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A novel wavelet based hybrid method for finding the solutions of higher order boundary value problems

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ABSTRACT

In this paper, a new wavelet based hybrid method is developed for obtaining the solution of higher order linear and nonlinear boundary value problems. The proposed method is based on approximation of solution by non-dyadic wavelets family with dilation factor 3. Discretization of domain is done by collocation method. The nonlinearities in boundary value problems are tackled by Quasi-linearization technique. Eleven numerical experiments are performed on linear and nonlinear boundary value problems with order ranging from eighth to twelfth to prove the successful application of the proposed method. Also, the obtained solutions are compared with exact and numerical solutions available in the literature to prove the efficiency of the method over other methods.

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1. Introduction

Many physical phenomena like hydro dynamic and hydromagnetic stability [1], induction motor with two rotor circuits [2], viscoelastic flows in fluid dynamics etc. are governed by the higher order boundary value problems. Higher order boundary value problems (HOBVPs) have been a major concern for the researchers, especially when these are nonlinear or higher order linear ODE with variable coefficients. Existence and uniqueness of solution for HOBVPs has already been established by Agarwal in his book [3]. But general closed form solution for these kinds of problems has yet not been established. Therefore, researchers are using numerical techniques to find the solutions of HOBVPs. Many numerical mechanisms have been developed by the researchers to solve these problems such as Variational Iteration Decomposition Method (VIDM) [4], Optimal Homotopy Asymptotic Method (OHAM) [5], Galerkin Method with Quintic B-splines (GMQBS) [6], Legendre Galerkin Method (LGM) [7], Reproducing Kernel Space Method (RKSM) [8], Variational Iteration Method (VIM) [9], Modified Variational Iteration Method (MVID)

[10], Sextic B-splines Collocation Method (SBSCM) [11], Petrov-Galerkin Method (PGM) [12], Homotopy Perturbation Method (HPM) [13], Quintic B-Spline Collocation Method (QBSCM) [14], Haar Wavelet Collocation Method (HWCN) [15] with dilation factor 2, Modified Adomian Decomposition Method (MADM) [16] etc.

Wavelet based numerical techniques are one of the latest techniques in mathematical theory of approximation which are in considerable qualitative progress in comparison with other methods. Majority of the work has been done by using dyadic wavelets. Till date no literature is available for the use of non-dyadic wavelets in finding the solution of higher order boundary value problems. The existence of non-dyadic wavelets have been proved by Chui and Lian [17] in 1995 in the study of construction of wavelets. This motivates and inspires us to use non-dyadic wavelet with collocation method for the solution of HOBVPs. In the present study, a new wavelet based hybrid method is developed by using non-dyadic wavelet with collocation method.

The main objective of our work is to establish a non-dyadic Haar wavelet based collocation technique for numerical solution of linear and nonlinear HOBVPs emerging in many physical phenomena. To test the efficiency and accuracy of the method, we consider the general HOBVPs of the type

$$x^n(t) = f(t, x, x', x'' \dots x^{n-1}) \quad a \leq t \leq b \quad (1.1)$$

with the following types of constraints on the solution at the boundary points

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Scale-3 Haar Wavelets and Quasilinearization based Hybrid Technique for the Solution of Coupled Space-Time Fractional - Burgers' Equation

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ABSTRACT

The aim of this study is to develop a hybrid method using scale 3 Haar wavelets for obtaining the solution of coupled space-time fractional Burgers' equation. Scale 3 Haar wavelets were used to estimate the solution by series approximation. Caputo and Riemann-Liouville definitions were used to handle the fractional derivatives and integrals in the problem. A quasi-linearization technique was implemented to handle the nonlinearity in the problems. Two examples of coupled space-time fractional Burgers' equations were studied to analyze the performance of the proposed technique.

Keywords: Caputo derivatives, fractional coupled Burgers' Equation, Quasi-linearization, Riemann-Liouville integration, scale 3 Haar wavelets

INTRODUCTION

Fractional calculus emerges as a great tool in explaining the physical and chemical phenomenon with alienate kinetics having microscopic complex behavior. There are fractional differential models which have a non-differentiable but continuous solution such as Weierstrass type functions (Zahle & Ziezold, 1996). These kinds of characteristics are not possible to explain with the help of ordinary or partial differential models. Earlier the field of fractional calculus was purely mathematical without any visible application but

in these days, fractional calculus has gained a huge importance in the field of science and technology because of its application in the various field like theory of thermo-elasticity (Povstenko, 2009), viscoelastic fluids (Tripathi et al., 2010), dynamics of earthquakes (Lopes et al., 2013) and fluid dynamics (Momani & Odibat, 2006a). It

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A Study on Source Device Attribution Using Still Images

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Abstract

Images are acquired and stored digitally these days. Image forensics is a science which is concerned with revealing the underlying facts about an image. The universal approaches provide a general strategy to perform image forensics irrespective of the type of manipulation. Identification of acquisition device is one of the significant universal approach. This review paper aims at analyzing the different types of device identification approaches. All research papers aiming camera and mobile detection using image analysis were acquired and then finally 60 most suitable papers were included. Out of these, 32 states of art papers were critically analyzed and compared. As every research starts with the literature review such analysis is significant. This is the first attempt for source camera and source mobile detection evaluation as per the authors knowledge. The authors have concluded that the Accuracy rate of Lens Aberration based detection techniques deteriorates when the different source camera from same brand were under consideration. The performance of color filter array Based Detection techniques dropped when the post processing operation were used on images. These techniques were vulnerable to high compression rate for JPEG images.

1 Introduction to Image Forgery and Forensics

An image is a grouping of pixels. These pixels are arranged in rows and column to depict an image in a 2-dimensional structure. Each pixel has some area and intensity value associated with it as exhibited in Fig. 1. Intensity values at respective areas constitute an image. An image processing operation will result in the modification of intensity value of pixels in an image. The amount of change in pixel intensity depends on the image processing procedure. For example, if the brightness of an image needs to be increased or contrast needs to be enhanced; the intensity value of the pixels needs to be altered slightly. While if one object needs to be translated or rotated in the image, then the intensity values of

the pixels need to be changed altogether. An image is characterized by its color depth and resolution. The color depth of an image is controlled by the quantity of bits (k) required to represent an image pixel. Generally, a pixel is represented by 24 bits; 8-bit for each Red, Green and Blue (R, G and B) plane, thus resulting in color depth of 2^{24} colors in the image. Another significant attribute of an image is its resolution. It is equivalent to the quantity of pixels present in an image. It is determined as the product of the number of rows (m) and number of columns (n) of pixels present in an image, i.e. ' $m \times n$ '. Resolution and color depth of an image has a direct impingement on the image size. The image size is determined as ' $m \times n \times k$ '. The image size increases when either number of pixels, or the color depth increases. A good quality image, having high resolution and high color depth, would have a larger image size as compared to a poor-quality image with the same visual substance. There are many file formats available for images like BMP, TIFF, PNG and JPEG. Some of them offer information preservation while others offer less memory consumption. The selection of file format depends on the usage and purpose of the image. One must consider file size, application and image quality before selecting an appropriate file format. Image formats such as BMP, PNG and TIFF use a lossless compression scheme and maintain the quality of the image; while lossy compression file formats like GIF and JPEG sacrifices image quality for

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A computational approach for printed document forensics using SURF and ORB features

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Abstract

Document forgery is quite common nowadays due to the availability of cost-effective scanners and printers. Important documents like certificates, passport, identification cards, etc., are protected using watermarks or signatures. These are made secured with a protective printing mechanism with extrinsic fingerprints. Therefore, it is easy to authenticate such documents. Other documents required a passive approach for their authentication. These approaches look for document inconsistencies for chances of modification. Some of these attempt to detect and fix the source of the printed document. This paper proposes a classifier-based model to identify the source printer and classify the questioned document in one of the printer classes. A novel approach of utilizing Speeded Up Robust Features and Oriented Fast Rotated and BRIEF feature descriptors is proposed for printer attribution. Naive Bayes, k -NN, random forest and different combinations of these classifiers have been experimented for classification. The proposed model can efficiently classify the questioned documents to their respective printer class. An accuracy of 86.5% has been achieved using a combination of Naive Bayes, k -NN, random forest classifiers with a simple majority voting scheme and adaptive boosting methodology.

Keywords Document forensics · Printer forensics · SURF · ORB · Voting scheme · AdaBoost

1 Introduction

It is a digital world where everything is going paperless. But, even nowadays many important documents are still on paper. Popular examples include certificates, receipts, official documents, etc. These documents are vulnerable as they lack the required security features. This limitation has invited manipulations in documents. These manipulations in documents are termed as document tampering and can be performed easily using economical devices like

scanners and printers. Usually, the document to be manipulated is first scanned and then the scanned image of the original document is manipulated easily. Therefore, before relying on a document, one must check its authenticity. Generally, the document authentication is done using active techniques. The techniques such as a watermark or signature are widely used to protect the digital documents. These techniques embed some additional extrinsic fingerprints to the document so that any manipulation will disturb these fingerprints and hence can be traced easily. But it is not possible to use such technology for all the documents as its costly and time-consuming. Manipulators exploit this weakness and attempt the desired changes in the document. Such unprotected documents require authentication using passive techniques. Such techniques are based on document image intrinsic features. Intrinsic features are the fingerprints of hardware and/or software used for the production of the authentic/manipulated document. While examining printed documents for manipulations, the identification of source printer can be extremely helpful. Therefore, there is a requirement for techniques that can identify the source printer. It has many industrial applications. In developing countries, every piece of information

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Dynamic routing and wavelength assignment for efficient traffic grooming

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Abstract: The routing and wavelength assignment (RWA) schemes play an important role in all computer networks. The performance of a computer network and resource utilization largely depend on the RWA. The demand for higher bandwidth is increasing with each passing day, so more efficient RWA schemes need to be devolved to cater the increasing requirements. RWA becomes more challenging for dynamic traffic as the nature and flow of data are not known in advance. In this paper, a dynamic RWA scheme has been proposed for establishing a path in optical networks. The proposed scheme is based upon dynamic conversion sensing algorithm. It can be applied on a number of different network topologies. The proposed scheme is dynamic in nature, which is significantly useful for dynamic traffic grooming. The proposed scheme has been applied on 14 nodes National Science Foundation Network (NFSNet). Simulation results have shown that the blocking probability of this scheme is very low as compared to the existing schemes. So, the proposed dynamic RWA scheme enhances the network efficiency. It is useful for congestion hit networks. The reduced blocking probability in wavelength division multiplexing optical networks leads to better resource utilization and enhanced performance.

Keywords: blocking probability; dynamic traffic grooming; routing and wavelength assignment; WDM optical networks.

1 Introduction

The optical networks are playing a significant role in the modern era of networking. The performance of these networks can be optimized using different methods and schemes. Traffic grooming is mainly concerned with the optimization of capacity utilization of any transmission

systems or networks. Wavelength division multiplexing (WDM) along with optical networks has provided enough opportunities for huge data transfer at ultrahigh speed. The networks have a large scope of performance optimization due to their certain properties. These networks are capable to cross connect between different transport systems. Further, different layers can be used within the same system in WDM networks. The optimal use of resources enhances the overall network performance [1]. Different multiplexing techniques and other methods are used for different domains for traffic grooming of networks. Traffic grooming depends upon certain key parameters such as network planning, topology design, dynamic circuit provisioning, etc. Traffic grooming of any network is always a challenging job because the performance of networks depends upon so many parameters. Traffic grooming may be classified into two categories: traffic grooming for static traffic and network grooming for dynamic traffic. In case of static traffic, the nature and volume of traffic are known in advance. But in case of dynamic traffic, these parameters are not known in advance. So, dynamic traffic grooming is more challenging as compared to static traffic grooming. Moreover, the shifting trend towards mesh topology from the existing ring topology is again a challenge for traffic grooming [2, 3]. Optical networks are using optical fibers as physical medium of transmission. Using WDM technology, huge bandwidth and high capacity are offered by optical networks, which can be used for a number of applications. In WDM, the number of light beams of different wavelengths can be transmitted simultaneously through an optical fiber [4].

This paper is organized as follows: Section 2 covers the research motivation, Section 3 discusses the proposed work, Section 4 has results and discussions, and conclusion is presented in Section 5.

2 Research motivation

In the recent past, lot of research has been carried out on static and dynamic traffic grooming. Various key network parameters such as speed, throughput, packet loss, congestion, blocking probability, etc. have been considered for traffic grooming. Improvement of these parameters

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Link failure recovery using p-cycles in wavelength division multiplex (WDM) mesh networks

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Abstract: Network survivability has become a crucial requirement in all types of computer networks. It becomes even more significant for wavelength division multiplex (WDM) mesh networks due to their high speed and capacity. These networks are prone to link failures. A link failure may be a single or multiple link failure. A single-link failure is easy to locate and fix as compared to multiple link failures. A dual-link failure recovery technique has been proposed using p-cycles. This technique uses a replication method for the p-cycle circle. It is an enhancement of the original failure independent path protection p-cycle scheme. The replica properties of p-cycle have been used to protect the nodes through the same p-cycle available. Creating a new p-cycle always adds to the cost of the network, whereas using a replica of already existing p-cycle significantly reduces the network cost. The proposed technique is implemented using network simulator in three phases.

Keywords: link failure; p-cycle; WDM mesh networks.

1 Introduction

Wavelength division multiplex (WDM) mesh networks provide an inexpensive way to provide broadband internet access. In a WDM mesh network, a single node is able to communicate with multiple nodes using multiple data flows in both directions. The WDM network relies on a high-speed backhaul network, which is further composed of WDM routers. The primary use of WDM mesh networks is broadband internet access or mobile telephony backhauling. These networks can provide gateways for wired internet and other WDM services. A typical WDM network

is shown in Figure 1. The network performance of a WDM network may be optimized by using multiple radios [1, 2].

The survivability schemes may be proactive and reactive in nature. Alternate routes are precalculated for a proactive scheme, whereas the alternate routes are calculated after the actual fault occurs, in the case of the reactive scheme. These schemes may be classified as protection and restoration schemes. These schemes may be used independently or jointly to make the networks more survivable. The decision to choose a proactive or reactive scheme depends on various network parameters and the nature of services. p-cycles are currently a genuinely understood plan with numerous fascinating and appealing properties. They can ensure proficient, quick and guaranteed recovery against failures [3, 4, 5]. The remaining paper is divided as: Section 2 presents the related work. The proposed method is demonstrated in Section 3. Section 4 is about results and discussion. Finally, the conclusion is presented in Section 5.

2 Related work

A lot of research has been carried out regarding in network survivability. There are many reasons for network failure, so different survivability schemes are required to handle these failures. In the present study, we are only concentrating on p-cycle based failure recovery in this section. Schupke [6] has analyzed the dual-link failure restorability using p-cycles. p-cycles were able to provide fast failure recovery in WDM networks. The number of p-cycles deployed and further survival of dual-link failures were considered in a Pan-European network case study. Using p-cycle protection, high capacity efficiency, and faster protection switching was achieved. Yadav et al. [7] have used intercycle switching (ICS) for network survivability. An idle p-cycle was used to reduce the length of the p-cycle restoration segment by using an idle p-cycle. An enhanced ICS was also used to improve effectiveness.

Zhong and Zhang [8] investigated the performance of flow p-cycle and optimal path pair based dual-source protection approaches. The results have been analyzed for source failure recovery. It was observed that the importance of source failure recovery is more as compared to the

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Computational Offloading in Android Devices Using Cloud Computing Capabilities

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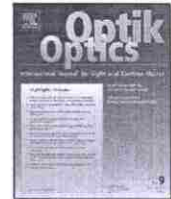
Abstract – Mobile devices have witnessed several stages as phone adoption has increased rapidly across the globe, with the results that the manipulations of smartphones are increasing thrice compared to Personal Computers. The recent developments in smartphone technology have led users into a new way of mobile computing. Portable communication devices such as smartphones and other hand held devices have replaced the existing computing technology. Smart mobile devices are equipped with low processing capacity computing processors and limited power batteries as compared to computers, which instead have a high-level hardware configuration. Hence it becomes onerous to execute any applications on these compact devices, resulting in a performance lacking and high power consumption. The offloading computation mechanism proves out to be an uncompromisable solution to this situation, which may result in high performance efficiency and improved battery life in these devices. As this solution involves cloud computing, hence uploading data to cloud service engines and retrieving back the results come out to be a time and energy-consuming factor. Therefore, this investigation tries to put its focus on the behavior of time and energy consumption in mobile devices by using Computation offloading mechanism and by implementing a decision-making framework termed as Ternary decision maker, which can outcome the above factor. Copyright © 2018 Praise Worthy Prize S.r.l. - All rights reserved.

Keywords: TDM (Ternary Decision-Making), Smart Phone, Offloading, Coprocessor, Mobile Cloud Computing, Android

Nomenclature						
Cost Function	Definition	N_{input}	[KB]	O	Amount of processing data into processing unit	
		N_{output}	[KB]	O	Amount of resulting data from processing unit	
Target	Major unit for computation, e.g. CPU/Coprocessor /Cloud	μ_{cpu}	[MHz]	X	Mobile CPU speed	
		μ_{cop}	[MHz]	X	Mobile Coprocessor speed	
T_{target}	Measured execution time when execute on target	μ_{cid}	[MHz]	O	Cloud speed	
T_{narget}	Estimated execution time when execute on target	μ_{mem}	[Mbps]	X	Memory access bandwidth	
E_{target}	Measured energy consumption when execute on target	P_{basic}	[Watt]	X	Basic power when idle	
		P_{cpu}	[Watt]	X	Mobile CPU running power	
E_{narget}	Estimated energy consumption when execute on target	P_{cop}	[Watt]	X	Mobile Coprocessor running power	
		P_{nic}	[Watt]	X	Network Interface power consumption	
Decision Factor	Unit	Variable	Definition			
B	[Kbps]	O	Transmission bandwidth			
t_{comp}	[s]	O	Module execution time on mobile CPU			

I. Introduction

The Advanced and intelligent mobility solutions are equipped with high-end functionalities to understand the mobile application platform. To meet the growing demands of millions of users, several modifications are being done in the smart phones so to make them more



Original research article

ACO based single link failure recovery in all optical networks

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ABSTRACT

An optical network has a major role to play in modern computer networks. The optical network is providing a platform for transmission of huge amount of data at very high speed. These networks may fail due to various reasons. These failures may result in significant loss of revenue and time. Since this loss has a considerable effect on user and service provider, so the survivability of these optical networks has become very important issue to address. The survivability of a network is the capability of network to provide continuous services. The link failure is one of the very common failures in optical networks. A failed link is required to restore accurately and quickly so that failure impact can be minimized. In this paper, we have proposed a method to address survivability in all optical networks in case of single link failure. This method minimizes the recovery time for single link failure. Ant Colony Optimization (ACO) technique along with adjacent shortest cycle is used to calculate alternative path for retransmission of data.

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1. Introduction

Optical fiber communication has been acknowledged as the best solution for high bandwidth requirements of the users. Each optical fiber has the ability to support bandwidth demand up to 50 THz. Some other significant features of optical fiber are low cost and extremely low bit error rates. Optical networks along with Wavelength Division Multiplexing (WDM) technology provide an ideal platform to support high speed transmission for huge amount of data. The speed offered by an optical network may be in the range of terabits per second. Generally the web applications need such high speed. So the optical networks have a very significant role to play for achieving high transmission rates for huge amount of data [1,2].

Survivability in optical networks has gained significant importance because of the ultra-high capacity provided in terms of speed and throughput [2]. A single failure even for a very small duration can affect millions of applications and users, which may result in tremendous revenue loss. There are several reasons to deploy survivability schemes in the networks. First and foremost, it is the issue of user satisfaction as everybody expects a reliable network. Secondly such type of network can cause significant revenue loss if failed. Generally survivability schemes address three kinds of events: attacks, failures and accidents. Attacks are potentially damaging events and include intrusions and denial of service. Failure is the state where system is unable to deliver expected output. It may be because of deficiencies in the system or in the external element on which the system depends. Accidents comprise broad range of unexpected events such as natural disasters. All of these

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

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Abstract

In this research paper, high-speed Free-space optical connectivity is explored for the long-distance of data transfer in various weather conditions. The system evaluates information transmission with the data rate of 2.5 Gbps up to a distance of 5 km. A high-speed SS-based free-space optical communication system is incorporated. It has been investigated by changing the WDM spectrum of Highly Non Linear Fiber by the Kerr effect of nonlinearity. The de-multiplexer provides 4 data-carrying channels with the capacity of 2.5 Gbps that are modulated using various modulation techniques. Furthermore, the efficiency of the system is evaluated by varying various parameters of the system including beam divergence angle, receiver/ transmitter antenna diameter, etc. The use of spectrum slicing offers an opportunity for a high data rate, broader bandwidth communication.

Keywords Beam divergence · HNLF · FSO · Quality factor · RZ · NRZ · CSRZ

1 Introduction

Presently, Free-Space Optics (FSO) has attracted much consideration in air communication due to numerous benefits over RF (radio frequency) transmission such as wide bandwidth, license-free operation and security, etc. (Parkash et al. 2016; Liu et al. 2005). The FSO is popular as compared to optical fiber communication, owing to more flexibility and cost-effectiveness, also more rapid and simpler for deployment and re-deployment (HeatleyD et al. 1998). Nowadays, various multiplexing techniques permit to hold the number of independent and autonomous optical carriers that have the ability to support Tbps of information (Ciaramella et al. 2009). Various researches on wireless communication by using the wavelength division multiplexing techniques have been done. Also, WDM provides the numerous ways of optical wireless communication for the data transmission which states

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