDS: MOOC, ICT, SWYAM, EDUCATION, COMMUNICATION.

INTRODUCTION

The way the Internet has connected the entire world globally, ICT has made information and communication highly dynamic. For a more extensive utilization of the data, the data should be conveyed to individuals. It is only when the information reaches the intended audience, the purpose of creation of information as well as its

தொகுதி-9 எண் 2
Vol. 9 No. 2

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GLORIFICATION OF GYM CULTURE THROUGH SOCIAL MEDIA AND ITS EFFECT ON YOUNG WOMEN (A STUDY ON URBAN AREA OF JALANDHAR DISTRICT)

POOJA SHREE
M.Phil student, Journalism and Mass Communication Department,
I.K. Gujral Punjab Technical University, Jalandhar, Punjab

SHIVA A RAJA
Assistant Professor, Journalism and Mass Communication Department,
I.K. Gujral Punjab Technical University, Jalandhar, Punjab

Dr. SARABJIT SINGH
Assistant Professor, Journalism and Mass Communication Department,
I.K. Gujral Punjab Technical University, Jalandhar, Punjab

ABSTRACT

This research will help various gym owners and investors to understand the growth of the market and point such things by which the Gym companies will ensure their marketing techniques. In addition, gym members and people too, will be benefitted because they will be enabling to know the reasons of increase demand of Gym houses especially for women. Also inspire them to open the gyms in the 2 tier and 3 tier cities also. The study is also very important for the advertisers, social media advisers and for persons in the field of public relation who works for women because it's finding shows the perception and behavior of the gym going women. All above written importance influence the researcher to study this topic. This research focuses on the gym glorification of gym culture through social media and its effects on young women.

Keywords: Gym, Culture, Social Media, Women

INTRODUCTION

Internet came with a revolution. All the countries came together to form a global world. After the establishment of this global world, social media emerged and created a kind of social society. In today's time, we do not accept reality as fast as we accept social media. Social media influenza has become so big and contagious that it is affecting the lives of individuals their society and culture equally. Everyone including young, old, urban and rural is using social media and their culture has become a social mediated culture. Social media has become a platform for the people, where their daily routine, entertainment, happiness, gossips or emotions can be expressed. What is being shown on social media becomes a trend. Social media is changing our culture. Social media has become the part and the parcel of our lives. How one start her\his day to how he\she ends the day can be seen on various social media platforms. Today, social media is also involved in daily activity fitness included in our daily life. Which exercises we have to do or do yoga or how it is done, this social media tells us. The effect of social media is affecting both men and women. Gyming is seen in the Urban Areas as a culture of the gym. People appreciate their time in the busy routine for the gym. The number of gyms in the Urban Areas is on the rise, as well as women's attraction towards the gym, many women are going to the

ISSN:2231-6930

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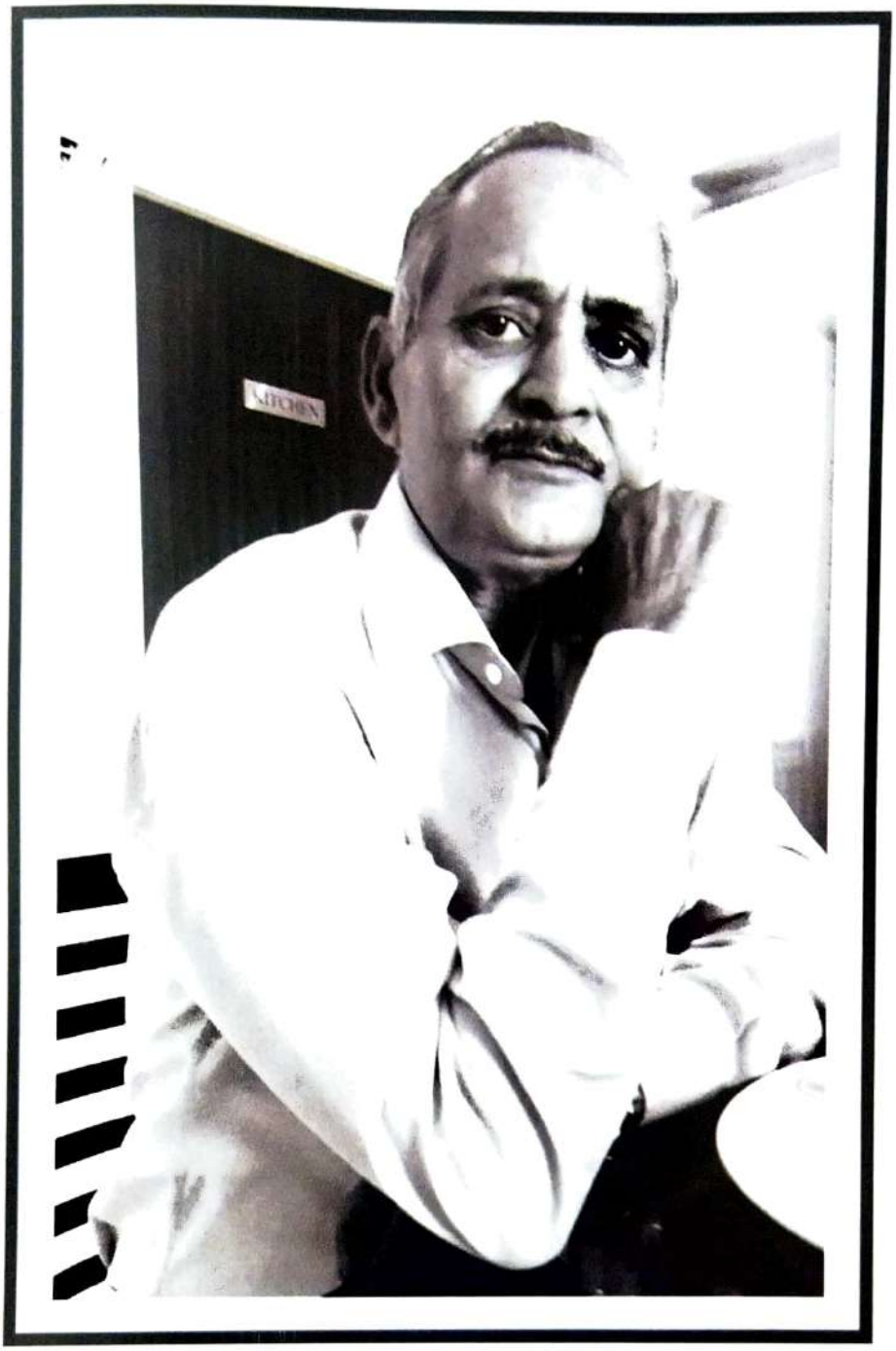
ਪੁਸਤਕ



ਅਪ੍ਰੈਲ-ਸਤੰਬਰ, 2022 ਮੁੱਲ 75 ਰੁਪਏ, 5 ਪੌਂਡ

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'ਪ੍ਰਵਚਨ' ਸਾਹਿਤ, ਸਮੀਖਿਆ ਤੇ ਸੱਭਿਆਚਾਰ ਨੂੰ ਸਮਰਪਿਤ, ਯੂ.ਜੀ.ਸੀ. ਕੇਅਰ ਲਿਸਟ ਅਨੁਸਾਰ ਪ੍ਰਵਾਨਿਤ ਤ੍ਰੈ-ਮਾਸਿਕ ਪਤ੍ਰਿਕਾ

ਸਾਲ : 22 ਪੁਸਤਕ ਲੜੀ : 87-88 ਅਪ੍ਰੈਲ-ਸਤੰਬਰ, 2022

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pravachanpunjabi@gmail.com
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ਅੰਦਰ ਪੜ੍ਹੋ

☛ ਪਰਚਾ 'ਪ੍ਰਵਚਨ' ਜਸਵਿੰਦਰ ਸਿੰਘ ਮੰਡ ਨੇ Bright Printing Press, Mohalla Kishanpura, Jalandhar ਤੋਂ ਛਪਵਾ ਕੇ ਪਿੰਡ-ਮੰਡ ਮੌੜ, ਡਾਕਖਾਨਾ: ਕਰਤਾਰਪੁਰ, ਜ਼ਿਲ੍ਹਾ ਜਲੰਧਰ-144801 ਤੋਂ ਪ੍ਰਕਾਸ਼ਤ ਕੀਤਾ।
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ਵਿਧਾ-ਸ਼ਾਸਤਰ ਤੇ ਰਜਨੀਸ਼ ਬਹਾਦਰ ਦਾ ਵਿਧਾ-ਚਿੰਤਨ

-ਡਾ. ਸਰਬਜੀਤ ਸਿੰਘ : 94780-98061

ਇਤਿਹਾਸਕ ਦ੍ਰਿਸ਼ਟੀ ਤੋਂ ਦੇਖਿਆਂ ਇਹ ਸੂਝ ਪੈਂਦੀ ਹੈ ਕਿ ਸਾਹਿਤ ਪਹਿਲਾਂ ਹੋਂਦ ਵਿਚ ਆਇਆ ਤੇ ਇਸਦੇ ਆਧਾਰ ਤੇ ਵਿਧਾ ਦੀਆਂ ਪਛਾਣਯੋਗ ਰੀਤੀਆਂ ਤੇ ਸਿਧਾਂਤ ਸਥਾਪਿਤ ਹੁੰਦੇ ਹਨ। ਪਰੰਪਰਕ ਅਰਥਾਂ ਵਿਚ ਵਿਧਾ ਹਦਾਇਤਾਂ ਜਾਂ ਨਿਯਮਾਂ ਦਾ ਉਹ ਸੰਗ੍ਰਹਿ ਹੈ, ਜੋ ਟੈਕਸਟ ਨੂੰ ਦੇਖਣ ਜਾਂ ਇਸਦੀ ਪੜ੍ਹਤ ਲਈ ਕ੍ਰਮ, ਸੰਚਾ, ਢਾਂਚਾ ਜਾਂ ਗਰਾਮਰ ਨਿਰਧਾਰਿਤ ਕਰਦੀ ਹੈ। ਪਰ ਅਜੋਕਾ ਉਤਰ-ਸੰਰਚਨਾਵਾਦੀ ਤੇ ਉਤਰ-ਆਧੁਨਿਕਤਾਵਾਦੀ ਚਿੰਤਨ ਇਸ ਪਰੰਪਰਕ ਵਿਧਾ-ਸੰਕਲਪ ਦੇ ਵਿਪਰੀਤ ਦ੍ਰਿਸ਼ਟੀ ਦਿੰਦਾ ਹੈ। ਇਸ ਅਨੁਸਾਰ ਜੋ ਰਚਨਾ ਪਰੰਪਰਕ ਵਿਧੀ-ਵਿਧਾਨ ਵਿਚ ਸਥਾਪਿਤ ਹੋ ਕੇ ਰਚੀ ਗਈ ਹੈ ਉਹ ਨਾਵਲ, ਨਾਟਕ ਜਾਂ ਵਿਧਾ ਹੈ ਪਰ ਇਸ ਵਿਧੀ-ਵਿਧਾਨ ਨੂੰ ਉਲੰਘ ਜਾਣ ਵਾਲੀ ਜਾਂ ਇਸ ਪ੍ਰਤੀ ਪ੍ਰਤੀਰੋਧਕਤਾ ਦਿੰਦੀ ਰਚਨਾ ਸਾਹਿਤ ਜਾਂ ਲਿਖਤ ਕਹਾਉਣ ਦੀ ਅਧਿਕਾਰੀ ਹੈ। ਭਾਵੇਂ ਹਰ ਸਾਹਿਤ ਰਚਨਾ ਇਕ ਵਿਧਾ-ਪਰਿਵਾਰ ਦੀ ਮੈਂਬਰ ਵੀ ਹੁੰਦੀ ਹੈ ਪਰ ਇਹ ਇਸ ਤੋਂ ਲਾਜ਼ਮੀ ਤੌਰ 'ਤੇ ਅਲਹਿਦਾ ਹੋਂਦ ਵੀ ਹੁੰਦੀ ਹੈ। ਕਿਸੇ ਵਿਸ਼ੇਸ਼ ਇਤਿਹਾਸਕ ਪੜਾਉ ਤੇ ਸਾਹਿਤ-ਸਮੀਖਿਆ ਜਦੋਂ ਸਾਹਿਤ ਸਬੰਧੀ ਨਿਸਚਿਤਤਾਵਾਦੀ ਨਿਯਮ ਪਛਾਣ ਲੈਂਦੀ ਹੈ ਤਾਂ ਸਾਹਿਤ ਆਪਣੇ ਗਤੀਸ਼ੀਲ ਸੁਭਾਉ ਕਰਕੇ ਇਨ੍ਹਾਂ ਨਿਯਮਾਂ ਤੋਂ ਅਗਾਂਹ ਤੁਰ ਪੈਂਦਾ ਹੈ। ਇਹ ਵੀ ਸਪਸ਼ਟ ਹੋਣ ਦੀ ਲੋੜ ਹੈ ਕਿ ਵਿਧਾ ਕੇਵਲ ਰੂਪਾਤਮਕ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ ਦਾ ਸਮੂਹ ਨਹੀਂ ਸਗੋਂ ਇਸ ਵਿਚ ਦ੍ਰਿਸ਼ਟੀਮੂਲਕ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਵਿਚਾਰਧਾਰਕ ਨਿੱਖੜਤਾਵਾਂ ਤੇ ਸਭਿਆਚਾਰਕ ਅਵਚੇਤਨ ਤੇ ਖ਼ਸਲਤਾਂ ਵੀ ਸ਼ਾਮਿਲ ਹੁੰਦੀਆਂ ਹਨ। ਅਸੀਂ ਇਕੋ-ਜਿਹੇ ਸੰਚੇ ਵਿਚ ਢਲੇ ਨਾਵਲ ਜਾਂ ਹੋਰ ਸਾਹਿਤ ਰੂਪ ਪੜ੍ਹਨ ਦੇ ਆਦੀ ਹਾਂ, ਵਿਧਾ ਸੰਚੇ ਤੋਂ ਬਾਹਰ ਜਾਂਦੀ ਲਿਖਤ ਸਾਡੀ ਪਰੰਪਰਾ-ਪ੍ਰਵਾਨ ਸੂਝ ਨੂੰ ਪ੍ਰਵਾਨ ਨਹੀਂ। ਅਜਿਹਾ ਕਹਿਣ ਦਾ ਭਾਵ ਵਿਧਾ ਦੇ ਸੰਕਲਪ ਨੂੰ ਰੱਦ ਕਰਨ ਦਾ ਨਹੀਂ ਸਗੋਂ ਵਿਧਾ ਤੇ ਟੈਕਸਟ ਦੇ ਸੰਤੁਲਿਤ ਸਬੰਧ ਦੀ ਨਵੇਂ ਸਿਰਿਉਂ ਪਛਾਣ ਕਰਨ ਦਾ ਹੈ।

ਵਿਧਾ ਦੇ ਸੰਦਰਭ ਵਿਚ ਅਜੋਕੇ ਚਿੰਤਨ ਨੇ ਇਹ ਨੁਕਤਾ ਦ੍ਰਿੜ ਕਰਾਇਆ ਹੈ ਕਿ ਸਿਸਟਮ ਦੇ ਰੂਪ ਵਿਚ ਤਾਂ ਵਿਧਾਵਾਂ ਆਪਣੀ ਪੂਰੀ ਸੰਭਾਵਨਾ ਹੰਢਾ ਚੁੱਕੀਆਂ ਹਨ ਪਰ ਕਿਉਂ ਜੋ ਸਾਹਿਤ ਸਦਾ ਅਭਿਆਸੀ ਮਾਰਗ ਤੇ ਅਗਰਸਰ ਰਹਿੰਦਾ ਹੈ ਇਸ ਲਈ ਸਿਸਟਮ ਦੇ ਰੂਪ ਵਿਚ ਨਿਸ਼ਚਿਤ ਹੋਈ ਵਿਧਾ ਨੂੰ ਹਮੇਸ਼ਾ ਓਵਰਫਲੋਅ ਕਰਦਾ ਹੋਣਾ ਚਾਹੀਦਾ ਹੈ। ਦੂਜੇ ਸ਼ਬਦਾਂ ਵਿਚ ਵਿਧਾ ਦਾ ਅਜੋਕਾ ਸੰਕਲਪ ਸਾਹਿਤ ਨੂੰ ਸਥਾਪਿਤ ਨਿਯਮਾਂ ਦੇ ਬਾਰੰਬਾਰ ਮਕਾਨਕੀ ਦੁਹਰਾਉ ਵਿਚ ਨਾ ਦੇਖਦਾ ਹੋਇਆ ਇਸਨੂੰ ਸਿਰਜਣਾਤਮਕ ਤਜਰਬੇ ਜਾਂ ਅਭਿਆਸ ਦੀ ਅਮੂੱਕ ਪ੍ਰਕਿਰਿਆ ਤੇ ਊਰਜਾ ਨੂੰ ਜਨਮ ਦਿੰਦਾ ਹੈ। ਬਣੇ ਬਣਾਏ ਰਸਤਿਆਂ 'ਤੇ ਤੁਰਨਾ ਤਾਂ ਹਰ ਲੇਖਕ ਲਈ ਆਸਾਨ ਹੈ ਪਰ ਨਵੇਂ ਰਸਤਿਆਂ ਦੀ ਤਾਲਾਸ਼ ਦੁਰਗਮ ਤੇ ਬਿਖਮ ਹੈ। ਅਭਿਆਸੀ ਮਾਰਗ ਤੇ ਤੁਰੀ ਲਿਖਤ ਸਾਹਿਤ ਪਰੰਪਰਾ, ਇਤਿਹਾਸ, ਅਨੁਕਰਣ, ਪੂਰਵ ਪ੍ਰਾਪਤ ਪ੍ਰਵਚਨ ਤੇ ਰੂਪਾਤਮਕ ਵਿਧੀ-ਵਿਧਾਨ ਤੋਂ ਵੱਖਰਾ ਸੰਸਾਰ ਸਿਰਜਦੀ ਹੈ। ਲਿਖਤ ਵਿਧਾ ਦੇ ਪੂਰਵ ਪ੍ਰਾਪਤ

ਸਹਾਇਕ ਪ੍ਰੋਫ਼ੈਸਰ (ਪੰਜਾਬੀ), ਆਈ.ਕੇ. ਗੁਜਰਾਲ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਕਪੂਰਥਲਾ

Iranian Journal of Mathematical Sciences and Informatics
Vol. 17, No. 2 (2022), pp 01-17
DOI: 10.52547/ijmsi.17.2.1

Wave Propagation in Generalized Thermodiffusion Elastic Medium with Impedence Boundary Condition

Sachin Kaushal[a*], Kulwinder Parmar[b], Priya[c]

[a]Department of Mathematics, School of Chemical Engineering and Physical Sciences, Lovely Professional University, Punjab, India
[b]Department of Mathematics, IKG Punjab Technical University Hoshiarpur Campus, Punjab, India
[c]Langara College Vancouver, British Columbia, Canada

E-mail: sachin_kuk@yahoo.co.in
E-mail: kulmaths@gmail.com

Abstract. In the present investigation, we study the reflection of plane waves, that is, Longitudinal displacement wave(P-Wave), Thermal wave(T-Wave) and Mass Diffusive wave(MD-Wave) in thermodiffusion elastic-half medium which is subjected to impedence boundary condition in context of one relaxatioon time theory given by Lord and Shulman theory (L-S) and the Coupled theory (C-T) of thermoelasticity. The expressions of amplitude ratios are obtained numerically and their variation with angle of incidence is presented graphically for a particular model to emphasize on the impact of impedence parameter, relaxation time and diffusion. Some special cases are also deduced.

Keywords: Thermodiffusion, Amplitude Ratios, Plane waves, Impedence boundary.

2000 Mathematics subject classification: 74F05, 74J05, 76R50.

*Corresponding Author

Received 8 August 2018; Accepted 26 August 2019

[DOI: 10.52547/ijmsi.17.2.1]

sustainability

MDPI

Article

Modeling Multistep Ahead Dissolved Oxygen Concentration Using Improved Support Vector Machines by a Hybrid Metaheuristic Algorithm

Rana Muhammad Adnan [1,2], Hong-Liang Dai [2], Reham R. Mostafa [3], Kulwinder Singh Parmar [4], Salim Heddam [5] and Ozgur Kisi [6,7,*]

1 State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University, Nanjing 210098, China; rana@hhu.edu.cn or rana@gzhu.edu.cn
2 School of Economics and Statistics, Guangzhou University, Guangzhou 510006, China; hldai618@gzhu.edu.cn
3 Information Systems Department, Faculty of Computers and Information Sciences, Mansoura University, Mansoura 35516, Egypt; reham_2006@mans.edu.eg
4 Department of Mathematics, IKG Punjab Technical University, Jalandhar 144005, India; dr.kulmaths@ptu.ac.in
5 Faculty of Science, Agronomy Department, Hydraulics Division University, 20 Août 1955, Route El Hadaik, BP 26, Skikda 21024, Algeria; s.heddam@univ-skikda.dz
6 Department of Civil Engineering, University of Applied Sciences, 23562 Lübeck, Germany
7 Department of Civil Engineering, Ilia State University, 0162 Tbilisi, Georgia
* Correspondence: ozgur.kisi@th-luebeck.de

Abstract: Dissolved oxygen (DO) concentration is an important water-quality parameter, and its estimation is very important for aquatic ecosystems, drinking water resources, and agro-industrial activities. In the presented study, a new support vector machine (SVM) method, which is improved by hybrid firefly algorithm–particle swarm optimization (FFAPSO), is proposed for the accurate estimation of the DO. Daily pH, temperature (T), electrical conductivity (EC), river discharge (Q) and DO data from Fountain Creek near Fountain, the United States, were used for the model development. Various combinations of pH, T, EC, and Q were used as inputs to the models to estimate the DO. The outcomes of the proposed SVM–FFAPSO model were compared with the SVM–PSO, SVM–FFA, and standalone SVM with respect to the root mean square errors (RMSE), the mean absolute error (MAE), Nash–Sutcliffe efficiency (NSE), and determination coefficient (R^2), and graphical methods, such as scatterplots, and Taylor and violin charts. The SVM–FFAPSO showed a superior performance to the other methods in the estimation of the DO. The best model of each method was also assessed in multistep-ahead (from 1- to 7-day ahead) DO, and the superiority of the proposed method was observed from the comparison. The general outcomes recommend the use of SVM–FFAPSO in DO modeling, and this method can be useful for decision-makers in urban water planning and management.

Keywords: water quality; dissolved oxygen concentration; estimation; support vector machine; firefly algorithm; particle swarm optimization

Citation: Adnan, R.M.; Dai, H.-L.; Mostafa, R.R.; Parmar, K.S.; Heddam, S.; Kisi, O. Modeling Multistep Ahead Dissolved Oxygen Concentration Using Improved Support Vector Machines by a Hybrid Metaheuristic Algorithm. *Sustainability* **2022**, *14*, 3470. https://doi.org/10.3390/su14063470

Academic Editors: Angela Gorgoglione, Pablo E. Santoro and Fabian A. Bombardelli

Received: 22 December 2021
Accepted: 3 March 2022
Published: 16 March 2022

1. Introduction

Nowadays, the control of freshwater quality is a strategic priority for water resource and management [1], and for a better reduction in water pollution [2]. The dissolved oxygen concentration is an important water quality variable, and its fluctuation in response to several chemical, biochemical, and physical factors has been well documented [3]. Currently, in situ measurements of DO concentrations, which are often accompanied by other water quality variables, have facilitated the development and application of a large number of numerical models for the better prediction of the DO in freshwater ecosystems. Because of the effect of other variables, the DO modeling becomes nonlinear in nature, and it is difficult to capture nonlinearity with simple models. However, models that are based

Received: 8 February 2021 | Revised: 18 September 2021 | Accepted: 20 September 2021

DOI: 10.1002/er.7341

RESEARCH ARTICLE

INTERNATIONAL JOURNAL OF ENERGY RESEARCH WILEY

Comparison of the advanced machine learning methods for better prediction accuracy of solar radiation using only temperature data: A case study

Amin Mirbolouki[1] | Salim Heddam[2] | Kulwinder Singh Parmar[3] | Slavisa Trajkovic[4] | Mojtaba Mehraein[1] | Ozgur Kisi[5]

[1]Faculty of Engineering, Kharazmi University, Tehran, Iran

[2]Faculty of Science, Agronomy Department, Hydraulics Division University, Skikda, Algeria

[3]Department of Mathematics, IKG Punjab Technical University, Kapurthala, India

[4]Faculty of Civil Engineering & Architecture, University of Nis, Nish, Serbia

[5]School of Technology, Ilia State University, Tbilisi, Georgia

Correspondence
Mojtaba Mehraein, Faculty of Engineering, Kharazmi University, Tehran, Iran.
Email: mehraein@khu.ac.ir

Summary

Estimation of solar radiation (SR) carries importance for planning available renewable energy, and it is also beneficial for solving agricultural, meteorological, and engineering problems. This study compares the ability of hybrid adaptive neuro fuzzy (ANFIS) models and long short-term memory to search a suitable approach for SR prediction with minimum number of input parameters (temperature) in Mediterranean region of Turkey, which could be useful for the regions in which other effective parameters (eg, relative humidity, wind speed) are not available. The models considered were assessed by considering four data splitting scenarios, 50% train—50% test, 60% train—40% test, 70% train—30% test, and 80% train—20% test. Among the hybrid methods, the ANFIS with grey wolf optimization and genetic algorithm showed a superior accuracy. The study shows that applying different data splitting scenarios is necessary for better assessment of the data-driven methods since the accuracies of the implemented methods increase by about 30% to 60% when the splitting data scenario varies from 50-50% to 80-20%. Sensitivity analysis shows that the performance of the model increases by about 40% using extraterrestrial radiation for the best model. The ANFIS with grey wolf optimization and genetic algorithm is recommended to predict monthly solar radiation with limited input data.

KEYWORDS

ANFIS, LSTM, solar radiation modeling, temperature-based modeling

1 | INTRODUCTION

Solar energy is one of the major energy resources of the earth, and its usage can be a solution for the environmental pollution and climate caused by the combustion of fossil fuels.[1,2] Accurate prediction of solar radiation (SR) is necessary for many key sectors such as renewable energy, agriculture, meteorology, engineering,

Abbreviations: ANFIS, adaptive neural-fuzzy inference system; ANOVA, analysis of variance; ANN, Artificial neural network; CNN, convolutional neural network; DE, differential evolution; DENFIS, dynamic evolving neural-fuzzy inference system; FIS, fuzzy interface system; GA, genetic algorithm; GWO, gray wolf optimization; HHO, Harris hawks optimization; K, Kurtosis of data; LSSVM, least square support vector regression; LSTM, Long short-term memory; ML, machine learning; MARS, multivariate adaptive regression spline; PSO, particle swarm optimization; RNN, recurrent neural networks; SR, solar radiation; SVM, support vector machine; TSMS, Turkish State Meteorological Service; WT, wavelet transform.

sciendo

Int. J. of Applied Mechanics and Engineering, 2021, vol.26, No.4, pp.99-112
DOI: 10.2478/ijame-2021-0052

INFLUENCE OF DIFFUSION AND IMPEDENCE PARAMETERS ON WAVE PROPAGATION IN THERMOELASTIC MEDIUM

Sachin KAUSHAL*
Department of Mathematics, School of Chemical Engineering and Physical Sciences
Lovely Professional University-Punjab, INDIA
Email: sachin_kuk@yahoo.co.in

Rajneesh KUMAR
Department of Mathematics, Kurukshetra University Kurukshetra-Haryana, INDIA

Kulwinder PARMAR
Department of Mathematics, IKG Punjab Technical University Hoshiarpur Campus, Punjab, INDIA

The aim of the present paper is to study the impact of diffusion and impedance parameters on the propagation of plane waves in a thermoelastic medium for Green and Lindsay theory (G-L) and the Coupled theory (C-T) of thermoelasticity. Results are demonstrated for impedance boundary conditions and the amplitude ratios of various reflected waves against the angle of incidence are calculated numerically. The characteristics of diffusion, relaxation time and impedence parameter on amplitude ratios have been depicted graphically. Some cases of interest are also derived from the present investigation.

Key words: plane waves, amplitude ratios, diffusion, impedance parameters.

1. Introduction

Thermodiffusion is an extensive area of research in an elastic solid due to its many applications in the field of oil extraction. The coupling between mass diffusion, strain and fields of temperature leads to thermodiffusion. The theory of thermodiffusion in an elastic solid for a C-T model was presented by Nowacki [1, 2, 3, 4], but it implies the infinite speeds of propagation of thermoelastic waves. Sherief *et al.* [5] introduced the theory of generalized thermodiffusion having one relaxation time, that allows the finite speed of waves in an elastic medium. Sherief and Saleh [6] studied a half space problem in the theory of generalized thermoelastic diffusion having one relaxation time. Various authors discussed different types of problems in a thermoelastic medium [7-11].

Kumar and Kansal [12] obtained fundamental solutions and studied wave propagation problems in the theory of thermoelastic diffusion. El-Naggar *et al.* [13] studied the effect of the magnetic field, rotation, thermal field, initial stress and voids on the reflection of p-wave with one relaxation time. Marin *et al.* [14] extended the influence theorem to the generalized thermoelasticity in the context of L-S and G-L theories of thermoelasticity. Othman and Said [15] studied the effect of diffusion and internal heat source with three phase lag in the context of two-temperature theory of thermoelasticity. Saeed *et al.* [16] investigated the thermal effects and relaxation times in poroelastic material using finite element methods under the G-L model.

The wave propagation is part of several investigations of seismology as it provides precise results which are beneficial for economic activities like tracing of mineral ores, hydrocarbons, construction of dams, bridges, roads, the design of highways. The problem of reflection of plane waves has impedance; boundary conditions are well postulated as linear combinations of unspecifies functions and their derivatives described

* To whom correspondence should be addressed

Air Quality, Atmosphere & Health
https://doi.org/10.1007/s11869-021-01075-x

Prediction of COVID-19 pervasiveness in six major affected states of India and two-stage variation with temperature

Sarbjit Singh[1,3] · Kulwinder Singh Parmar[2] · Jatinder Kaur[2,4] · Jatinder Kumar[3] · Sidhu Jitendra Singh Makkhan[5]

Received: 27 June 2020 / Accepted: 11 August 2021

Abstract
Coronavirus disease knocked in Wuhan city of China in December 2019 which spread quickly across the world and infected millions of people within a short span of time. COVID-19 is a fast-spreading contagious disease which is caused by SARS-CoV-2 (severe acute respiratory syndrome-coronavirus-2). Accurate time series forecasting modeling is the need of the hour to monitor and control the universality of COVID-19 effectively, which will help to take preventive measures to break the ongoing chain of infection. India is the second highly populated country in the world and in summer the temperature rises up to 50°, nowadays in many states have more than 40° temperatures. The present study deals with the development of the autoregressive integrated moving average (ARIMA) model to predict the trend of the number of COVID-19 infected people in most affected states of India and the effect of a rise in temperature on COVID-19 cases. Cumulative data of COVID-19 confirmed cases are taken for study which consists of 77 sample points ranging from 1st March 2020 to 16th May 2020 from six states of India namely Delhi (Capital of India), Madya Pradesh, Maharashtra, Punjab, Rajasthan, and Uttar Pradesh. The developed ARIMA model is further used to make 1-month ahead out of sample predictions for COVID-19. The performance of ARIMA models is estimated by comparing measures of errors for these six states which will help in understanding future trends of COVID-19 outbreak. Temperature rise shows slightly negatively correlated with the rise in daily cases. This study is noble to analyse the variation of COVID-19 cases with respect to temperature and make aware of the state governments and take precautionary measures to flatten the growth curve of confirmed cases of COVID-19 infections in other states of India, nearby countries as well.

Keywords COVID-19 · Time series data · ARIMA model · Temperature variation · Forecasting · Correlation analysis

Introduction

COVID-19 (coronavirus disease-2019), a disease caused by SARS-Co-2 (severe acute respiratory syndrome-coronavirus-2), is a rapidly spreading communicable disease which has aroused great attention all over the world. It has immense potential to generate explosive outbreaks in confined settings. World Health Organization (WHO), on January 30th, 2020, declared it "Public Health Emergency of International Concern" (PHEIC) and then later termed it as Pandemic on March 11th, 2020 (Lai et al. 2020; Wang et al. 2020; WHO 2020; Yang and Wang 2020). It is assumed that its origin is linked to the seafood and live animal market in Wuhan, Hubei Province, China. The super spreading speed of this virus caused the disease to spread to entire China in just 30 days and then devasted the whole world with 857,641 number of confirmed cases and 42,006 number of deaths (data of WHO as on April 2nd, 2020). The rapid escalation and global spread of this pandemic have witnessed near exponential growth in the number of new cases, reaching almost every country, territory, and area (Huang et al. 2020; Shen et al. 2020; Singh et al. 2020).

✉ Kulwinder Singh Parmar
dr.kulmaths@ptu.ac.in; kulmaths@gmail.com

1 Guru Nanak Dev University College, Narot Jaimal Singh, Pathankot, Punjab 145026, India

2 Department of Mathematics, I.K. Gujral Punjab Technical University, Punjab 144603, India

3 Department of Mathematics, Guru Nanak Dev University, Amritsar, Punjab 143005, India

4 Guru Nanak Dev University College, Verka, Amritsar, Punjab 143501, India

5 Department of Mathematics, Lovely Professional University, Punjab 144411, India

Published online: 21 September 2021

Neural Computing and Applications
https://doi.org/10.1007/s00521-020-05506-1

ORIGINAL ARTICLE

Soft computing model coupled with statistical models to estimate future of stock market

Sarbjit Singh[1,3] · Kulwinder Singh Parmar[2] · Jatinder Kumar[3]

Received: 21 February 2020 / Accepted: 4 November 2020

Abstract
Almost every organization around the globe is working with uncertainty due to inevitable changes and growth in every sphere of life. These changes affect directly or indirectly the stock market prices which makes forecasting a challenging task. So, the need for reliable, cost-effective, and accurate forecasting models significantly arises to reduce risk and uncertainty in stock market investment. Different time series models have been proposed by data scientists and researchers for accurate prediction of the future with the least errors. Econometric autoregressive time series models such as autoregressive moving average (ARMA) and autoregressive integrated moving average (ARIMA) models have established forecasting models capable of generating accurate forecasts. Wavelet methods, being capable of handling nonlinear data, combined with autoregressive models generate more accurate forecasts. In this present study, soft computing models of discreet wavelet transformation and wavelet denoising combined with autoregressive models are developed to forecast the weekly and daily closing prices of the BSE100 S&P Sensex index. Statistical error analysis of the forecasting outcomes of coupled models has been made to evaluate the performance of the prediction of these models. The prediction results reveal that soft computing methods coupled with autoregressive models (wavelet-ARIMA and wavelet denoise-ARIMA) generate considerably accurate forecasts as compared to baseline models (simple regression, ARMA and ARIMA models) and coupled models (wavelet-ARMA and wavelet denoise-ARMA models).

Keywords Closing prices · BSE time series data · Discrete wavelet transformation · Wavelet denoising · ARIMA model · ARMA model · Forecasting

1 Introduction

The stock market plays a vital role in the growth and development of industry and affects the economy of a country to a great extent. Some important functions of the stock market include the economic condition of a country, valuation of securities and to provide a ready market for sale and purchase of securities. For this reason, the government, industry, and investors continuously keep a close watch on the activities of the stock market. BSE (Bombay Stock Exchange) is the 11th largest stock exchange across the globe consisting of 30 well established and financially sound partner companies. BSE 100 S&P measures the performance of 100 largest and most liquid Indian companies. It was launched in 1989 with 1983–1984 as the base year. The BSE Sensex, earlier known as BSE National Index, efficiently records the pulsation of stock prices and stock markets in India.

Forecasting is an approach to estimate the future by understanding past events and is needed by almost every organization for optimum growth. Accurate prediction of the future is one of the major issues in numerous real-life problems, it helps to reduce the degree of uncertainty and develop new policies to earn high profits. Stock market prediction is a challenging task due to the risk and uncertainty involved in an investment. So, accurate prediction of stock market prices helps in reducing risk and making

✉ Kulwinder Singh Parmar
dr.kulmaths@ptu.ac.in

[1] Department of Mathematics, Guru Nanak Dev University College, Narot Jaimal Singh, Pathankot, Punjab, India

[2] Department of Mathematics, I.K. Gujral Punjab Technical University, Kapurthala, Punjab, India

[3] Department of Mathematics, Guru Nanak Dev University, Amritsar, Punjab, India

Published online: 04 January 2021

Received: 14 August 2020 | Revised: 19 July 2021 | Accepted: 4 August 2021

DOI: 10.1002/ep.13736

ENVIRONMENTAL PROGRESS & SUSTAINABLE ENERGY

Optimization of engine operating variables on performance and emissions characteristics of biogas fuelled CI engine by the design of experiments: Taguchi approach

Sunil Kumar Mahla[1] | Tarun Goyal[1] | Deepam Goyal[2] | Himanshu Sharma[3] | Amit Dhir[3] | Geetesh Goga[4]

[1]Department of Mechanical Engineering, I. K. Gujral Punjab Technical University, Kapurthala, India

[2]Chitkara University Institute of Engineering & Technology, Chitkara University, Rajpura, India

[3]School of Energy & Environment, Thapar Institute of Engineering & Technology, Patiala, India

[4]IES College of Technology, Bhopal, India

Correspondence
Sunil Kumar Mahla and Tarun Goyal, Department of Mechanical Engineering, I. K. Gujral Punjab Technical University, Kapurthala, India.
Email: mahla.sunil@gmail.com and tarungoyal.ikgptu@gmail.com

Deepam Goyal, Chitkara University Institute of Engineering & Technology, Chitkara University, Rajpura, India.
Email: bkdeepamgoyal@outlook.com

Funding information
Science and Engineering Research Board, Grant/Award Number: SB/FTP/ETA-306/2013

Abstract

Biogas obtained from renewable resources is a viable solution for solving energy scarcity and environmental degradation. A single-cylinder 4-stroke natural aspirated variable compression ratio research engine was fuelled with biogas as primary and diesel as a pilot injection in this work. Experiments were designed based on Taguchi L_9 OA (orthogonal array) choosing biogas flow rate, compression ratio, and engine load as input factors, while brake thermal efficiency (BTE), BSEC, CO, HC, NOx, and smoke were targeted responses. The effects level of factors on responses was analysed by using MINITAB software. The higher value of raw data and *S*/*N* ratios for BTE was observed with low biogas flow rate, higher compression ratio, and full engine load. On the other hand, lower raw data and high *S*/*N* ratio analysis for emissions characteristics (CO, HC, NOx, and smoke) were achieved in the order of rank, that is, engine load > biogas flow rate > compression ratio. With the analysis of results, optimum levels of various factors were evaluated. These results showed that the Taguchi method design was an effective tool for optimizing the elements in terms of combustion performance and emissions characteristics.

KEYWORDS
design, emissions, optimization, performance, Taguchi method

1 | INTRODUCTION

CI engine's cost-effectiveness and reliable nature make them frontier in the transportation, agriculture, construction, and shipping industry. High exhaust ejections caused by high combustion temperature have hazardous influences on the ambient air quality. Increased fossil fuel consumption by diesel engine coupled with the diminishing nature of fossil fuels and their ecological issues create stress on finding clean and alternative fuels.[1,2] Replacement of conventional fuels with clean and renewable energies will help reduce greenhouse gas emissions and reduce imports for developing countries like India. Biogas is considered an enticing clean and alternative fuel owning to its serene and cost-effectiveness under dual-fuel (DF) mode in diesel engine.[3] The DF operation entails the mixing of biogas with air before it enters

Short Communication | Published: 08 July 2022

Implementation of Logistic Regression on Diabetic Dataset using Train-Test-Split, K-Fold and Stratified K-Fold Approach

Meenu Bhagat & Brijesh Bakariya

National Academy Science Letters **45**, 401–404 (2022) | Cite this article

Abstract

Diabetes is a chronic metabolic disorder causing high blood sugars, that further severely affect body parts like the heart, liver, kidneys, lungs, eyes, nerves, blood vessels etc. There are three types of diabetes- Type-1 Diabetes, Type-2 Diabetes, and Gestational Diabetes. In Type-1, body of the patient fails to produce insulin. In Type-2

1220: Visual and Sensory Data Processing for Real Time Intelligent Surveillance System | Published: 26 August 2021

Deep convolutional neural model for human activities recognition in a sequence of video by combining multiple CNN streams

Neeraj Varshney & Brijesh Bakariya

Multimedia Tools and Applications **81**, 42117–42129 (2022) | Cite this article

Abstract

The video file is a collection of image sequential; this image sequence holds both spatial and temporal information. Optical flow and motion history images are two well-known methods for the identification of human activities. Optical flow describes the speed of every individual pixel point in the picture. Still, this information about the motion cannot represent the complete action and different movement speeds. The durations of Local body parts show almost similar intensity in the Motion history

1174: Futuristic Trends and Innovations in Multimedia Systems Using Big Data, IoT and Cloud Technologies (FTIMS)
Published: 02 January 2022

Human activity recognition by combining external features with accelerometer sensor data using deep learning network model

Neeraj Varshney, Brijesh Bakariya, Alok Kumar Singh Kushwaha & Manish Khare

Multimedia Tools and Applications **81**, 34633–34652 (2022) | Cite this article

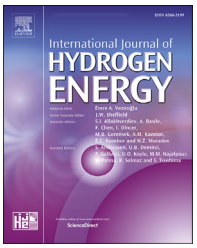
Abstract

Various Human Activities are classified through time-series data generated by the sensors of wearable devices. Many real-time scenarios such as Healthcare

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/he



Effect of utilization of hydrogen-rich reformed biogas on the performance and emission characteristics of common rail diesel engine

Himanshu Sharma [a], *Sunil Kumar Mahla* [b], *Amit Dhir* [a,*]

[a] *Enviro-Energy Research Lab, School of Energy and Environment, Thapar Institute of Engineering and Technology, Patiala, 147004, India*

[b] *Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Campus, Hoshiarpur, 146001, India*

HIGHLIGHTS

- Hydrogen-rich reformed biogas synthesized through dry-oxidative reforming.
- Common rail CI engine was fuelled with different flow rates of gaseous fuel.
- Improvement in brake thermal efficiency, brake energy and diesel consumption.
- Reduction in HC, NO_X, and CO_2 emissions with increase in CO emissions.

ARTICLE INFO

Article history:
Received 5 October 2021
Received in revised form
14 December 2021
Accepted 11 January 2022
Available online xxx

Keywords:
Hydrogen-rich reformed biogas
Diesel engine
Dual fuel mode
Emissions
Performance

ABSTRACT

The utilization of renewable gaseous fuels in the diesel engine has gained significant interest in recent years due to its clean-burning nature and higher availability. In this study, hydrogen-rich reformed biogas was used as a gaseous fuel in a common rail diesel engine with diesel as pilot fuel. The hydrogen-rich reformed gas was synthesized through dry-oxidative reforming. The experimentations were performed in the load range from 6 to 24 N m with two different flow rates of gaseous fuel (0.5 and 1.5 kg/h) at a constant speed of 1800 RPM. The effects on engine performance parameters (brake thermal efficiency, brake specific energy consumption, and brake specific diesel consumption), combustion parameters (rate of pressure rise and maximum heat release rate) and emission parameters (Unburnt hydrocarbons, nitrogen oxides, carbon monoxide, and carbon dioxide) were assessed. The induction of gaseous fuel led to an increase in brake thermal efficiency by 10.5%, reduction in brake specific energy consumption by 13.6%, and a reduction of 26.4% in brake specific diesel consumption with a flow rate of 0.5 kg/h when compared to diesel-only mode at 24 N m load. The HC, NO_X and CO_2 emissions were reduced by 18.2%, 7.4% and 1.4% with a flow rate of 0.5 kg/h when compared to diesel-only mode at 24 N m load due to lower availability of carbon content in the combustible mixture. The utilization of renewable fuel like hydrogen-rich reformed biogas has great potential for overcoming the issue related to both biogas and hydrogen in diesel engines. Moreover, the higher diesel substitution also demonstrates the potential for cost-saving and fossil fuel conservation.

* *Corresponding author.*
E-mail address: amit.dhir@thapar.edu (A. Dhir).

https://doi.org/10.1016/j.ijhydene.2022.01.073
0360-3199/

Materials Research Express

PAPER

Predicting the effect of fiber orientations and boundary conditions on the optimal placement of PZT sensor on the composite structures

Rahul Samyal[1], **Ashok Kumar Bagha**[1], **Raman Bedi**[1], **Shashi Bahl**[2,*], **Kuldeep K Saxena**[3] and **Shankar Sehgal**[4]

[1] Department of Mechanical Engineering, Dr B R Ambedkar National Institute of Technology, Jalandhar 144011, India
[2] Department of Mechanical Engineering, I K Gujral Punjab Technical University, Hoshiarpur, Campus Hoshiarpur 146001, India
[3] Department of Mechanical Engineering, GLA University, Mathura 281406, India
[4] Mechanical Engineering Department, UIET Panjab University, Chandigarh 160014, India
[*] Author to whom any correspondence should be addressed.

E-mail: rahulsamyal.me.18@nitj.ac.in, baghaak@nitj.ac.in, bedir@nitj.ac.in, shashi.bahl@ptu.ac.in, saxena0081@gmail.com and sehgals@pu.ac.in

Keywords: optimal position, piezoelectric, composite structures, fiber orientation, modal-model

OPEN ACCESS

RECEIVED
11 April 2021

REVISED
9 June 2021

ACCEPTED FOR PUBLICATION
23 June 2021

PUBLISHED
2 July 2021

Abstract

In this paper, the modal-model of the composite structure is predicted and viewed to decide the optimal position of the PZT sensors on the composite structures. The novelty of this work is to systematically study the effect of fiber orientations and boundary conditions on the modal-model and the optimal location of the PZT sensors on the composite structures. The glass fibers are reinforced in a polyester matrix at different fiber orientations such as 0°, 30°, 45°, 60° and 90°. It is used for various engineering applications, especially in the aerospace and automobile sector, and it is very important to measure its dynamical response. The PZT patches can be embedded on the composite structures to measure their vibrational response. In this paper, ABAQUS software is used to build the finite element model of the PZT-composite structure. The composite structure is modeled with different boundary conditions. It is observed that the orientation of the fibers as well as the boundary condition directly put their effect on the modal-model of the composite structure and also on the selection of the optimal position of the PZT patches. It is found that the optimal position of the PZT directly depends upon the fiber orientation.

1. Introduction

Composite materials have distinct properties from other conventional and metallic materials such as high fatigue life, corrosion resistance, specific strength, specific stiffness, wear resistance, acoustical insulation, and many more. Inherent properties like high specific strength and durability have immense the use of composite material in various naval, aerospace and automobile applications [1, 2]. The extensive use of composite materials opens a wide range of failures caused in a static and dynamic mode. In this regard, both static and dynamic analysis of the composite structures is essential to study to avoid failure of the structure. The composite structure may fail because of its resonance condition, so it is very important to predict or measure the modal characteristics (spatial model, modal-model, and response model) of the structure. Researchers studied the vibrational analysis of the composite structures in which they analyzed the importance of prediction of the modal-model (natural frequencies, mode shapes and viscous damping coefficients) for effective dynamic analysis. The study of natural frequencies and their corresponding mode shapes of the structure are combined to term as modal analysis. Modal analysis of any structure depends upon the physical properties of the material, structure-dimensions, and boundary conditions. In the case of composite materials, there are two or more different materials combined at the homogenous level that may affect the modal analysis separately. In composite materials, mostly fibers are embedded at different orientations in the matrix or resin. The orientation of reinforced fibers into the matrix may affect the modal-model of the system.

Materials Today: Proceedings 52 (2022) 2285–2294

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Implementing Industry 4.0 technologies in self-healing materials and digitally managing the quality of manufacturing

Mohd Ammar [a], Abid Haleem [a], Mohd Javaid [a], Shashi Bahl [b,*], Ajay Singh Verma [b]

[a] Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India
[b] Department of Mechanical Engineering, I. K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India

ARTICLE INFO

Article history:
Received 15 July 2021
Received in revised form 28 August 2021
Accepted 14 September 2021
Available online 5 October 2021

Keywords:
Industry 4.0
Quality management
QMS
Quality 4.0
DQMS
Self-healing materials

ABSTRACT

Quality has always been an essential part of manufacturing. Companies have always focused on methods and techniques to improve and manage the quality, even in the past. With the help of Industry 4.0 technologies, manufacturing industries have evolved a lot. Technologies like Industrial Internet of Things (IIoT), Additive Manufacturing (AM), Big Data, Augmented reality (AR)/ Virtual Reality (VR)/ Mixed Reality (MR) and many more have opened new manufacturing industries. Various new methods to manage the quality have been introduced. This paper discusses the integration of Software Suites, Interactive SOPs, and training platforms, Electronic Logs, Advanced SPC and Big Data Analytics for developing advanced quality management systems. Smart Materials may be the answer to many of the problems faced in the industries, accordingly the paper has also discusses the latest developed technologies in smart materials and the possibilities of integrating them with IIoT. In the last, it discusses various error detection methods during manufacturing, problems and their solutions using Industry 4.0.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Mechanical Engineering: Transcending Boundaries-2021.

1. Introduction

At the 2011 Hannover Messe (Trade Fair) in Germany, Industry 4.0, or the fourth industrial revolution, was first introduced. Then a strategic plan for transforming the manufacturing sector was also announced. This revolution is being driven by three critical technological factors: connectivity, intelligence, and flexible automation. Now that the twenty-first century has entered its third decade, most manufacturing operations have shifted to the digital realm. As a result of the technological capability gained through Industry 4.0, we have observed a rise in the flexibility and efficiency of all intricate procedures. The promise of these technologies has been realised in practically every area, resulting in significant changes. Manufacturing accounts for more than 16% of global gross domestic output (GDP). Governments in emerging economies such as India and China have adopted programs like Make in India and Make in China to stimulate economic growth. China has developed a three-pronged strategy for transforming the country into the world's next manufacturing centre by applying smart and innovative manufacturing technology. On the other hand, India seeks to reduce its dependency on imported goods by increasing indigenous manufacturing skills.

Additionally, it has introduced various business-friendly policies, resulting in a $286 billion rise in foreign direct investment (FDI) between 2014 and 2019. This value represents approximately 46% of the nation's total foreign direct investment (FDI) since 2000 [1]. With such substantial expenditures and stakes in the manufacturing business, it is vital to maintain and improve the process's overall quality. This purpose can be accomplished in a variety of ways. It has been a very long time since quality management systems and standards were formed. Integrating them with Industry 4.0 technology is critical, as is giving more affordable quality management system solutions. Integration of software suites, interactive standard operating procedures and training platforms, electronic logs, enhanced statistical process control, and big data analytics enables this. Fig. 1 presents the history of industrial revolution.

In Industry 4.0, integrating information technology with operational technology resulted in new digital solutions. A cyber-physical world is created by emerging technologies such as additive manufacturing, advanced robotics, augmented and virtual

* Corresponding author.
E-mail address: shashi.bahl@ptu.ac.in (S. Bahl).

https://doi.org/10.1016/j.matpr.2021.09.248
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Mechanical Engineering: Transcending Boundaries-2021.

Materials Today: Proceedings 52 (2022) 2295–2304

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Role of smart materials and digital twin (DT) for the adoption of electric vehicles in India

Sayed Suhaib Kamran [a], Abid Haleem [a], Shashi Bahl [b,*], Mohd Javaid [a], Devaki Nandan [c], Ajay Singh Verma [b]

[a] Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India
[b] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[c] Department of Industrial & Production Engineering, G.B. Pant University of Agriculture & Technology, Pantnagar 263145, India

ARTICLE INFO

Article history:
Available online 5 October 2021

Keywords:
Digital Twin (DT)
Industry 4.0
Electric Vehicle (EV) industry
Electric Vehicles (EVs)
Repair and maintenance
Smart Materials

ABSTRACT

This paper aims to integrate Industry 4.0 technologies, precisely the Digital Twin concept and smart materials, with the Electric Vehicle (EV) industry, to complement the adoption of Electric Vehicles (EVs) in the Indian market. In the current scenario, the adoption of EVs in India faces challenges ranging from insufficient charging facilities to the difficulties related to the complicated connections inside an EV, making the repair and maintenance of these vehicles quite arduous and costly. This paper specifically deals with the complexities regarding the repair and maintenance of EVs and aims to ease the process to ensure a bright future for the EV industry in the Indian markets. Throughout this paper, different challenges regarding the repair and maintenance of EVs are discussed. The solutions to overcome these challenges with the help of various Industry 4.0 technologies and smart materials will pave the way for the smooth and efficient adoption of EVs in the Indian markets. The paper also discusses the significant research challenges associated with the study and its future scope in the industry. The findings of this study enabled us to recognize a variety of smart materials that the EV industry can use in their cars which will make the maintenance of EVs much more affordable by cutting down the heavy costs incurred in getting the dents and scratches repaired if the vehicle meets an accident. Also, the use of Digital Twin in the servicing and repair of EVs will make the process a lot more convenient by reducing the service time and related costs drastically. Further in our study, we have described in detail the working process of DT and smart materials in the EV industry to achieve the goals of this study.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Mechanical Engineering: Transcending Boundaries-2021.

1. Introduction

The rapid developments in science and technology have enabled us to change our industries' work drastically. One such technology gaining rapid development these days is Digital Twin (DT), which in simple terms is the connection between an actual physical model and its digital simulation on software. A Digital Twin (DT) enables the physical system or model to exchange real-time data with its virtual twin. The data thus obtained can be further processed and data mined to assess various parameters like the performance, lifetime, failure cycle, etc., of the physical system and hence, maximize its overall output. The concept of Smart Materials is relatively new but is on the rise currently due to their application in almost every modern world industry ranging from automobiles to the aviation industry, defense sector, medical field, and manufacturing industries. Smart Materials possess the ability to change their shape or configuration reversibly when acted upon by some external stimulus. This has enabled their entry into almost each industry operating in the current scenario.

The Electrical Vehicle (EV) industry is gaining momentum for a long time as its development is triggered by the fear of running out on our non-renewable resources, which are used to power our gasoline-powered vehicles like cars, buses, trucks, etc. Hence, vehicles driven by electric power are being developed to keep the environment clean due to their zero emissions and preserve fossil fuels. India is currently the fourth-largest emitter of greenhouse gases (GHG) in the world [1]. The transport sector accounts for 13% of

* Corresponding author.
E-mail address: shashi.bahl@ptu.ac.in (S. Bahl).

https://doi.org/10.1016/j.matpr.2021.09.249
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Mechanical Engineering: Transcending Boundaries-2021.

Physica Scripta

PAPER

Removing fiber orientation uncertainty from the finite element model of a composite lamina with direct updating algorithm

RECEIVED
9 December 2021

ACCEPTED FOR PUBLICATION
17 December 2021

PUBLISHED
28 December 2021

Sajid Mohammad Chhipa[1], **Pramod Kumar**[1], **Ashok Kumar Bagha**[1] **and Shashi Bahl**[2,3,*]

[1] Department of Mechanical Engineering Dr B.R. Ambedkar National Institute of Technology Jalandhar 144011, India
[2] Department of Mechanical Engineering I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[3] https://scholar.google.com/citations?hl=en&user=_aYBcmIAAAAJ.
[*] Author to whom any correspondence should be addressed.

E-mail: ersmchhipa@gmail.com, kushwahapramod@nitj.ac.in, baghaak@nitj.ac.in and shashi.bahl@ptu.ac.in

Keywords: Direct updating algorithm, modal-model, composite lamina, uncertainties, frequency response function

Abstract

In this paper, a direct updating algorithm is proposed to remove the uncertainties present in the simulated/analytical finite element (FE) model of a composite material lamina. There are number of possible uncertainties present in the composite materials such as its constituent properties and its orientations, boundary conditions and its assumed dimensions etc It is observed from this analytical study that the uncertainty present in the fiber orientation in the matrix put its direct effect on the modal-model (natural frequencies and corresponding mode shapes) of the composite material lamina. The direct updating algorithm has been already used for many isotropic structures. However, for anisotropic structures like composite materials, the application to accurate the simulated-finite element model by using finite element model updating techniques is a new area of research. In this regard, to remove these uncertainties from the simulated-finite element model of a composite lamina, the application of direct updating algorithm is proposed. It is observed from the present study that by updating the mass and the stiffness matrices through direct updating algorithm, the vibration pattern of the mode shapes are updated. It is found that the maximum percentage error in the constituent properties and in the fiber orientation is 22.58% and 100% respectively that are reduced to 0% in the modal-model of the lamina by the application of direct updating algorithm. This represents the novelty of the application of direct updating method for composite lamina structures. The overlay of frequency response function (FRF) curves are plotted to authenticate the results. Also, it is found that the application of the direct updating algorithm increases the tracking performance of the simulated FE model response when excited at different resonant frequencies.

1. Introduction

Damage is the leading cause of the failure of any product or structure. These damages could be due to many reasons such as human errors, product structure life, poor quality, crack propagation, creep-fatigue, endurance limit, natural phenomena, environmental condition uses etc So there is a need to detect the damage in any structure. Therefore, the '*simulation*' world is introduced where anyone can make or create a similar real-world experimental environment in a personal computer or workstation. Anyone can set all the parameters in the computer to study the real-time experimental structure in the physical world. Although many simulations might sound fascinating, they would always fail to match the exact conditions and environment of the real-time experimental structure. Mostly, finite element (FE) method technique is used to solve all the engineering problems. The finite element method provides approximate results due to presence of uncertainties and errors. These errors can be present in the FE simulation model in many forms. These could be present in the boundary condition, geometrical dimensions, properties parameters etc Errors present in the simulation model of boundary condition type could be of the cantilever type, clamped-clamped type, clamped-free type etc and error

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

The impact of smart materials, digital twins (DTs) and Internet of things (IoT) in an industry 4.0 integrated automation industry

Ahmad Majid Qazi [a], Syed Hasan Mahmood [b], Abid Haleem [a], Shashi Bahl [c,*], Mohd Javaid [a], Kanu Gopal [d]

[a] Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India
[b] Department of Engineering Design, Indian Institute of Technology Madras, Chennai 600036, India
[c] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[d] Department of Computer Science & Engineering, Chandigarh Group of Colleges, Greater Mohali 140307, India

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Automation
Digital twins (DT)
Industry 4.0
Smart materials
Internet of things (IoT)

ABSTRACT

The automation industries in their initial stages were factories with a limited number of machine components and a large and skilled worker base. Since the beginning of the 20th century, newer technologies are being adopted in the automation industry, and newer benchmarks are being set up; industry 4.0 is the latest of this trail and brings the idea of smart industries. Elements of Industry 4.0 primarily drive these industries. Intelligent materials, intelligent designs, faster data transmission, and accession shape the cutting-edge revolutions in this age. Researchers are constantly pushing the bars to attain new and smart materials with more applications than we can imagine. Despite being appealing, these technologies face many hurdles while making their way to the mainstream consumer base. This paper discusses the latest developments in such technologies, their potential applications in many fields, and the practical steps to pave their way into the automation industry.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Materials and Mechanical Engineering. (ICAMME-2022).

1. Introduction

As the name suggests, automation amalgamates the two words 'automatic' and 'machine'. Automation refers to any technology which involves minimum human involvement. A typical example would be the shifting of gears in a vehicle. While earlier we used to shift gears manually, the introduction of automatic transmission (AT) and continuously varying transmission (CVT) changed this process from manual to automatic. In automated transmissions, the gear system senses the vehicle's speed with the help of specific mechanical parameters and changes the gears accordingly; this is a pretty good example of how automation comes into play. Ever since the advent of modern technology since the beginning of the 19th century, we have been through four major industrial revolutions; with the steam engine bringing the first industrial revolution, then the discovery of electricity and mass production on assembly lines being the second, digitalization of products being the third, and finally into the fourth industrial revolution. The fourth industrial revolution is based on the 'cyber-physical' interaction, the vision of products and services being interconnected to each other through the Internet of things (IoT) where the manufacturing machines interact with the products whose manufacturing is under process, in order to drive a smooth, cooperative and efficient manufacturing process [1].

2. Industry 4.0

The term 'Industry 4.0' refers to the following characteristic pillars utilized in industries of the fourth generation:

- *Big data and artificial intelligence (AI) analytics:* Imagine a virtual space full of objects of different colors, shapes, and sizes. Suppose a person is required to utilize all the brown cubes of small size for his need; sorting out all the small-brown cubes would be a hectic and challenging task when they are only a small per cent from among an ocean of objects. Now imagine this same virtual space having all the like objects linked together such that when one come seeking small-brown-cubes, all they need to do is pick one of them, and all the rest will follow along. Such is the similitude of Big Data and AI analytics, with Big Data being those objects of different colors, sizes and shapes and the

* Corresponding author.
E-mail address: shashi.bahl@ptu.ac.in (S. Bahl).

https://doi.org/10.1016/j.matpr.2022.01.387

Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Materials and Mechanical Engineering. (ICAMME-2022).

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Role of energy technologies in response to climate change

Ahmad Shamoon [a], Abid Haleem [a], Shashi Bahl [b,*], Mohd Javaid [a], Sonu Bala Garg [c]

[a] Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India
[b] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[c] Department of Electronics & Communication Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Energy production
Renewable energy
Energy technologies
Supply chain
Efficiency

ABSTRACT

Several crises have gripped the world, clearly showing how vulnerable our energy supply is. However, emissions from industrial and energy applications have threatened our future with climate change. There is a need to redesign our strategies on energy policies. The present energy generation methods have sustained us for a long time, but they seem unsustainable for future energy demands. This energy supply and production could soon collapse if it keeps going on. It will affect not only humans but the whole planet. The primary purpose of this study is to look for new ideas that will help us produce ample energy and consider their impacts on the environment. We could alleviate this energy deficiency problem by involving the frequent use of renewable energy technologies as they do not rely on fuels and seem eco-friendly. However, before initiating any project, their impact on the environment needs extensive research. Some of the possible improvements in some present methods of energy generation were studied and mentioned. The improvement in materials used for energy applications could result in enhanced efficiency. Despite the technological advances we have, there are many challenges before us. Efficiencies of renewable energy technologies could be increased by upgrading the required equipment and infrastructure. Ensuring a mix of reliable energy production methods and ensuring minimal impact on the environment would lead us in the future. Resilient and efficient energy production will sustain our future energy demands at a low cost. Hydrogen can be viewed as an alternative fuel. It contains the highest energy content per unit weight and should be included in energy applications. There is no doubt that another war or crisis would severely affect fossil fuel-based economies. Because of such concerns, the global trend of using fossil fuels has changed. Increasingly, countries are investing in other renewable energy sources. Several challenges await us before we can implement the new changes to our energy infrastructure. In an uncertain future, our priority should be how to produce enough clean energy. The time has come to create new plans for the future of energy, minimize carbon emissions and consider the environmental consequences of these actions. There are many questions regarding climate change and energy supply which we will be covering in this report.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Materials and Mechanical Engineering. (ICAMME-2022).

1. Introduction

Energy is at the heart of development and urbanization. In the past, the Iran-Iraq crisis in the 1980s showed how vulnerable global energy production and supplies are. Moreover, these chains have been affected by other, numerous conflicts and pandemics, sending the prices skyrocketing. There are various processes through which energy is produced worldwide, depending on the region and resources. We have been using fossil fuel-based energy generation methods and have ignored the other alternatives, like renewable energy. The energy demands are expected to grow in the coming future, and the present methods of energy generation are not efficient enough to quench our thirst for energy. Also, there are several implications with our existing energy infrastructures, on which more work has to be done. From COP26 held in Glasgow 2021, it was clear that our planet's natural climate was changing fast and that our planet could not possibly sustain our energy demands based on fossil fuels. Climate change is the consequence of relying on fossil fuels for more than a century. As a result, glaciers are melting, and in a few hundred years, most of the land will

* Corresponding author.
E-mail address: shashi.bahl@ptu.ac.in (S. Bahl).

https://doi.org/10.1016/j.matpr.2022.02.025
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the International Conference on Advances in Materials and Mechanical Engineering. (ICAMME-2022).

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Transformation temperature and corrosion behavior of porous NiTi and NiTiCu shape memory alloy

Neeraj Sharma [a,*], Abhishek Sharma [b], Kapil Kumar Goyal [c], Shaman Gupta [a], Shashi Bahl [d], Gaurav Kumar Sharma [e]

[a] Department of Mechanical Engineering, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, India
[b] Department of Mechanical Engineering, Manipal University Jaipur, Jaipur, India
[c] Department of Industrial and Production Engineering, Dr B R Ambedkar National Institute of Technology, Jalandhar, India
[d] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur, India
[e] Department of Mechanical Engineering, Punjab Engineering College (Deemed to be University), Chandigarh, India

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
NiTi
NiTiCu
Corrosion resistant
Transformation Temperature

ABSTRACT

The present research work deals with the fabrication of porous NiTi and NiTiCu shape memory alloy (SMA) by powder metallurgy process. These SMAs have number of applications in medical and space industries. The transformation temperature of both SMAs is measured by differential scanning calorimetry (DSC). Corrosion behavior is measured by potentiodynamic polarization curve in the presence of artificial saliva (pH value 7.4). Result shows that transformation temperature decreases by 8 °C to 10 °C after copper addition. Also, the corrosion current density decreases for NiTiCu, which exhibit more corrosion resistant than equi-atomic NiTi alloy. The corrosion current density of NiTiCu is less than NiTi by a factor of 31.

Selection and peer-review under responsibility of the scientific committee of the 4th International Conference on Advances in Mechanical Engineering and Nanotechnology.

1. Introduction

Shape memory effect is the characteristic of a material to come to its original shape after thermal treatment. NiTi alloy showed the shape memory effect due to which it has its applications in medical devices and engineering industries. Other applications of NiTi alloy were found in cardio-vascular and stent etc. due to bio-compatibility and super-elasticity [1,2].

NiTi alloys transformed from austenite to martensite by twinning mechanism. The main mechanism of super-elasticity is martensitic transformation from B2 (austenite) to B19′ (martensite). When some element like Fe or Al are added in equi-atomic NiTi alloy or nickel-rich aged NiTi alloys, the R-Phase transformation takes place with 0.1% strain as pre-martensite phase [3–5].

Formation of protective, highly adherent and stable oxide film of TiO_2 results of good corrosion resistance. Titanium has an affinity to react with oxygen and is highly reactive, these oxide film protect the leaching of metal ion. This can only be happened when surfaces (metal) are subjected to air and/or moisture. If in any case, surface oxide film damaged then it re-heal itself by the help of water/moisture or oxygen [6]. In addition to this, when the titanium surface placed in biological environment, the development of calcium-phosphate on its surface takes place [7–11], which act as a protective layer against diffusion. The corrosion rate and its resistance rely on the surface conditions and its nature [12]. In addition of the above, the porous alloys increases the tissue growth and decreases the Young's moduli of material to match its characteristics with bone.

From the literature, it was found that researchers [13–27] worked on the development and classification of NiTiCu and NiTi alloys. But the effect of ternary element on the transformation temperature and corrosion rate is still underway. Thus, in current work, NiTi and NiTiCu porous SMA were developed by powder metallurgy process. Copper particles were blended into NiTi alloy and study corrosion behavior of SMA. Also, the transformation temperature plays a major role in shape memory effect. It is very critical to control the transformation temperature. Here in the current work, a trial has been made to evaluate the transformation temperature.

* Corresponding author.
E-mail address: neerajsharma@mmumullana.org (N. Sharma).

https://doi.org/10.1016/j.matpr.2022.02.519

Selection and peer-review under responsibility of the scientific committee of the 4th International Conference on Advances in Mechanical Engineering and Nanotechnology.

Materials Today: Proceedings 57 (2022) 936–941

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Environmental impact of energy production and extraction of materials - a review

Ahmad Shamoon [a], Abid Haleem [a], Shashi Bahl [b,*], Mohd Javaid [a], Sonu Bala Garg [c], Rakesh Chandmal Sharma [d], Jatinder Garg [e]

[a] Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India
[b] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[c] Department of Electronics & Communication Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[d] Department of Mechanical Engineering, Maharishi Markandeshwar (Deemed to be University) Mullana, Ambala 133207, India
[e] Department of Mechanical Engineering, Baba Hira Singh Bhattal Institute of Engineering & Technology, Lehragaga 148031, India

ARTICLE INFO

Article history:
Available online 16 March 2022

Keywords:
Energy mix
Hydrocarbons
Climate change
Renewable energy
Energy infrastructure
Materials

ABSTRACT

Energy is a basic necessity. In this modern world, energy is produced using different resources and technology, which helps sustain our energy demands. All the present economies have relied on fossil fuel-based energy generation for past decades. The continuous exploitation of resources for energy purposes has left areas uninhabitable. While renewable energy technologies are emerging and in trend, the same story goes for them. Almost all present-day energy methods have some effect on the environment. The nexus of energy and the environment is a fragile balance. This balance should remain. The study includes a comparison of renewable and nonrenewable sources; the problem associated with fossil fuel extraction, and analyzes the impact of various energy-producing infrastructures on the environment. In mining rare earth elements, toxic chemicals are released into the atmosphere. The extraction of such materials leads to environmental concerns. Energy production should remain as neutral as possible.

Selection and peer-review under responsibility of the scientific committee of the Third International Conference on Aspects of Materials Science and Engineering.

1. Introduction

It is well known that we need energy for heating and cooling purposes, transport, manufacturing of basic things and every other thing we could think of. Energy is converted from one to another during these processes. The electricity we receive comes from our local power grids. The electricity is produced using several different methods, each employing different types of equipment and technology. It largely depends on the availability of natural resources present in that region. Some regions are resource deficient. The sale of these fossil fuels to such nations benefited the economy of those nations. However, these energy infrastructures use fuel to operate. This fuel comes from renewable resources or nonrenewable sources like fossil fuels. Conventional methods like thermal power plants use steam turbines. These turbines are rotated by steam produced from heat [1]. For heating purposes, fossil fuels come into play. The major land-management and resource-extraction activities require energy. On top of that, fossil fuels are key factors contributing to increased greenhouse gas emissions and land-use change [2].

Coal-fed and diesel-fed power plants were very common for much of the previous century. Developing nations still rely heavily on these fuels. These power plants emit vast amounts of greenhouse gases, produce low power output and need ample fuel. Thus, the excavation of such locations for fossil fuels became a trend. More nations poured money for these expensive drilling and excavation. The blame for environmental concerns goes to nonrenewable methods of electricity generation. Transport and military vehicles also contribute significantly to greenhouse gases. The renewable energy sources in which heavy investments also damaged the natural surroundings [3]. Although these technologies are encouraged, their effect on their surroundings is often neglected or not covered. However, damage to the environment includes carbon emissions and the physical impact on such places. Large-scale drilling operations damage the natural topography of the area. Marine ecosystems are negatively impacted by offshore

* Corresponding author.
E-mail address: shashi.bahl@ptu.ac.in (S. Bahl).

https://doi.org/10.1016/j.matpr.2022.03.159

Selection and peer-review under responsibility of the scientific committee of the Third International Conference on Aspects of Materials Science and Engineering.

Materials Today: Proceedings 57 (2022) 942–947

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

IoT-based low-cost 3D mapping using 2D Lidar for different materials

Mohd Yusuf [a], Aman Zaidi [a], Abid Haleem [a], Shashi Bahl [b,*], Mohd Javaid [a], Sonu Bala Garg [c], Jatinder Garg [d]

[a] Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India
[b] Department of Mechanical Engineering, I. K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[c] Department of Electronics & Communication Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[d] Department of Mechanical Engineering, Baba Hira Singh Bhattal Institute of Engineering & Technology, Lehragaga 148031, India

ARTICLE INFO

Article history:
Available online 17 March 2022

Keywords:
3D mapping
Lidar
Internet of Things
Cost-effective

ABSTRACT

Three-dimensional (3D) mapping is the technology of profiling objects in three dimensions to map them in real life. 3D mapping is an excellent tool for analysis, surveying, and other engineering domains. 3D light detection and ranging (Lidar) technology usually does 3D mapping, but the cost of 3D Lidar is very high, which constrains its applicability in the Industry. The need for a low-cost 3D mapping has increased widely. A cost-effective 3D mapping based on the Internet of Things (IoT) using 2D Lidar is proposed. 2D Lidar is lower in cost than 3D Lidar, so it completely replaces the 3D Lidar for applications that need moderate or low accuracy. This research sought to confirm the applicability of this low-cost IoT-based advanced sensing technology, i.e., Lidar, in the engineering domain. A two-dimensional Lidar mapping system prototype is constructed, and the same is used to generate three-dimensional (3D) point cloud models. Lidar measurements are greatly dependent on the materials. Every material has different absorbance and reflectivity, which alter the Lidar measurements. In this research, we have shown how different material affects Lidar accuracy.

Selection and peer-review under responsibility of the scientific committee of the Third International Conference on Aspects of Materials Science and Engineering.

1. Introduction

The fourth industrial revolution is characterised by increasing digitalisation and interconnection of products, value chains, and business. The essence of the Industry 4.0 is the 'Internet of Things (IoT)', the interconnection of people, things and machines [1]. This interconnection produces a variety of new innovative devices which are low cost and efficient. IoT is a technology used to communicate between interrelated computing devices, digital machines, mechanical machines, and animals or people. IoT describes a network of things that are added with sensors, software and various other technologies to communicate and exchange data remotely [2]. Using IoT, a new device is developed, significantly reducing the cost of 3D mapping in the Industry.

A 3D mapping is a technique to create a three-dimensional view of the space in consideration [3]. It uses machine vision to aid in profiling objects in three dimensions, and it is an excellent technology for engineers to visualise and gain insights about spatial information of any geometry or space. Engineers encounter various situations requiring 3D models of complex real-world geometries for analysis purposes or running simulations in the real world. For example, a 3D model of Rock Blasted Tunnel is complex and cannot be made using available CAD software. Hence 3D mapping is done in these cases, and also, due to fast-paced infrastructural development in various developing regions worldwide, there has been an increase in the usage of 3D mapping when analysing building designs and architectural requirements.

Wang et al. [4] presented the historical evolution of Lidar and how it became one of the essential pieces of equipment in high precision measurements. The authors discussed the various applications and future uses of Lidar. Ocando et al. [5] gave an algorithm that performs an autonomous 3D mapping of an environment with a 2D scanner. They presented how to implement and control the system remotely with the help of a robot operating system (ROS). Chong et al. [6] performed a detailed mapping of the urban environment using a single Lidar. The authors use a matcher to improve scan matching for recognising the place efficiently. They used Monte Carlo loop closure detection. Wang and Menenti [7] discussed the requirement of short-range 2D and 3D Lidar in autonomous vehicles. They showed that with further advancement, the Lidar has become cost-effective and reliable in measuring turbulence, volcanic ash, wind shear, etc., from the aircraft in real-time, which is life-saving. The authors presented that success-

* Corresponding author.
E-mail address: shashi.bahl@ptu.ac.in (S. Bahl).

https://doi.org/10.1016/j.matpr.2022.03.161
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the Third International Conference on Aspects of Materials Science and Engineering.

Physica Scripta

PAPER

Finite element model updating of smart structures with direct updating algorithm

RECEIVED
15 February 2022

REVISED
25 March 2022

ACCEPTED FOR PUBLICATION
6 April 2022

PUBLISHED
18 April 2022

Shivam Verma[1], **Saurabh Kango**[1], **Ashok Kumar Bagha**[1] **and Shashi Bahl**[2,*]

[1] Department of Mechanical Engineering, Dr B.R. Ambedkar National Institute of Technology, Jalandhar 144011, India
[2] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[*] Author to whom any correspondence should be addressed.

E-mail: shivamv.de.20@nitj.ac.in, kangos@nitj.ac.in, baghaak@nitj.ac.in and shashi.bahl@ptu.ac.in

Keywords: direct updating algorithm, smart structure, finite element method, piezoelectric patches, uncertainties, modal-model

Abstract

In this paper, a finite element model updating algorithm is proposed to enhance the accuracy of the simulated finite element model of a smart structure (collocated piezoelectric patches embedded on a cantilever beam). Piezoelectric patches are used to sense and control the excessive vibrations of the structures. Mostly, they are mounted on flexible structures to measure their response at different excitations. The finite element method can be used to model the beam embedded with collocated piezoelectric patches. The complete finite element formulation of the smart structure is briefly described in this paper. There are different types of uncertainties that may be present in the simulated finite element model of a smart structure such as uncertainty in the structural boundary conditions, in the material elastic properties, the dimensions of the structure, piezoelectric elastic and electric properties, and the location of the piezoelectric patches mounted on the structure. In the present analytical study, the above uncertainties present in the smart structure are reduced by using the direct updating algorithm. It is found that the direct updating method through updating the mass and the stiffness matrices of the smart structure successfully enhance the accuracy of the simulated finite element model of the beam embedded with PZT patches. The state-space method is used to predict the response in the frequency domain. The maximum percentage error in the simulated finite element model of the piezoelectric embedded beam structure due to its structural and the electrical property uncertainty is 10.36% and 23.52% respectively and that was completely removed by using the direct updating algorithm. The optimal location of the piezoelectric patches is also taken as uncertainty which is successfully updated by using the proposed direct updating algorithm. The maximum percentage error in the natural frequencies of the smart structure due to location uncertainty is 18.39% which was also completely removed. To validate the outcomes, a frequency response function (FRF) is plotted.

1. Introduction

The finite element (FE) method is a numerical tool that can be used to provide approximate solutions to a wide range of engineering problems. The smart structures, a combination of structures with the electric transducers (piezoelectric sensors and actuators) can be successfully modeled by using the finite element method (FEM). The FE modeling of smart structures is carried out by Hwang and Park [1]. A two-dimensional FE of a smart structure to model its structural, as well as piezoelectric parts, was proposed. Piefort and Andre [2] developed a FE formulation for an electro-mechanically coupled piezoelectric structure. A multi-layered mindlin shell and volume elements were used for this purpose. Hamilton's principle was implemented to derive the constitutive equations related to structural as well as electrical parts of the smart structure. Gabbert *et al* [3] performed the FE modeling to model the smart structures to obtain the natural frequencies of the electro-mechanical coupled

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Understanding the role of advanced materials for energy infrastructure and transmission

Ahmad Shamoon [a], Abid Haleem [a], Shashi Bahl [b,*], Mohd Javaid [a], Chander Prakash [c], Dharam Budhhi [d]

[a] Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India
[b] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[c] School of Mechanical Engineering, Lovely Professional University, Phagwara 144411, India
[d] Division of Research & Innovation, Uttaranchal University, Uttarakhand, 248007, India

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Energy mix
Climate change
Fossil fuel age
Fuel cells
Sustainability
Energy infrastructure

ABSTRACT

The era of fossil fuels may be coming to an end. Our decades-old reliance on fossil fuels has degraded the environment. As a result, governments are shifting to renewable energy technologies. Renewable resources are considered to be sufficiently plentiful and the costs of producing energy per unit are lower; further economy of scale is making them affordable. The present energy mix consists of conventional thermal power plants that operate on fossil fuels, natural gas and renewable energy infrastructures. However, efficiencies of these energy facilities remain insufficient except for hydroelectricity. The lower performance results in inadequate energy production for huge populations and urbanization; thus, due to such reasons, scientists and researchers have adopted a new approach to deal with the efficiency issue. The new system is based on new techniques and study and development of new advanced materials used in the energy infrastructures. Some materials like graphene have been used for energy harvesting and storage in different energy technologies and facilities. Such materials are being studied and considered for various energy applications like energy storage, energy harvest, etc. To preserve our environment and solve the issues regarding efficiencies and energy storage systems, there is an urgent need to develop new materials to alleviate our efficient energy production and storage problem. This paper explores the various materials which have been introduced in multiple energy technologies as well as other energy-related applications.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Materials, Processing & Characterization.

1. Introduction

Energy has been one of the most critical topics for humanity since the Industrial Age. In the 21st century, the world faces the challenge of providing cheap, abundant electricity to meet the needs of a growing global population while preserving environmental values [1]. We utilize energy every day in a variety of ways. For example, we use electrical appliances in our homes that consume energy in electricity. Energy is a necessity for urbanization and economic development. The age of fossil fuel is coming to a close. Fossil fuels are being phased out because we have understood the concept of climate change and the impact of excess carbonization. Studies have shown that the remaining oil resources are expected to last for 190 years, natural gas for 230 years, and coal for 2900 years [2]. Such energy infrastructures consume diesel, coal, and gas as fuels and release tremendous amounts of greenhouse gases, accelerating climate change. As a result, renewable energy gained momentum worldwide. Literature indicates that using renewable energy sources instead of fossil fuels, such as bioenergy, solar energy, geothermal energy, hydropower, wind, and ocean energy, will eventually help the world attain sustainability [3]. There is a high demand for developing devices for efficiently using or storing renewable energy since renewable energy does not produce harmful emissions. Therefore, the current use of fossil fuels needs to be replaced with renewable energy to preserve our environment [4].

Materials for energy applications have been developed in recent years. These materials are used in energy infrastructure for various purposes. Such advanced materials are vital to develop cost-effective, high-efficiency and clean energy technologies. The primary aim of materials used in different coal-fired power plants is

* Corresponding author.
E-mail address: shashi.bahl@ptu.ac.in (S. Bahl).

https://doi.org/10.1016/j.matpr.2022.04.756

Selection and peer-review under responsibility of the scientific committee of the International Conference on Materials, Processing & Characterization.

Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Artificial intelligence and advanced materials in automotive industry: Potential applications and perspectives

Sayed Suhaib Kamran [a], Abid Haleem [a], Shashi Bahl [b,*], Mohd Javaid [a], Chander Prakash [c], Dharam Budhhi [d]

[a] Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India
[b] Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India
[c] School of Mechanical Engineering, Lovely Professional University, Phagwara 144411, India
[d] Division of Research & Innovation, Uttaranchal University, Uttarakhand, 248007, India

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Artificial intelligence (AI)
automobile Industry
Intelligent systems
Smart vehicles

ABSTRACT

The first part of this paper presents a literature review-based study of the most emerging technology of the century, artificial intelligence (AI) and its various applications in the automobile sector. In this era of the fourth Industrial Revolution (Industry 4.0), industries have become all the more sophisticated owing to the intelligent technologies employed to maximize production, quality, and profits; and minimize wastage, time and cost of production. This paper studies various aspects of AI and related tools and techniques and aims to employ them in the automobile industry to make modern vehicles smart, safe and reliable. Simultaneously, it strives to automate the drives, thereby reducing manual labor, increasing efficiency and relieving humans of performing mundane, repetitive tasks. This paper explores different areas of the automotive industry like the vehicle itself, the designing and manufacturing sectors, the after-sales services. It provides solutions to make each of them 'Intelligent'. The second part briefs us about advanced materials like polymer composites, carbon fiber, and high-strength steel. It discusses the various factors that make these intelligent materials feasible in the automobile industry and discusses the methods and areas of applications of these advanced materials in the automobile industry.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Materials, Processing & Characterization.

1. Introduction

The three industrial revolutions completely transformed the face of our industries from manufacturing goods using pure human labor, i.e. complete manual production, to producing those operating machines and finally mass production of goods using organized production and assembly lines. However, even with the incorporation of machines in the production process, humans play an essential role in a production by operating these machines and overlooking the entire process. Machines only reduce human intervention. They are not yet capable of completely replacing humans, and the primary reason behind this is their inability to think and act according to the situation. Unlike humans, machines do not have brains and cannot make decisions that require comprehensive understanding and consideration of various factors determining a decision's effectiveness and suitability. For example, a machine can be programmed to produce 'x' units of a commodity daily but cannot effectively increase or decrease the production in case of a change in demand. Another example is that the parking sensors on a car can only assist the driver in parking but cannot park the vehicle by itself, or the navigation systems can only tell the route that is least congested but cannot drive the car through traffic without a human being present on the driving seat and controlling the steering wheel, the accelerator and the brake pedals. Even the most sophisticated systems can only make the task easier by assisting humans but cannot completely take over the job.

With the ever-advancing technology and the never-ending desire of humans to achieve maximum comfort, it becomes inevitable to develop systems capable of completely replacing humans and completing a task independently. This led to the development of artificial intelligence, or in other words, machine or software programs that possess the ability to think, understand and make decisions like human beings [1]. Though artificial intelligence has not yet reached the epitome of its development, inchoate systems have been employed in various sectors of different industries. One

* Corresponding author.
E-mail address: shashi.bahl@ptu.ac.in (S. Bahl).

https://doi.org/10.1016/j.matpr.2022.04.727
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the International Conference on Materials, Processing & Characterization.

Special Issue: Advances in Processing & Characterisation of Materials

Institution of MECHANICAL ENGINEERS
Journal of PROCESS MECHANICAL ENGINEERING

Proc IMechE Part E:
J Process Mechanical Engineering
1–8

DOI: 10.1177/09544089221107992
journals.sagepub.com/home/pie
SAGE

Effects of nano filler powder during microwave-based joining of SS304 butt joints

Sony Salot[1], Shankar Sehgal[2], B. S. Pabla[1], Harmesh Kumar[2], Chander Prakash[3], Shashi Bahl[4] and Kuldeep K Saxena[5]

Abstract

Filler powder plays an important role during microwave hybrid heating-based joining process. In this work, nano-size nickel powder has been taken as filler material for preparing SS304-SS304 butt joints. Effects of size of nickel powder on mechanical properties (strength and hardness) of joints have been investigated. Scanning electron microscope tests show that the joints possess uniform microstructure. Energy dispersive spectroscopy tests demonstrated the presence of elements (Chromium, iron, carbon, silicon, manganese, phosphorus) other than filler powder (Nickel) in the joint region thereby confirming complete melting of joint region and also transfer of carbon from graphite separator sheet to joint region during microwave processing. Micro-hardness test results showed that nano-size filler powder-based joints are less prone to surface wear than corresponding micro-size filler powder-based joints. Micro-tensile strength of nano-size nickel powder-based joints is also far better than micro-size filler powder-based joints.

Keywords

Butt joints, filler material, joining, microwave hybrid heating, micro-hardness, strength

Date received: 25 February 2022; accepted: 17 May 2022

Introduction

Joining is a manufacturing process which helps in achieving desired components by joining two or more sub-components together. Conventional joining techniques have some limitations to join metals and alloys such as chances of having steep thermal gradients resulting into cracks formation, poor joint-quality, non-uniform micro-structure, energy losses, high energy consumption, environmental pollution etc.[1–4] These problems can be minimized by using microwave hybrid heating (MHH) based joining process instead of conventional joining processes. During microwave processing, interaction of microwaves and materials takes place at molecular level; which leads to energy conversion through dipole rotation and ionic conduction. The dielectric properties of processed materials decide the level of interaction of microwaves with the target materials. Absorption of microwaves in dielectric material depends upon the complex permittivity and loss tangent.[5]

$$\varepsilon = (\varepsilon' - j\varepsilon'') \tag{1}$$

$$\tan\delta = \frac{\varepsilon''}{\varepsilon'} \tag{2}$$

where ε, ε', j, ε'' and $\tan\delta$ are complex permittivity, absolute permittivity, electrical polarizability, dielectric loss factor and loss tangent respectively. ε' is related to the ability of microwaves to penetrate into material. ε'' and $\tan\delta$ indicate respectively, the capabilities of material to store and to efficiently convert absorbed energy to heat. Ceramics, ceramics composites and polymers are good absorbers of microwaves. Hence they can be easily processed through microwave processing. On the other hand, metallic materials are very good reflectors of microwaves because of very low skin depth.

Mechanical and micro-structural characterization of mild steel (MS) based joints was done by Bansal et al.[6] Formation of substitutional type of solid solution at interface region was confirmed through X-ray diffraction

[1]Department of Mechanical Engineering, National Institute of Technical Teachers Training and Research, Chandigarh, India
[2]Mechanical Engineering, UIET, Panjab University, Chandigarh, India
[3]School of Mechanical Engineering, Lovely Professional University, Phagwara, India
[4]Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur, India
[5]Mechanical Engineering Department, GLA University, Mathura, India

Corresponding authors:
Shankar Sehgal, Mechanical Engineering, UIET, Panjab University, Chandigarh, 160 014, India
Emails: sehgals@pu.ac.in; shankar.sehgal@alumni.iitd.ac.in

Chander Prakash, School of Mechanical Engineering, Lovely Professional University, Phagwara
Email: chander.mechengg@gmail.com

International Journal on Interactive Design and Manufacturing (IJIDeM)
https://doi.org/10.1007/s12008-022-00933-x

ORIGINAL PAPER

Optimisation of cutting parameters during turning of 16MnCr5 steel using Taguchi technique

Swapnil Agarwal[1] · Rajiv Suman[1] · Shashi Bahl[2] · Abid Haleem[3] · Mohd Javaid[3] · Munesh Kumar Sharma[4] · Chander Prakash[5] · Shankar Sehgal[6] · Piyush Singhal[7]

Received: 20 April 2022 / Accepted: 23 May 2022

Abstract
This research aims to propose an optimisation of cutting parameters during the CNC turning of 16MnCr5 steel materials utilising TiN coated cutting tools. Surface finish quality is a significant criterion for many turned workpieces in a machining operation. As a result, selecting optimised cutting parameters is significant for monitoring the desired surface quality. This research aims to investigate the best cutting conditions for achieving the lowest surface roughness and highest material removal rate in CNC turning of 16MnCr5 steel materials using the Taguchi method. Taguchi techniques were used to determine the best cutting parameters for each experiment measure. The orthogonal array, signal–noise ratio, and analysis of variance were utilised to investigate turning operation performance characteristics. According to ANOVA, the depth of cut plays a significant part in constructing larger MRR, and Feed plays a critical role in creating lower surface roughness. As a result, it is probable to increase machine consumption in an automated manufacturing setting while decreasing production costs.

Keywords CNC machining process · Taguchi method · Material removal rate (MRR) · Surface roughness

1 Introduction

The classical turning method transformed the raw material into the desired result. Compared to manual processes such as manual and semi-automatic lathes, the CNC machining process improves the efficiency of output parameters. The surface roughness of the final product is primarily responsible for product quality [1, 2]. It demonstrates that the majority of the industry is focused on quality assurance. Choosing the correct settings, particularly for surface roughness, is critical to achieving good surface roughness. A surface roughness tester can be used to assess surface quality.

16MnCr5 steel is used as a workpiece and the turning operation is carried out with the TNMG160404 carbide-coated cutting tool. The categorisation in the turning process is analysed using an L9 orthogonal array. The workpiece material was 16MnCr5 steel which was processed in a CNC lathe machine at varying cutting speeds, feed rate and depth of cut. The Taguchi technique optimises surface roughness and material removal rate [3–5]. The Optimisation approach will provide us with minimal surface roughness and the highest material removal rate. The results reveal that feed is an essential requirement for achieving the appropriate surface roughness and the desired material removal rate level determines the depth of cut. Taguchi technique and ANOVA are included in this software. Gilbert's [6] research focuses on optimising machining settings in the turning process, which enhances output while decreasing costs. Dave et al. [7] used TiN coated cutting tools in this study, and the machining characteristics of several grades of EN materials were evaluated

✉ Shashi Bahl
shashi.bahl@ptu.ac.in

1 Department of Industrial and Production Engineering, G.B. Pant University of Agriculture and Technology, Pantnagar 263153, India

2 Department of Mechanical Engineering, I.K. Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur 146001, India

3 Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi 110025, India

4 Division of Research and Innovation, Uttaranchal University, Uttarakhand 248007, India

5 School of Mechanical Engineering, Lovely Professional University, Phagwara 144411, India

6 UIET, Panjab University, Chandigarh 160014, India

7 Department of Mechanical Engineering, GLA University, Mathura 281406, India

Published online: 23 June 2022

Indian Journal of Engineering & Materials Sciences
Vol. 29, June 2022, pp. 331-344

Recent advances in additive manufacturing for current challenges, materials and their applications

Ajay Singh Verma[a], Atul Bisht[b], Suman Kant[b], & Shashi Bahl[a*]

[a]Department of Mechanical Engineering, I K Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur, Punjab 146 001, India
[b]Production & Industrial Engineering Department, PEC University of Technology, Chandigarh 160 012, India

Received: 25 January 2022; Accepted: 16 February 2022

Additive Manufacturing (AM) technology in 3-D printing has grown into a great field in today's technological world, especially in manufacturing sectors. Various AM technologies have been developed presently and their advancement has been processed worldwide is presented. Their advancement included usability and compatibility of the different types of material. Moreover, the applications of 3-D printing via different AM technologies in biomedical applications, dental implants, pharmaceutical industries, chemical processing equipment, structural components, automotive industries, marine sectors, aerospace sectors, sports equipment and food processing industries have been presented. However, suggested applications via different AM technologies have also been reported. Further, the challenges in development of the 3D structure via different AM technologies have also been discussed. The remedial/treatment like pre and post processing operations, tool path planning, and slicing orientation have also been suggested in printing of the sound 3D complex structure.

Keywords: Additive manufacturing, 3-D printing, Materials, Applications, Challenges

1 Introduction

There have been various traditional and non-conventional methods to fabricate the 3D structure in order to meet the consumer expectations. The revolution in industry has drastically changed from conventional to advanced manufacturing processes like rapid prototyping, additive manufacturing. Advanced manufacturing means structured and effective production, which involves computer modeling, simulation, and design. Additive manufacturing is the advanced manufacturing process that is a cornerstone in the third industrial revolution[1] which has existed for over the past three decades. Recently, Additive Manufacturing (AM) also known as three-dimensional (3-D) printing or rapid prototyping, got attention due to an efficient production methodology approach. Moreover, this technology has got more attention due to expiry of the major patents. The last patent in AM has been expired in 2009 on fused deposition modeling (FDM), afterwards the technology was then accessible by many distinct industries and 3-D printers could be manufactured without violating intellectual property rights.

The terms AM and 3-D printing have been indistinguishable. The word AM refers to the technology of accumulating progressive layer of material over one another, producing final 3D structure through CAD model data. However, 3-D printing is the technology that prints 3D structure through deposition of layers of materials with the help of print hothead, extruder nozzle or any other printing process[2]. In the AM technology, the rapid prototyping was the first application where the 3D model have been produced effectively which has to undergo further quality control and inspection tests before mass production. Previously, Charles (Chuck) W. Hull in 1980 successfully printed the 5cm tall tea cup with stereolithography apparatus (SLA-1), an AM technology[3]. Towards the end of the 1980s, selective laser sintering (SLS) technology has been the new revolution in powder metallurgy processing which was developed at University of Texas by C.R. Deckard. In this SLS technology, powdered particles was melted by focused laser beams[4]. Further, C.S. Crump invented fused deposition modeling (FDM) technology in the late 1980s. In his invention, the accumulation of thermoplastic material took place layer-by-layer through a 3-axis robot[5]. The apparatus and procedure which have been used in this FDM technology was patented in 1992 and founded Stratasys Inc. After the development of these technologies, there were no practical applications in industries that were implemented due to being expensive as compared to existing technology. It has

*Corresponding author (E-mail:shashi.bahl@ptu.ac.in)

Indian Journal of Engineering & Materials Sciences
Vol. 29, June 2022, pp.

Experimental investigation for the dynamic characteristics of short natural fiber reinforced composite materials

Kartikay Singh Pawar[a], Ashok Kumar Bagha[a], Shashi Bahl[b*], & Manoj Kumar Agrawal[c]

[a]Department of Mechanical Engineering, Dr B R Ambedkar National Institute of Technology, Jalandhar, Punjab 144 011, India

[b]Department of Mechanical Engineering, I K Gujral Punjab Technical University Hoshiarpur Campus, Hoshiarpur, Punjab 146 001, India

[c]Department of Mechanical Engineering, GLA University, Mathura, Uttar Pradesh 281 406, India

Received: 25 January, 2022; Accepted: 16 February, 2022

The study of mechanical and dynamic characteristics of composite materials is important. Vibration is one of the major problems faced because of the uncertainty and the disturbances due to its surroundings. For composite being used in the structures like aircraft, automobiles, railway coaches and buildings it should have sound mechanical and dynamic characteristics. Many researchers have been interested in the natural fiber based composite materials for solving problems such as environmental sustainability while also having good mechanical properties. In this paper, our objective is to explore the use of the short fiber and studied the dynamic and mechanical characteristics of banana-epoxy; kenaf-epoxy and hemp-epoxy natural fiber reinforced composite materials. The use of short fibers in the composites makes it easy to process and thus reduces the production cost when compared to composites which are made from long fiber mat. All composites which are fabricated have shown enhancement in the mechanical strength when the fiber loading in the composite is increased. It is concluded that the composite samples prepared from kenaf, banana and hemp shows better damping characteristics when compares to the neat epoxy material. It is also found that the hemp fiber based composite has shown the highest tensile strength and kenaf fiber based composite has shown the highest damping properties.

Keywords: Short natural fibers, Damping, Tensile strength, Fabrication, Modal analysis

1 Introduction

The conventional composite materials use synthetic fibers such as glass, carbon etc. as reinforcement. Increase in demand of more sustainable products and environmental consciousness has led to less use of these conventional composite materials and increased use of natural fiber based composites. The composite materials based on natural fibers case less pollution, are biodegradable in nature and have very less health hazards as compared to the composites based on synthetic fibers[1,2]. These renewable materials have great potential in replacing the traditional composite materials. Better understanding of the static and dynamic properties of the composite materials is required to use them in structural components. In many industrial applications, specially, for automotive industry, the important factors are the sound absorption, dynamic and damping properties.

The composite materials exhibit much better energy dissipation performance as compared to the traditional materials. This property of composite materials makes them a better alternative to improve the vibration damping performance. Natural fiber reinforced composite materials possess good mechanical properties, are light in weight, exhibit good sustainability and are environment friendly[3,4]. Natural fibers exhibit good potential and have number of benefits including low density, low cost and good sustainability[5]. Natural fiber reinforced composite materials show better acoustic performance and vibration damping properties as compared with the composites based on synthetic fibers[6,7]. Natural fiber based composite materials such as Flax fiber/polypropylene composite material has been used extensively in automotive industry[8]. The significance of natural fiber based composite are becoming more important due to their numerous benefit. Short and randomly oriented fiber based composite found use in many applications due to their easy fabrication. The composite which are fabricated with short fiber possess good mechanical properties such as stiffness, tensile stress and durability[9].

The natural fiber composite has shown great potential to fabricate the composite as they are environmentally sustainability and also have good mechanical properties[10–13]. The use of the natural fiber

*Corresponding author (E-mail: shashi.bahl@ptu.ac.in)

Original article

Institution of MECHANICAL ENGINEERS
Journal of PROCESS MECHANICAL ENGINEERING

Metallurgical, mechanical and tribological behavior of Reinforced magnesium-based composite developed Via Friction stir processing

Proc IMechE Part E:
J Process Mechanical Engineering
1–12

DOI: 10.1177/09544089211063099
journals.sagepub.com/home/pie
SAGE

Prem Sagar[1], Amit Handa[1] and Gitesh Kumar[2]

Abstract

Reinforced magnesium metal matrix nanocomposites (MMMNCs) have piqued the interest of scientific community in recent years. Friction stir processing (FSP) is a known process to achieve the highest level of secondary phase nanocomposites distribution in the base monolithic matrix. In this study, an attempt has been made to synthesize magnesium base AZ61A/n-TiC nanocomposites using FSP and the influence of tool rotational speed on the metallurgical, mechanical, and tribological behavior of the developed composites has been studied. Microstructural examination shows that as tool rotational speed increases, high plastic deformation occurs and heat is generated along with the concomitant shattering impact of rotation, which consequently develops larger grains in the stir zone. However, this also provides thrusts resulting in uniform distribution of the nanoparticles in the base matrix. Microhardness and ultimate tensile strength of the developed nanocomposite were found to be significantly improved when contrasted with the base metal. Lower wear rate was observed for the composite developed at 800 rpm along with the abrasive type of wear mechanism.

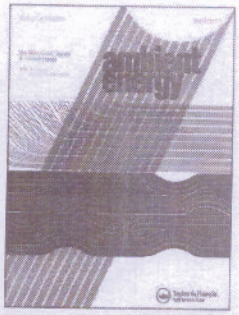
Keywords

Friction stir processing, AZ61A magnesium alloy, Micro-hardness, Tensile strength, wear

Date received: 29 July 2021; accepted: 9 November 2021

Introduction

Researchers have Reported that in addition to improvement of the aerodynamic properties, up-gradation of the accessories, optimization of drive efficiency, improvement of tire rolling resistance, one way to control carbon dioxide emissions are reducing the vehicle weight (Cui 2008). For manufacturing lightweight vehicles to reduce GHG emissions, the demand for the development of lightweight materials in the past few decades has accelerated to an enormous degree. In addition to above, these novel materials are required to have high strength-to-weight ratios and low density for maximum use. Therefore, accentuation has now been on the creation of lightweight and reasonable strength materials to cater high corrosion rate which constraints their extensive use in structural applications.[1,2] Numerous investigations have reported that these properties could be proficiently and viably improved by the incorporation of stiffer reinforcement particulates in various base alloys.[3,4] Adding Nano/reinforce particulates is a promising approach as detailed by.[5] For the homogeneous dispersion of the reinforcements and uniform distribution of the particulates, Friction stir processing (FSP) is considered to be the far head of other technologies. FSP is based on the principle of friction stir welding, which has been effectively used by numerous researchers to join lightweight materials.[6–8] The detailed study of FSP is presented elsewhere.[9] Due to uncommon attributes such as high temperature and strain, FSP develops composites with uniform



International Journal of Ambient Energy

Taylor & Francis
Taylor & Francis Group

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/taen20

Influence of irradiation and addition of antioxidants on the oxidation stability of Jatropha, Pongamia, and Tectona Grandis biodiesels.

Meetu Singh, Neerja Sharma, Amit Sarin, Sujeet Kesharvani, Chandrabhushan Tiwari, Tikendra Nath Verma & Gaurav Dwivedi

To cite this article: Meetu Singh, Neerja Sharma, Amit Sarin, Sujeet Kesharvani, Chandrabhushan Tiwari, Tikendra Nath Verma & Gaurav Dwivedi (2022): Influence of irradiation and addition of antioxidants on the oxidation stability of Jatropha, Pongamia, and Tectona Grandis biodiesels., International Journal of Ambient Energy, DOI: 10.1080/01430750.2022.2058999

To link to this article: https://doi.org/10.1080/01430750.2022.2058999

Accepted author version posted online: 29 Mar 2022.

Environ Monit Assess (2022) 194:119
https://doi.org/10.1007/s10661-021-09746-z

Dosimetry of indoor alpha flux belonging to seasonal radon, thoron and their EECs

Anjali Kaushal · Manish Joshi · Amit Sarin · Navjeet Sharma

Received: 25 March 2021 / Accepted: 23 December 2021

Abstract Radon (^{222}Rn) and thoron (^{220}Rn) are ubiquitous radioactive noble gases present in the earth's crust. The source term for these gases includes soil and building materials as well. The radiological impact of radon/thoron gases and their decay products on human life is a matter of concern and has been given due attention in research and policy. The present study aims to measure and quantify residential radon/thoron gas and the decay product's concentration and to discuss the associated interpretations for Ludhiana district of Punjab, India. Passive measurement techniques employing a single-entry pinhole dosimeter for gases and direct progeny sensors for the decay product's concentration have been used in this work. The obtained data from these measurements have been analysed using appropriate statistical techniques. The variations have been linked with the changes in the ventilation conditions, building material, room type and altitude. A higher concentration of radon and thoron gas was observed in the winter season for the study region. It was estimated that the contribution of radon and thoron decay products towards the annual average inhalation dose is 75% and 25%, respectively.

Keywords Radon · Thoron · Progeny · Pinhole dosimeter · Inhalation dose · Seasonal dependence

A. Kaushal (✉)
Department of Physical Sciences, I.K.G. Punjab Technical University, Kapurthala 144601, Punjab, India
e-mail: anjali13kaushal@gmail.com

A. Kaushal · N. Sharma
Department of Physics, D.A.V. College, Jalandhar 144008, Punjab, India

M. Joshi
Radiological Physics & Advisory Division, Bhabha Atomic Research Centre, Mumbai, India

A. Sarin
Department of Physical Sciences, I.K.G. Punjab Technical University, Amritsar Campus, Amritsar 143105, Punjab, India

Introduction

Exposure of human beings to the ionizing radiations present in the natural environment has associated health risk concerns. Radon (^{222}Rn) and thoron (^{220}Rn) are radioactive gaseous elements produced as immediate decay products of ^{226}Ra and ^{224}Ra respectively, found in decay chains of ^{238}U and ^{232}Th present in earth's crust. Radon having half-life ($t_{1/2}$) of 3.8235 days decays by alpha radiation of energy 5.48 MeV where as thoron having half-life ($t_{1/2}$) of 55.6 sec emits alpha radiation of energy 6.28 MeV. Radon has been long known as lung cancer causing agent (Darby et al., 2005; Stojanovska et al., 2011). Radon and thoron gases enter into the indoor air through the process of exhalation from soil and building materials (Nazaroff and Nero, 1988).These gases and their decay products present in air enter the human body mainly through inhalation. Recent studies have established that thoron

Published online: 24 January 2022

Journal of Radioanalytical and Nuclear Chemistry
https://doi.org/10.1007/s10967-021-08050-x

Quantification of doses and health risks to organs and tissues corresponding to different age groups due to radon in water

Amit Sarin[1] · Anjali Kaushal[2,4] · Bikramjit Singh Bajwa[3] · Navjeet Sharma[4]

Received: 23 March 2021 / Accepted: 8 October 2021

Abstract
This paper quantifies the inhalation and ingestion doses to different organs and tissues due to radon dissolved in drinking water. For this a study was under taken in Ludhiana district of Punjab, India. Radon enters the human body through respiratory tract during inhalation and through stomach during ingestion process. Utilizing the measured radon concentrations in water samples and adopting dose conversion models, ingestion doses corresponding to different age groups (infants, 1-year, 5-year, 10-year, 15-year and adults) were estimated. The study concludes that the maximum dose is received by the stomach as compared to other organs and tissues. Dose to lower age groups was found to be higher than that for the adults. Cancer mortality and morbidity risks have also been estimated for different cancer-sites. Stomach was seen to possess maximum cancer mortality risk for both male and female gender. An assessment of contribution of radon dissolved in water radon to indoor concentration was also made.

Keywords Inhalation dose · Ingestion dose · Cancer mortality risk · Cancer morbidity risk · Incremental indoor radon concentration

Introduction

Due to the special biological role of water in the body, it is very important to regularly examine the quality of water being consumed by humans since it can have very serious health implications. One of the parameter indicating the suitability of water for drinking purpose is its bacteriological quality. It has been reported that due to poor bacteriological quality of drinking water, about 50% urban population in developing countries, at any time, is affected by infectious diseases such as cholera, dysentery, typhoid, viral hepatitis A, ameobiosis, Shigellosis etc. [1, 2]. Besides the bacteriological contamination, mineralogical composition of drinking water is also important. Presence of certain heavy elements such as lead, arsenic etc. and certain radioactive elements, beyond permissible limits, can have detrimental effects on human health. Elevated levels of radiological sources such as radon and uranium, can also lead to significant health impacts which are discussed briefly in following paragraphs [4]. So, radiological contamination of drinking water is also an important parameter to study. Groundwater reaches us after traversing through rocks and soil and its quality is influenced by the transfer of contaminants from these matrices.

Radon, a radioactive gas present in air and soluble in water, is a major source of radiation dose for humans [5, 6]. Radon-222, an intermediate decay product in U-238 decay series, produced by alpha decay of Ra-226, is the only gaseous element in the decay series. It has a half-life of 3.82 days and considered as hazardous if inhaled or ingested in high concentration for long periods. Radon can enter in our bodies via two pathways: inhalation and ingestion. Radon present in indoor air enters the body through inhalation during breathing. Being an air quality contaminant, it has been given due importance when assessing radiation risk for some of the specified cases. Studies in past have highlighted the

✉ Anjali Kaushal
anjali13kaushal@gmail.com

1 Department of Physical Sciences, I.K.G. Punjab Technical University, Amritsar campus, Amritsar, Punjab 143105, India

2 Department of Physical Sciences, I.K.G. Punjab Technical University, Kapurthala, Punjab 144601, India

3 Department of Physics, Guru Nanak Dev University, Amritsar, Punjab 143005, India

4 Department of Physics, D.A.V. College, Jalandhar, Punjab 144008, India

Published online: 29 October 2021

Fluctuation and Noise Letters
Vol. 20, No. 4 (2021) 2150033 (8 pages)

DOI: 10.1142/S0219477521500334

World Scientific
www.worldscientific.com

Analysis of Nonlinear Active Noise Behavior of Fuzzy Controller Using Non-Perturbation Methods

Monika Rani*,‡, Rakesh Goyal† and Vikramjeet Singh†

*Kanya Maha Vidyalaya
Jalandhar, Punjab, India

†I K Gujral Punjab Technical University
Kapurthala, Punjab, India
‡gargnitk24@gmail.com

Received 4 October 2020
Accepted 11 November 2020
Published 26 December 2020

Communicated by He Wen

In this paper, a Fuzzy controller model has been converted into a time-dependent nonlinear model and then quadratic Riccati differential equation was analyzed to satisfy the solution of the nonlinear active noise behavior of Fuzzy controller. Further, the approximate solutions of this equation using non-perturbation methods i.e., adomian decomposition method (ADM), variational iterational method (VIM) and homotopy perturbation method (HPM) were investigated. A comparison of these methods has also been given with tabular and graphical presentations. Our results reveal that VIM provides the closest approximate solution and fast convergence for the proposed model as compare to ADM and HPM.

Keywords: Quadratic Riccati differential nonlinear differential equation; adomian decomposition method (ADM); variational iterational method (VIM) and homotopy perturbation method (HPM); Fuzzy controller.

1. Introduction

Most of the nonlinear systems have the problem of the stability and computational complexity. These problems can be reduced by splitting the system into a number of local linear systems. Various methods have been proposed to find the common stability of these local linear systems by the researchers. The fuzzy controller can be analyzed by designing differential equations. These equations have been widely used in optical, network synthesis, medical, controllers, quantum mechanics, trajectory tracking, modeling, means, financial mathematics, multi-input–multi-output (MIMO) systems, spacecraft attitude control fields of physical sciences, mathematics, chemistry, engineering, etc. [1–8]. The Riccati differential equation

Singh et al. Visual Computing for Industry, Biomedicine, and Art (2022) 5:3
https://doi.org/10.1186/s42492-021-00100-1

Visual Computing for Industry, Biomedicine, and Art

ORIGINAL ARTICLE Open Access

Comparative analysis of proficiencies of various textures and geometric features in breast mass classification using k-nearest neighbor

Harmandeep Singh[1*], Vipul Sharma[1] and Damanpreet Singh[2]

Abstract

This paper introduces a comparative analysis of the proficiencies of various textures and geometric features in the diagnosis of breast masses on mammograms. An improved machine learning-based framework was developed for this study. The proposed system was tested using 106 full field digital mammography images from the INbreast dataset, containing a total of 115 breast mass lesions. The proficiencies of individual and various combinations of computed textures and geometric features were investigated by evaluating their contributions towards attaining higher classification accuracies. Four state-of-the-art filter-based feature selection algorithms (Relief-F, Pearson correlation coefficient, neighborhood component analysis, and term variance) were employed to select the top 20 most discriminative features. The Relief-F algorithm outperformed other feature selection algorithms in terms of classification results by reporting 85.2% accuracy, 82.0% sensitivity, and 88.0% specificity. A set of nine most discriminative features were then selected, out of the earlier mentioned 20 features obtained using Relief-F, as a result of further simulations. The classification performances of six state-of-the-art machine learning classifiers, namely k-nearest neighbor (k-NN), support vector machine, decision tree, Naive Bayes, random forest, and ensemble tree, were investigated, and the obtained results revealed that the best classification results (accuracy = 90.4%, sensitivity = 92.0%, specificity = 88.0%) were obtained for the k-NN classifier with the number of neighbors having k = 5 and squared inverse distance weight. The key findings include the identification of the nine most discriminative features, that is, FD26 (Fourier Descriptor), Euler number, solidity, mean, FD14, FD13, periodicity, skewness, and contrast out of a pool of 125 texture and geometric features. The proposed results revealed that the selected nine features can be used for the classification of breast masses in mammograms.

Keywords: Mammography, Breast cancer, Machine learning, Classification

Introduction

Breast cancer continues to be one of the deadliest diseases. It is caused by the invasion of abnormal cells across the usual boundaries due to uncontrolled growth and division [1]. According to the latest statistics, female breast cancer remains a significant hurdle, with an estimated 2.26 million new cancer cases, accounting for nearly 24.5% of the 9.22 million new cancer cases diagnosed among women in 2020. Breast cancer has surpassed lung cancer in terms of the cause of mortality among women, accounting for 15.5% of the total 4.43 million deaths in women of all age groups due to cancer [2]. Early detection of breast cancer is the only entity that can help reduce the death rate [3]. Screening using mammogram images is still considered the best, most reliable, and economical method for the detection of early signs of breast cancer. Radiologists must carefully examine mammogram images to detect abnormalities

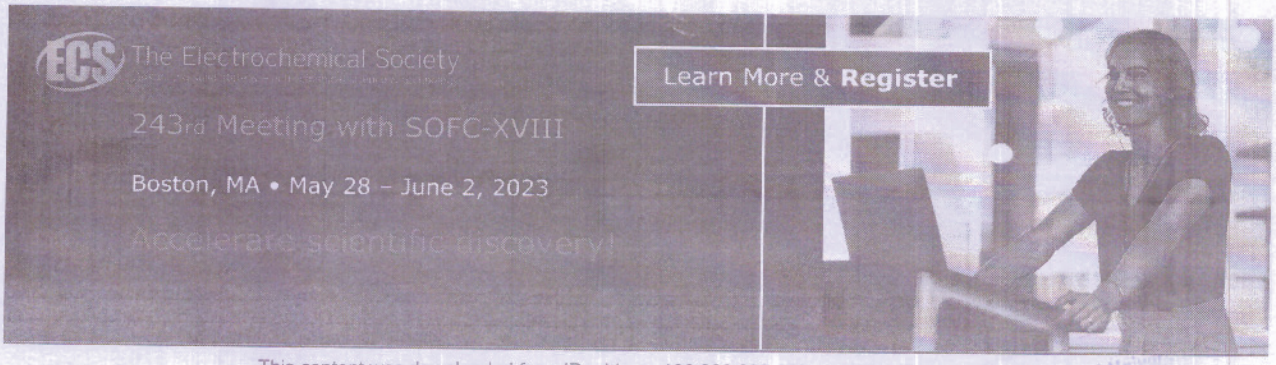
* Correspondence: singh.harman.saini@gmail.com
[1]Department of Computer Science and Engineering, IKG Punjab Technical University, Jalandhar, Punjab 144603, India
Full list of author information is available at the end of the article

Journal of Physics: Conference Series

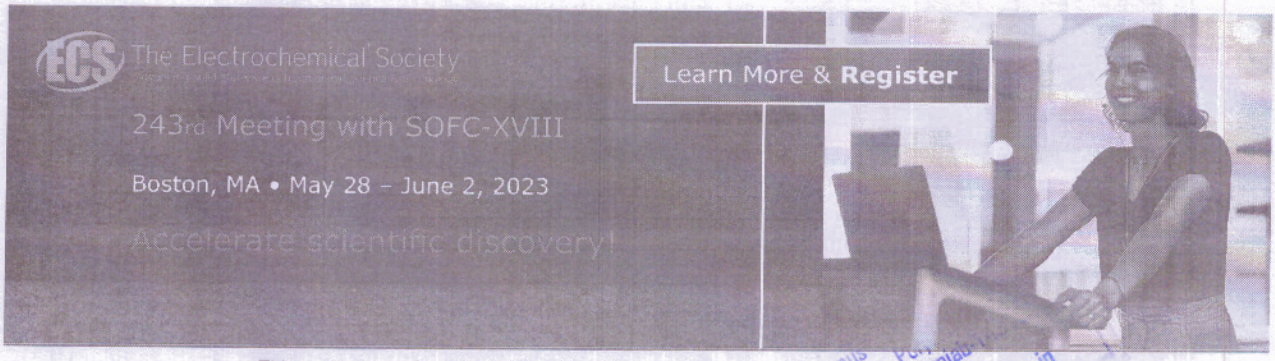
PAPER • OPEN ACCESS

Computer aided diagnosis of liver ultrasound images using K-nearest neighbour approach

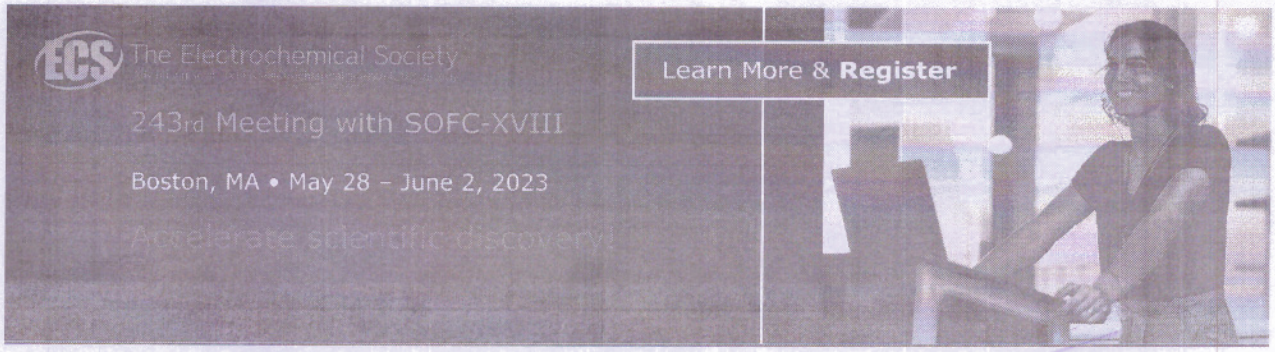
To cite this article: V Sharma and V Sharma 2022 *J. Phys.: Conf. Ser.* **2267** 012060



Machine learning based computer aided diagnosis system for classification of breast masses in mammograms



Mammogram Image Retrieval System Using Texture and Semantic Features



Received: April 28, 2022. Revised: May 18 2022.

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International Journal of
Intelligent Engineering & Systems

http://www.inass.org/

Exploiting the Performance of Marine Predators Optimization Algorithm in Combination with Neural Network Classifiers for Breast Mass Classification

Harmandeep Singh[1]* Vipul Sharma[1] Damanpreet Singh[2]

[1]*Department of Computer Science and Engineering, IKG Punjab Technical University, Jalandhar, 144603, India*
[2]*Department of Computer Science and Engineering, Sant Longowal Institute of Engineering and Technology, Sangrur, 148106, India*
* Corresponding author's Email: singh.harman.saini@gmail.com

Abstract: Recently, breast cancer has achieved top position in terms of cause of mortality among women of all age groups by surpassing the lung cancer. To improve the survival rate, timely assessments are essential. Mammography is the best modality among the most widely used timely detection modalities. The radiologists' manual reading may have an impact on the accuracy of the diagnosis. As a result, the computer-aided diagnosis (CAD) systems are being developed as tools to reduce the false alarms and to increase the diagnosis accuracy. In this study, an attempt has been made to improve the diagnosis performance of the CAD systems by incorporating recently developed marine predators algorithm (MPA) in conjunction with three different neural network classifiers including feedforward neural network (FFNN), cascade forward neural network (CFNN), and recurrent neural network (RNN). Unlike other existing studies, fully digital mammogram images from INbreast dataset have been employed for testing of the system proposed in this study. Experimental results reveal that the best classification performance [Accuracy 97.34%, Sensitivity: 98.40%, Specificity: 100.00%] is obtained when MPA is used in conjunction with RNN classifier. To demonstrate the usefulness of the proposed system, the obtained results are compared with the results obtained using already invented CAD systems in previously published studies using the same dataset. The findings suggest that the proposed system is acceptable for real-time clinical applications.

Keywords: Computer-aided diagnosis, Breast masses, Feature selection, Metaheuristic algorithms.

1. Introduction

For many years, cancer has been one of the most serious risks to human life. In both developed and developing countries, breast cancer is one of the most important health challenges. Lung cancer has now been superseded by breast cancer as the leading cause of death among women of all ages, according to recent figures [1]. It is mostly caused by aberrant cells invading over normal cell borders as a result of unregulated growth and division [2]. Breast cancer is distinguished by a variety of anomalies, including breast lumps, microcalcifications, architectural distortions, and bilateral asymmetry. Breast lumps/masses are the most prevalent and potentially hazardous type of abnormality. Breast cancer has already been established to have only one prognosis: timely/early identification [3]. CAD systems based on mammograms are being used as a second reader to assist radiologists in the early detection of breast cancer [4, 5].

Several researchers have already made major contributions in this area and large number of CAD systems have already been proposed in the literature. For instance, Sharma and Khanna [6] (2014) developed a CAD system for detection and classification of masses. Features based on the Zernike moments (ZM) of different orders were extracted and the support vector machine (SVM) classifier was used for breast lesion classification. The proposed CAD system obtained both sensitivity and specificity of 99 % on the image retrieval in medical applications (IRMA) reference dataset, and a sensitivity and specificity of 97 % and 96 % on the

 DOI: 10.22266/ijies2022.0831.32

Kuwait Journal of Science

ISSN 2307-4108 (Print)
ISSN 2307-4116 (Online)
DOI: 10.48129/kjs

Quantum behaved Intelligent Variant of Gravitational Search Algorithm with Deep Neural Networks for Human Activity Recognition

10.48129/kjs.18531

Sonika Jindal
Dept. of Computer Science and Engineering, I. K. Gujral Punjab Technical University, Jalandhar, India

Monika Sachdeva
Dept. of Computer Science and Engineering, I. K. Gujral Punjab Technical University, Jalandhar, India

Alok K. S. Kushwaha
Guru Ghasidas Vishwavidyalaya , Bilaspur, India

DOI: https://doi.org/10.48129/kjs.18531

Abstract

Human activity recognition (HAR) encompasses the detection of daily routine activities to advance usability in detecting crime and preventing dangerous activities. The recognition of activities from videos and image sequences with higher exactitude is the major challenge. This research work presents an automated system to recognize individual and group activities with major focus is the proposal of a novel quantum behaved intelligent variant of gravitational search algorithm to optimize the features for activity recognition. The proposed intelligent variant is termed as INQGSA which optimizes the features by using the advantageous attributes of quantum computing (QC) and intelligent gravitational search algorithm (INGSA). The INGSA adds the intelligent factor in the classical gravitational search algorithm (GSA) to avoid the trapping of agents in later iteration. The intelligent factor updates the position of mass agents by using the information of best and worst agents in an iteration. The addition of quantum computing based attributes (such as quantum bits, their superposition, and quantum gates, etc.) ensures the better diversity of discrete optimized features. The INQGSA approach optimizes the features extracted using rotation invariant local binary pattern. Finally, the optimized selected features are utilized by deep neural networks (DNN) for activity recognition. Here, the DNN models of ResNet-50V2 and ResNet-101V2 are included for the classification of activities. The experiments for the proposed system are conducted on the UCF-101 dataset containing 101 activities relevant to sports, playing musical instruments, human-human interactions, body motion, and human-object interaction. The performance comparison of the

International Journal of Modern Physics C
(2022) 2250146 (19 pages)

DOI: 10.1142/S0129183122501467

A novel quantum-behaved binary firefly algorithm with gravitational search algorithm to optimize the features for human activity recognition

Sonika Jindal* and Monika Sachdeva†

Department of Computer Science & Engineering
IK Gujral Punjab Technical University, Jalandhar, India
**sonikajindal@sbsstc.ac.in*
†*monika@ptu.ac.in*

Alok Kumar Singh Kushwaha

Department of Computer Science & Engineering
Guru Ghasidas Vishwavidyalaya, Bilaspur, India
alokkumarsingh.jk@gmail.com

Received 24 December 2021
Revised 12 March 2022
Accepted 19 March 2022
Published 21 May 2022

This paper proposes a novel optimization approach of the quantum-behaved binary firefly algorithm with a gravitational search algorithm (QBFA-GSA) for discrete feature optimization, which is utilized for the application of human activity recognition. The firefly algorithm (FA) and gravitational search algorithm (GSA) are recently introduced meta-heuristic algorithms that are efficient for optimizing the continuous solution set. The binarized version of the proposed approach enables it to optimize the discrete features and quantum behavior ensures the better diversity of the final optimized features. In the proposed QBFA-GSA approach, the features are optimized by following the combined advantageous attributes of FA and GSA in which the search space is initially explored by firefly agents until the current firefly finds the brighter firefly and further these agents adapt the attributes of GSA to complete the process. These optimized features are passed to deep neural networks (DNN) for the classification of human activities. Here, DNN models of deep convolutional neural networks (DCNN) and DCNN extended with residual blocks (DCNN-RB) are incorporated. The evaluation experiments for human activity recognition are conducted on a benchmark dataset of UCF-101, which is a composition of 101 different activities. The experimental results of the proposed QBFA-GSA approach are superlative to state-of-art techniques, which indicate that the proposed approach is efficient to optimize the features.

Keywords: Quantum computing; gravitational search algorithm; deep neural networks; discrete optimization; meta-heuristic; firefly algorithm; human activity recognition; feature selection.

PACS Nos.: 03.65.−w, 07.05.Mh, 45.10.Db, 89.20.Ff.

*Corresponding author.

Performance evaluation of machine learning based voting classifier system for human activity recognition

Sonika Jindal [1],* Monika Sachdeva [2], Alok K. S. Kushwaha [3]
[1,2,3] *Dept. of Computer Science and Engineering*
[1,2] *I. K. Gujral Punjab Technical University, Jalandhar, India*
[3] *Guru Ghasidas Vishwavidyalaya , Bilaspur, India*
**Corresponding author: sonikajindal@sbsstc.ac.in*

Abstract

In the last few decades, Human Activity Recognition (HAR) has been a centre of attraction in many research domains, and it is referred to as the potential of interpreting human body gestures through sensors and ascertaining the activity of a human being. The present work has proposed the voting classifier system for human activity recognition. For the voting classifier system, five machine learning classifiers are considered: Logistic Regression (LR), K-Nearest Neighbour (KNN), Random Forest (RF), Naive Bayes (NB), and Support Vector Machine (SVM). These machine learning classifiers are ensembled by analyzing the best performers among them. The ensemble voting classifiers are proposed under two variations, i.e., hard voting and soft voting. The various combinations of voting classifiers are compared and evaluated. For experiments, the benchmark dataset of the UCI-HAR dataset is considered, and all the data files are combined into a single file to avoid bias. The dimensionality of the dataset is reduced by using Principal Component Analysis (PCA) from 561 features to 200 components. The results reveal that Voting Classifier-II (a combination of SVM, KNN, and LR) using soft voting outperformed other machine learning classifiers.

Keywords: Hard voting; human activity recognition; machine learning; pattern recognition; soft voting; voting classifier

1. Introduction

HAR is a process of interpreting human body gestures or movements through sensors that are useful for numerous research domains, including human machine communication, robotics, etc (Yayan *et al.*, 2021). However, recognizing human activities is a very hard job to do because of unresolved challenges such as sensor mobility, sensor deployment, disordered background, and intrinsic unpredictability in the sense of how various human activities are conducted. A HAR system has the ability to simplify or automate many of the routine tasks of humans by recognizing them. The methods employed for HAR can be divided into two types: invasive and non-invasive. The invasive methods make use of wearing sensors to track subjects with the aim of developing a large dataset to learn from models (Sjarif & Shamsuddin, 2015). The non-invasive HAR, on the other hand, reduces the need for any wearable gadgets to monitor human activities. Such systems use Wi-Fi signals that are openly accessible in almost all premises.

HAR involves crucial activities in the classification task, such as sitting, falling, and human non-appearance, etc. All these movements are related to the smart home application, whereas the falling activity is specifically related to the health assistance of the elderly, where it is not possible to install cameras in separate rooms but a requirement to monitor the patients. The fact that the human body has an impact on the signal due to its reflection and several activities lead to the display of diverse attributes motivates the concept of Human Activity Recognition in which Wi-Fi signals are utilized. Furthermore,

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Available online at www.ijpe-online.com

International Journal of Performability Engineering

vol. 18, no. 9, September 2022, pp. 660-667
DOI: 10.23940/ijpe.22.09.p7.660667

Human Activity Recognition using Ensemble Convolutional Neural Networks and Long Short-Term Memory

Sonika Jindal[a,*], Monika Sachdeva[a], and Alok Kumar Singh Kushwaha[b]

[a]*Department of Computer Science and Engineering, IKG Punjab Technical University Jalandhar, Kapurthala, 144603, India*
[b]*Department of Computer Science and Engineering, Guru Ghasidas Vishawavidyalya, Bilaspur, 495009, India*

Abstract

Recent advances in artificial intelligence have transformed the world into a place where things can be recognized, the surroundings can be learned, and future sequences can be predicted. The advent of advanced technologies has resulted in improving the system and reducing the cost of monitoring systems. This study proposes an advanced ensemble approach of convolutional neural networks and long short-term memory (CNN-LSTM) for human activity recognition. The proposed approach evaluates the spatio-temporal features and recognizes the activities with enhanced accuracy. The method determines the activities by utilizing the RGB, skeleton, and depth-based attributes available in the dataset of UTD-MHAD. The experiments are conducted for the hand/arm-based 21 activities for which videos were captured with the help of depth and inertial sensors. The result evaluations are conducted with the measures of accuracy, precision, recall, and f-measure. These evaluations indicate the superior performance of the proposed ensemble approach compared to state-of-art techniques.

Keywords: human activity recognition; image and video processing; pattern recognition; convolutional neural networks; long short-term memory

(Submitted on June 17, 2022; Revised on July 12, 2022; Accepted on August 9, 2022)

1. Introduction

Human Activity Recognition (HAR) is a highly dynamic system that observes people's activities via videos, analyses the context of such activities, and recognizes human behaviors [1]. An activity is recognized regardless of the context in which it is performed and the person who does it. The most vital goal of HAR systems is to track and observe human behaviors to identify upcoming occurrences. HAR systems use visual and non-visual sensory input, along with contextual data, to identify human behavior. Using an appropriate data representation method, human behaviors can be more accurately recognized. The HAR system recognizes the activities on different levels. a) Active recognition for a single individual. b) Crowd participation and personal contact. c) Reduced the frequency of abnormal activities detection.

Understanding human activity is important in human-to-human contact and personal relationships. It is tough to extract since it provides information about a person's identity, personality, and psychiatric problems. One of the challenging concepts of HAR in computer vision and machine learning is the human capacity to identify another person's actions. Many applications, like video surveillance systems, human-computer interaction, and robots that can figure out how people act, need a lot of different activity detection systems [2]. When trying to identify human actions, one must establish a person's kinetic states for the computer to recognize the activity effectively. Human activities like walking and running occur organically in everyday life and are very simple to identify. On the other hand, actions such as peeling an apple, etc. are more difficult to detect. Complex actions may be broken down into smaller ones that are more easily recognized. Object recognition in a scenario may usually aid in better understanding human actions by providing valuable information about the current occurrence [3]. In this way, HAR systems are currently utilized in a variety of applications, including autonomous health monitoring [4,5], smart home development [6], surveillance for the elderly [7,8], analyzing abnormal activities [9,10], etc.

The majority of HAR research assumes a figure-centric scenario with a clean backdrop and the actor free to conduct an activity. Due to issues such as backdrop mess, partial occlusion, variations in size, perspective, lighting and appearances, and

* Corresponding author.
E-mail address: sonikajindal@sbsstc.ac.in

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Journal of Ambient Intelligence and Humanized Computing (2023) 14:3609–3620
https://doi.org/10.1007/s12652-021-03488-z

ORIGINAL RESEARCH

Transfer learning for image classification using VGG19: Caltech-101 image data set

Monika Bansal[1] · Munish Kumar[2] · Monika Sachdeva[3] · Ajay Mittal[4]

Received: 7 April 2021 / Accepted: 31 August 2021 / Published online: 17 September 2021

Abstract
Image classification is getting more attention in the area of computer vision. During the past few years, a lot of research has been done on image classification using classical machine learning and deep learning techniques. Presently, deep learning-based techniques have given stupendous results. The performance of a classification system depends on the quality of features extracted from an image. The better is the quality of extracted features, the more the accuracy will be. Although, numerous deep learning-based methods have shown enormous performance in image classification, still due to various challenges deep learning methods are not able to extract all the important information from the image. This results in a reduction in overall classification accuracy. The goal of the present research is to improve the image classification performance by combining the deep features extracted using popular deep convolutional neural network, VGG19, and various handcrafted feature extraction methods, i.e., SIFT, SURF, ORB, and Shi-Tomasi corner detector algorithm. Further, the extracted features from these methods are classified using various machine learning classification methods, i.e., Gaussian Naïve Bayes, Decision Tree, Random Forest, and eXtreme Gradient Boosting (XGBClassifier) classifier. The experiment is carried out on a benchmark dataset Caltech-101. The experimental results indicate that Random Forest using the combined features give 93.73% accuracy and outperforms other classifiers and methods proposed by other authors. The paper concludes that a single feature extractor whether shallow or deep is not enough to achieve satisfactory results. So, a combined approach using deep learning features and traditional handcrafted features is better for image classification.

Keywords ORB · SIFT · SURF · K-Means · LPP · PCA

1 Introduction

Image classification is considered as the main research topic in the area of computer vision and artificial intelligence. Image classification works on correctly identifying an object in an image. Earlier, various machine learning algorithms were used to solve this problem. Various handcrafted feature extraction methods were adopted to acquire the features from the image. The features used for image classification may be local, global, or both. Then, single or ensemble machine learning classification algorithms are employed to classify the images based on color, shape, texture, or some other feature. In the current era, the deep learning has given outstanding results in all the applications of computer vision like image classification, object detection, security, image processing, etc. Deep learning is a subset of machine learning. In the deep learning approach, both feature extraction and classification are done automatically to classify the images having similar objects. There is no

✉ Monika Bansal
write2monikabansal@gmail.com

Munish Kumar
munishcse@gmail.com

Monika Sachdeva
monasach1975@gmail.com

Ajay Mittal
ajay_mittal825@yahoo.com; ajaymittal@pu.ac.in

[1] SSD Women Institute of Technology, Bathinda, Punjab, India

[2] Department of Computational Sciences, Maharaja Ranjit Singh Punjab Technical University, Bathinda, Punjab, India

[3] Department of Computer Science and Engineering, I.K.G. Punjab Technical University, Mohali Campus-1, Mohali, India

[4] Department of Computer Science and Engineering, University Institute of Engineering and Technology, Panjab University, Chandigarh, India

Multimedia Tools and Applications (2023) 82:7553–7566
https://doi.org/10.1007/s11042-022-13718-x

COVID-19: Social distancing monitoring using faster-RCNN and YOLOv3 algorithms

Umang Ahuja[1] · Sunil Singh[1] · Munish Kumar[2] · Krishan Kumar[1] · Monika Sachdeva[3]

Received: 11 February 2021 / Revised: 21 May 2022 / Accepted: 24 August 2022 /
Published online: 27 August 2022

Abstract

As of March 31, 2021, the Coronavirus COVID-19 was affecting 219 countries and territories worldwide, with approximately 129,574,017 confirmed cases and 2,830,220 death cases. Social isolation is the most reliable way to deal with this pandemic situation. Motivated by this notion, this paper proposes a deep learning-based technique for automating the task of monitoring social distancing using surveillance cameras. To separate humans from the background, the proposed system employs object detection models based on F-RCNN (Faster Region-based Convolutional Neural Networks) and YOLO (You Only Look Once) algorithms. In the COVID-19 environment, these models track the percentage of people who violate social distancing norms on a daily basis. The authors compared the performance of both models in experimental work using the MS COCO dataset. Many tests were carried out, and we discovered that YOLOv3 demonstrated efficient performance with balanced FPS (frames per second).

✉ Munish Kumar
munishcse@gmail.com

Umang Ahuja
umangahuja1203@gmail.com

Sunil Singh
sunil32123singh@gmail.com

Krishan Kumar
k.salujauiet@gmail.com

Monika Sachdeva
monasach1975@gmail.com

[1] Department of Information Technology, University Institute of Engineering and Technology, Panjab University, Chandigarh, India

[2] Department of Computational Sciences, Maharaja Ranjit Singh Punjab Technical University, Bathinda, Punjab, India

[3] Department of Computer Science and Engineering, I. K. G. Punjab Technical University, Kapurthala, Punjab, India

Multimedia Tools and Applications (2021) 80:19753–19768
https://doi.org/10.1007/s11042-021-10711-8

Face mask detection using YOLOv3 and faster R-CNN models: COVID-19 environment

Sunil Singh[1] · Umang Ahuja[1] · Munish Kumar[2] · Krishan Kumar[1] · Monika Sachdeva[3]

Received: 7 July 2020 / Revised: 23 January 2021 / Accepted: 10 February 2021 /
Published online: 1 March 2021

Abstract

There are many solutions to prevent the spread of the COVID-19 virus and one of the most effective solutions is wearing a face mask. Almost everyone is wearing face masks at all times in public places during the coronavirus pandemic. This encourages us to explore face mask detection technology to monitor people wearing masks in public places. Most recent and advanced face mask detection approaches are designed using deep learning. In this article, two state-of-the-art object detection models, namely, YOLOv3 and faster R-CNN are used to achieve this task. The authors have trained both the models on a dataset that consists of images of people of two categories that are with and without face masks. This work proposes a technique that will draw bounding boxes (red or green) around the faces of people, based on whether a person is wearing a mask or not, and keeps the record of the ratio of people wearing face masks on the daily basis. The authors have also compared the performance of both the models i.e., their precision rate and inference time.

Keywords COVID-19 · YOLO v3 · Faster R-CNN · Face mask detection · Deep learning

✉ Munish Kumar
munishcse@gmail.com

Sunil Singh
sunil32123singh@gmail.com

Umang Ahuja
umangahuja1203@gmail.com

Krishan Kumar
k.salujauiet@gmail.com

Monika Sachdeva
monasach1975@gmail.com

Extended author information available on the last page of the article

Received: 9 March 2021 | Revised: 26 February 2022 | Accepted: 19 May 2022

DOI: 10.1002/ima.22770

RESEARCH ARTICLE

WILEY

LiteCovidNet: A lightweight deep neural network model for detection of COVID-19 using X-ray images

Sachin Kumar[1] | **Sourabh Shastri**[1] | **Shilpa Mahajan**[2] | **Kuljeet Singh**[1] | **Surbhi Gupta**[3] | **Rajneesh Rani**[2] | **Neeraj Mohan**[4] | **Vibhakar Mansotra**[1]

[1]Department of Computer Science and IT, University of Jammu, Jammu and Kashmir, India

[2]Department of Computer Science and Engineering, National Institute of Technology, Jalandhar, India

[3]Department of Electrical Engineering and Information Technology, Punjab Agricultural University, Ludhiana, India

[4]Department of Computer Science and Engineering, IK Gujral Punjab Technical University, Mohali, India

Correspondence
Sourabh Shastri, Department of Computer Science and IT, University of Jammu, Jammu and Kashmir, India.
Email: sourabhshastri@gmail.com

Abstract

The syndrome called COVID-19 which was firstly spread in Wuhan, China has already been declared a globally "Pandemic." To stymie the further spread of the virus at an early stage, detection needs to be done. Artificial Intelligence-based deep learning models have gained much popularity in the detection of many diseases within the confines of biomedical sciences. In this paper, a deep neural network-based "LiteCovidNet" model is proposed that detects COVID-19 cases as the binary class (COVID-19, Normal) and the multi-class (COVID-19, Normal, Pneumonia) bifurcated based on chest X-ray images of the infected persons. An accuracy of 100% and 98.82% is achieved for binary and multi-class classification respectively which is competitive performance as compared to the other recent related studies. Hence, our methodology can be used by health professionals to validate the detection of COVID-19 infected patients at an early stage with convenient cost and better accuracy.

KEYWORDS

chest X-ray, classification, COVID-19, deep neural network, LiteCovidNet

1 | INTRODUCTION

Coronavirus, also titled Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV-2), is the most disastrous virus in the history of the pandemic that had been discovered in late December 2019.[1] It is considered a syndrome of the respiratory system, the outbreak in Wuhan, Hubei Province, China.[2] This virus lately called Coronavirus Disease (COVID-19), recognized world-widely as Global Communal Health Extremity by World Health Organization (WHO) in January 2020, also acquired the status of "Pandemic" on March 11, 2020.[3–9] Till August 13, 2021, there are approximately 206 million confirmed cases across the world and 4.3 million deaths reported from more than 200 different countries and territories. The worst-hit countries were the USA, India, and Brazil.[10] This virus is spreading through human-to-human transmission via either respiratory droplets or contact routes.

Coronaviruses are among the largest groups of viruses that belong to the Nidovirales order including Roniviridae, Mesoniviridae, Arteriviridae, and Coronaviridae families. All viruses in the Nidovirales order are enveloped in non-segmented positive-sense ribonucleic acid (RNA) viruses. All of them contain very large genomes for RNA viruses. Coronaviruses contain a non-segmented, positive-sense RNA genome of 30 kilobases (kb). Coronaviridae and Nidovirales spread promptly in humans as well as mammals.[11–13] The COVID-19 virus causes different kinds of illnesses which range from symptomatic to asymptomatic infections. The main symptoms of COVID-19 are cold, dry cough, fever, sore throat, weakness, tiredness, etc. There are two major modes of transmission of the COVID-19 virus, that is, respiratory or droplets and

Soft Computing (2022) 26:4005–4018
https://doi.org/10.1007/s00500-021-06493-8

APPLICATION OF SOFT COMPUTING

Deep vision-based surveillance system to prevent train–elephant collisions

Surbhi Gupta[1] · Neeraj Mohan[2] · Padmalaya Nayak[3] · Krishna Chythanya Nagaraju[3] · Madhavi Karanam[3]

Accepted: 23 October 2021 / Published online: 12 November 2021

Abstract
Animal conservation is imperative, and technology can certainly assist in different ways. The extinction of endangered species like tigers and elephants has boosted the necessity for such efforts. Human–elephant collision (HEC) has been an active area of research for years. Apart from deforestation, the roads and rail tracks laid down through forest areas intervene a lot in wildlife. Collisions and tragedies are every day, especially in green belts in India and other Asian countries. Therefore, it is crucial to develop vision-based, automated, warning-generating systems to identify the animal/elephant near-site. In the proposed work, different deep learning-based models are proposed to identify elephants in image/video. Several convolutional neural network (CNN)-based models and three transfer learning (TL)-based models, i.e., ResNet50, MobileNet, Inception V3, have been experimented with and tuned for elephant detection. All the models are tested on a synthesized dataset having about 4200 images built using two public datasets, i.e., ELPephant and RailSem19. Two accurate CNN and transfer learning-based models are presented in detail. These highly accurate and precise models can alarm the trains and generate warning signals on site. The proposed CNN and inception network demonstrated high accuracy of 99.53% and 99.91%, respectively, and are remarkable in identifying elephants and hence preventing HEC. The same model can be trained for other animals for their preservation in similar scenarios.

Keywords Human–elephant collision · Rail track monitoring · Deep vision · Data augmentation · Transfer learning

1 Introduction

Animal mortality is becoming a critical concern worldwide as it is disturbing ecological balance, and many animal species are being endangered. The International Union for Conversation of Nature (IUCN) has already endangered the Indian elephant. Particularly in India, human life is intrinsically entangled with the giant animal elephant. Whether it is culture, mythology, or the Hindu custom, elephant is considered a sacred animal and the symbol of intellectual strength. In Hinduism, every auspicious work usually starts with a prayer to the elephant-faced Ganesh.

Nevertheless, the life of elephants is full of struggle in the present scenario. Due to much human intervention in their habitat, it is an endangered species now. The reason could be the costly ivory tusk of the mammal, the deforestation by the greedy human beings, or collision with humans; at the receiving end are the elephants (Langbein 2011; Morse et al. 2014). Poaching of elephants is a common incident, and the government is taking serious action to prevent this. Wild-life sanctuaries and parks have

✉ Surbhi Gupta
surbhi@pau.edu

Neeraj Mohan
erneerajmohan@gmail.com

Padmalaya Nayak
drpadmalaya2010@gmail.com

Krishna Chythanya Nagaraju
kcn_be@rediffmail.com

Madhavi Karanam
bmadhaviranjan@yahoo.com

1 Department of Electrical Engineering and IT, COAET, Punjab Agricultural University, Ludhiana, India

2 Department of CSE, IK Gujral Punjab Technical University, Mohali, India

3 Department of CSE, Gokaraju Rangaraju Institute of Engineering and Technology, Hyderabad, India

Artificial Intelligence Review
https://doi.org/10.1007/s10462-021-10046-8

Passive image forensics using universal techniques: a review

Surbhi Gupta[1] · Neeraj Mohan[2] · Priyanka Kaushal[3]

Accepted: 16 July 2021

Abstract

Digital tamper detection is a substantial research area of image analysis that identifies the manipulation in the image. This domain has matured with time and incredible accuracy in the last five years using machine learning and deep learning-based approaches. Now, it is time for the evolution of fusion and reinforcement-based learning techniques. Nevertheless, before commencing any experimentation, a researcher needs a comprehensive state of the art in that domain. Various directions, their outcome, and analysis form the basis for successful experiments and ensure better results. Universal image forensics approaches are a significant subset of image forensic techniques and must be explored thoroughly before experimentation. This motivated authors to write a review of these approaches. In contrast to the existing recent surveys that aim at image splicing or copy-move detection, our study aims to explore the universal type-independent techniques required to highlight image tampering. Several universal approaches based on resampling, compression, and inconsistency-based detection are compared and evaluated in the presented work. This review communicates the approach used for review, analysed literature, and lastly, the conclusive remarks. Various resources beneficial for the research community, i.e. journals and datasets, are explored and enumerated. Lastly, a futuristic reinforcement learning-based model is proposed.

Keywords Digital image forensics · Universal approaches · Resampling detection · Compression detection · Inconsistency-based forensics

✉ Surbhi Gupta
royal_surbhi@yahoo.com

Neeraj Mohan
erneerajmohan@gmail.com

Priyanka Kaushal
ms.priyankakaushal@gmail.com

1 Department of EEIT, COAET, Punjab Agricultural University, Ludhiana, Punjab, India

2 Department of CSE, I.K.G. Punjab Technical University Mohali Campus, Mohali, Punjab, India

3 Department of Applied Science, CGC Landran, Mohali, Punjab, India

Published online: 23 July 2021

Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 9, August 2021: 2487–2499

Research Article

GI-Science Based Morphometric Analysis for Geo-Hydrological Studies of Ghaggar River Basin, North-West India

Ritambhara K. Upadhyay[1], Gaurav Tripathi[2], Naval Kishore Sharma[3], Mukta Sharma[4*]

ABSTRACT

Morphometric analyses play a vital role in hydrological investigations. The application of GI-Science and processing techniques have greatly facilitated this through delineation of morphological features or drainage pattern, development and management of drainage basin, groundwater potential mapping, etc. to meet sustainable development goals. The Ghaggar river basin is located between Latitudes 27°39' N – 32°32'N and Longitudes 73°55'E – 77°36' E and covering an area of 20,454.08 sq.km elevation ranges from 169 metres to 1884 metres above MSL. The river originates from District Sirmaur in Himachal Pradesh and flows through Punjab, Haryana and Rajasthan. In the present study, the morphometric analysis of Ghaggar river basin has been performed to study the various drainage parameters using geospatial technique. The morphometric analysis shows that the watershed has five mini watersheds, sixth order stream segment, drainage network is dendritic in nature, drainage density is 0.434 km per sq. km, stream frequency is 0.096 streams per sq. km, bifurcation ratio of all mini watersheds is 2 to 12, Various morphometric parameters such as linear, aerial and relief aspects have been correlated with each other to apprehend their fundamental association and their influence over basin hydro-geomorphology, soil and topography. The geomorphic parameters are of immense utility in developing proper disposition and decision making of watershed for natural resource appraisal, catchment area advancement, watershed characteristics, planning and drainage development.

Keywords: morphometric analysis, geomorphic parameters, GI-Science, hydro-geomorphology, Ghaggar basin

INTRODUCTION

The evolution of a drainage system and the course of a river over space and time are greatly dependent on a number of variables such as structural components, geology, geomorphology, vegetation cover, soil and slope of the region through which it flows. Morphometry deals with measurement and mathematical study of the configuration of the earth's size, shape, surface, linear

[1,3]CAS Geology, Panjab University, Chandigarh. E-mail: ritambharaku@gmail.com; naval.kishore@gmail.com; ORCID: https://orcid.org/0000-0003-3952-9625
[2]Department of Geoinformatics, Central University of Jharkhand, Ranchi, India. E-mail: gauravtripathi3135gt@gmail.com
[4*]School of Built Environment, IKGPTU, Mohali Campus, Punjab. E-mail: mukta.geo@gmail.com

Mukta Sharma

A Geospatial Approach for Mapping and Delineation of Palaeochannels of Ghaggar Basin, North-West India, for Groundwater Development to Meet Sustainable Development Goals

Ritambhara K. Upadhyay, Naval Kishore, and Mukta Sharma

Abstract The palaeochannels or palaorivers are the remains of the rivers or stream courses that carried water in the past, but in the present scenario, they are lost rivers and are left with riverine sediments deposited along their courses. There are various techniques to detect these palaeochannels. In the present study, remote sensing and GIS-based techniques are applied for the delineation of palaeochannels in the Ghaggar River basin, North-West, India. LandSat 8, ETM + PAN and STRM DEM satellite datasets have been used for the demarcation of palaeochannels in the study region. Image enhancement techniques such as Normalized Difference Vegetation Index (NDVI), Hill Shade and Pan-sharpening have been applied on these satellite datasets for obtaining better spectral signatures. Drainage analysis through morphometry of the study region clearly shows high drainage density overlaying on the palaeochannels. The present work strongly emphasizes the potential of geospatial approach in the identification of palaeochannels and the high potential of these palaeochannels in meeting the groundwater sustainability as the palaeochannels have been found to carry high groundwater potential. These palaeochannels can be best utilized for meeting the Sustainable Development Goals (SDGs) as these serve as suitable sites for storm water harvesting and artificial recharge of aquifers during rainy seasons. Such measures can adequately address the rapidly depleting groundwater levels in the region and cater to the water needs as it is devoid of any major river flowing through it.

Keywords Palaeochannel delineation · Palaeochannel mapping · Geospatial approach · Morphometric analysis · Sustainable development goals

R. K. Upadhyay (✉) · N. Kishore
Centre of Advanced Studies in Geology, Panjab University, Chandigarh, India

M. Sharma
School of Built Environment, IKGPTU, Mohali Campus, Kharar, Punjab, India

V. Chembolu and S. Dutta (eds.), *Recent Trends in River Corridor Management*,
Lecture Notes in Civil Engineering 229,
https://doi.org/10.1007/978-981-16-9933-7_17

Mukta Sharma

Water Science

Taylor & Francis

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/twas20

Delineation and mapping of palaeochannels using remote sensing, geophysical, and sedimentological techniques: A comprehensive approach

Ritambhara Upadhyay, Naval Sharma & Mukta Sharma

To cite this article: Ritambhara Upadhyay, Naval Sharma & Mukta Sharma (2021) Delineation and mapping of palaeochannels using remote sensing, geophysical, and sedimentological techniques: A comprehensive approach, Water Science, 35:1, 100-108, DOI: 10.1080/23570008.2021.1941691

To link to this article: https://doi.org/10.1080/23570008.2021.1941691

Published online: 07 Jul 2021.

TRIBOLOGY - MATERIALS, SURFACES & INTERFACES
https://doi.org/10.1080/17515831.2022.2058797

I·M3 Institute of Materials, Minerals & Mining

Taylor & Francis

RESEARCH ARTICLE

Effect of *in-situ* tribo-oxide-layer on the non-lubricated tribological behaviours of LM27/SiC_p composites

Pardeep Kumar Nagpal[a], Suresh Kumar[b], Ranvir Singh Panwar[c], J. D. Sharma[c], Neeru Singla[a] and Sunil Kumar Mahla[a]

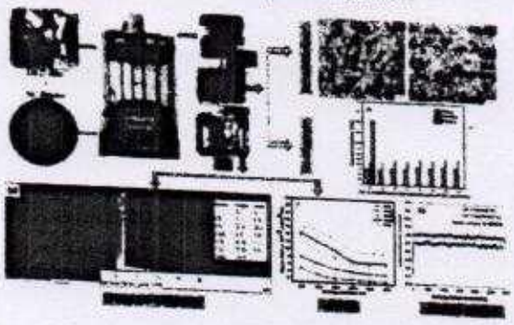
[a]Department of Mechanical Engineering, I.K. Gujral Punjab Technical University, Kapurthala, India; [b]Terminal Ballistic Research Laboratory, DRDO, Chandigarh, India; [c]Department of Metallurgical and Materials Engineering, Punjab Engineering College (Deemed to be University), Chandigarh, India

ABSTRACT

In this study, the influence of the *in-situ* tribo-oxide-layer on non-lubricated tribological behaviours of LM27/SiC_p composites was studied at different applied loads. For this purpose, LM27/SiC_p composites were manufactured by stir casting route with reinforcement of different amounts (3–12 wt.%) and different sizes (fine: 1–20 μm and coarse: 106–125 μm) of SiC_p. A comprehensive characterization of the friction and wear mechanisms ranging from mild to severe wear for oxidative and delamination at a contact pressure of 0.125–0.624 MPa was discussed. Results indicate that the friction and wear behaviour is strongly influenced by the morphology and the nature of the oxide scale on the wear track. *In-situ* formation of oxide layers on the contact region of the specimen supports the self-lubrication which supports better wear performance of LM27/SiC_p composites. However, these study portraits that composite with 12wt. % fine size SiC_p exhibits better wear performance in comparison to the other developed composites.

ARTICLE HISTORY
Received 14 June 2021
Accepted 23 March 2022

KEYWORDS
AMCs; optical microscope; wear; friction; oxide layer; worn debris; tribology; surface topography



1. Introduction

Aluminium matrix composites (AMCs) show great potential for producing automotive, construction, aerospace structures in rail transport and other different engineering sectors [1–4]. Generally, the calliper and rotor used in most automobile industries are typically made from ductile cast iron and grey cast iron, respectively. To reduce automobile weight and improve fuel efficiency, the auto industry has dramatically increased the demand for light vehicles in recent times [5–7]. To reduce automobile weight and improve fuel efficiency, the automobile industry has dramatically increased the demand for lighter vehicles in recent times. So, cast AMC brake rotors to fill the essential demand of automobile industries and provide 45–60% weight reduction in AMC braking system [4,8–10]. From the point of view of safety, the AMC material selected for the brake system should have stable and reliable friction and wear properties under varying conditions of load, velocity, temperature, environment and high durability. The aluminium alloy as a matrix is suitable for brake disc material selection based on these factors. Literature analysis allowed us to notice that there is a lot of research related to the review of materials for manufacturing friction and wear materials [4–10]. The method of friction and wear, including changes in the physical, chemical and mechanical properties of the composite surface, is relatively difficult [7]. At high temperatures, materials will oxidize and oxidation resistance plays an important role in the evaluation of their high-temperature properties [8]. It is known that a tribo-oxide layer typically forms on the contact surfaces, which can significantly affect the material's tribological properties and plays an important role in severe-mild wear

CONTACT Sunil Kumar Mahla skumarterm@gmail.com

Hindawi
Journal of Chemistry
Volume 2021, Article ID 6468749, 12 pages
https://doi.org/10.1155/2021/6468749

Hindawi

Research Article

Assessing the Applicability of Photocatalytic-Concrete Blocks in Reducing the Concentration of Ambient NO_2 of Chandigarh, India, Using Box–Behnken Response Surface Design Technique: A Holistic Sustainable Development Approach

Neeru Singla,[1] Sandeep Singla,[2] Parteek Singh Thind,[3] Sandeep Singh,[4] Jasgurpreet Singh Chohan,[5] Raman Kumar,[5] Shubham Sharma,[6] Somnath Chattopadhyaya,[7] Shashi Prakash Dwivedi,[8] Ambuj Saxena,[8] Alibek Issakhov,[9] and Nima Khalilpoor[10]

[1]*Department of Civil Engineering, I. K. Gujral Punjab Technical University, Jalandhar-Kapurthala Highway, VPO Ibban, Kapurthala 144603, India*
[2]*Department of Civil Engineering, RIMT University, Mandi Gobindgarh 147301, India*
[3]*Department of Civil Engineering, Punjab Engineering College, Chandigarh 160012, India*
[4]*Department of Civil Engineering, Chandigarh University, Ghuruan 140413, India*
[5]*Department of Mechanical Engineering, Chandigarh University, Gharuan 140413, India*
[6]*Department of Mechanical Engineering, I. K. Gujral Punjab Technical University, Jalandhar-Kapurthala Highway, VPO Ibban, Kapurthala 144603, India*
[7]*Department of Mechanical Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad, Jharkhand, India*
[8]*G. L. Bajaj Institute of Technology & Management, Gautam Buddha Nagar, Greater Noida 201310, Uttar Pradesh, India*
[9]*Faculty of Mechanics and Mathematics, Department of Mathematical and Computer Modelling, Al-Farabi Kazakh National University, Almaty, Kazakhstan*
[10]*Department of Energy Engineering, Graduate School of the Environment and Energy, Science and Research Branch, Islamic Azad University, Tehran, Iran*

Correspondence should be addressed to Shubham Sharma; shubhamsharmacsirclri@gmail.com and Nima Khalilpoor; nimakhalilpoor@gmail.com

Received 9 April 2021; Accepted 8 July 2021; Published 16 July 2021

Academic Editor: Pei-Yi Wang

Anthropogenic emissions, such as industrial, vehicular, biomass burning, and coal combustion, play a significant role in degrading the atmospheric conditions of India. Therefore, in the present study, applicability of the photocatalytic concrete blocks was estimated in improving the ambient environment of Chandigarh, India. The photocatalytic-concrete blocks were prepared by mixing the TiO_2 particles with cement. All the experiments, designed in accordance with the Box–Behnken approach, in combination with response surface methodology, were performed in a batch reactor. Further, the process parameters, namely, concentration of TiO_2 (1 to 5 g), UV-A irradiance (1 to 5 mW/cm^2), and relative humidity (RH) (10 to 70%), were optimized to achieve maximum degradation of NO_2. Outcomes of batch experiments depicted that the maximum degradation of NO_2, that is, 68.32%, was attained at 3.35 g of TiO_2, 5 mW/cm^2 of UV-A irradiance, and 64.60% RH. The findings of batch experiment were further theoretically applied to degrade the ambient NO_2 concentration of Chandigarh, India. It was estimated that using the photocatalytic concrete for construction of Chandigarh's pavements may reduce the ambient NO_2 concentration of Chandigarh, India, to an average of 5.80 μg/m^3. Afterwards, reusability of photocatalytic-concrete blocks was also assessed, and it was made evident that after five cycles, their efficiency was reduced by only 7.15%. Subsequently, it was revealed that hydrogen peroxide based treatment of photocatalytic concrete blocks could completely regenerate its treatment efficiency. Therefore, it is expected that the findings of this study may prove beneficial in urban planning, as it may assist scientific auditory in identifying the applicability of TiO_2 based photocatalysis in mitigating the impacts of vehicular emissions.