Workshop

Recent Advances in Robotics and Applications (RA)²

Monday, February 24, 2020

Venue: **Seminar Hall- IKG PTU, Kapurthla, Punjab, India**

WORKSHOP SCHEDULE

1:45-1:50	**Arrival & welcome at IKG PTU**	
1:50-2:00	**Opening** (Satvir Singh, IKG PTU Jalandhar)	
2:00 – 3:15	Ahmed CHEMORI, LIRMM – CNRS, France **Title:** Robotics Today: Research & Applications.	
3:15 – 4:30	Ahmed CHEMORI, LIRMM – CNRS, France **Title:** Advanced Control of Complex Robotic Systems.	
4:30 – 5:15	Neelesh KUMAR, CSIR-CSIO Chandigarh **Title:** Exoskeleton Device for Rehabilitation – MITRA.	
5:15-5:20	**Concluding Remarks** (Amit Gupta, IKG PTU Jalandhar)	

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ABSTRACTS

SPEAKER	Title & abstract of the Talk
Ahmed CHEMORI	Robotics Today: Research & Applications **Abstract:** Robotics is an interdisciplinary branch of engineering that includes mechanical engineering, electrical engineering, computer engineering, control engineering and others. It deals with design, construction and use of robots, as well as computer systems for their control, sensory feedback, and information processing. It may overlap with different fields such as electronics, computer science, mechatronics, artificial intelligence, nanotechnology and bioengineering. Robotics was initially and for a long time guided by needs in industry. Indeed, the early years of robotics was largely focused on robotic manipulators, mainly used for simple and repetitive automation tasks. The first industrial robot manipulator appeared in 1961 in the assembly lines of General Motors. Year after year, the progress of robotics and automation, as well as their associated innovative applications, have been noticed every day through the consideration of more and more complex tasks needing higher performances; such as those for operating in dangerous and hazardous environments. These complex and challenging tasks require a deeply understanding of robotic systems in different points of view, including mechanical design, kinematic and dynamic modelling, sensing, actuation, control design, optimization, etc. Nowadays, robotics is highly advanced, including various fields and applications. This talk will give a general overview of most of these robotic fields through various videos illustrating needs, challenges and applications.
Ahmed CHEMORI	Advanced Control of Complex Robotic Systems **Abstract:** Robotics was initially and for a long time guided by needs in industry. Indeed, the early years of robotics was largely focused on robot manipulators, used mainly for simple and repetitive automation tasks. The first industrial robot manipulator appeared in 1961 in the assembly lines of General Motors. The early control systems for robot manipulators were designed to control independently each axis of the robot as a SISO linear system. Linear automatic control theory was then extensively used in this basic solution, where the coupling dynamics between the different axes of the robot were often neglected and the robot model significantly simplified. Beyond these issues, the main barriers to progress were the high cost of computation, the lack of good sensors, and the lack of fundamental understanding of robot dynamics. However, the progress of robotics and automation as well as their associated innovative applications has required the consideration of more and more complex tasks needing high performances. These challenging tasks required a deeply understanding of complex nonlinear dynamics of robots. Besides, it has also motivated the development of new theoretical advances in automatic control, which has consequently enabled more sophisticated applications. Nowadays, robotic control systems are highly advanced, including various application fields. In this lecture the main challenges related to control of complex robotic systems will be emphasized, and illustrated through different applications in robotics, as well as some proposed advanced control solutions.
Neelesh KUMAR	Exoskeleton Device for Rehabilitation – MITRA **Abstract:** Rehabilitation using robotic devices is witnessing different applications for assistance and rehabilitation. Wearable biped robots, popularly known as Exoskeleton Devices, mimicking the human gait, near naturally, presents a unique opportunity for the restoration of impaired gait caused by various disorders. Initiated with rigid/fixed architecture fully actuated, mechanized machines, it in turn into flexible mechanism, anthropometrically suitable, hybrid actuation and portable power sources enabled devices making the augmentation and assistance available as per demand. The methods for identification of wearers intent based on neuro-bio-signal is gaining popularity among researchers. Exoskeleton with their applications in rehabilitation medicine and virtual reality simulation offer benefits for both disabled and healthy populations. Exoskeleton device can be used as a capability magnifier or as an assisting device for spinal cord injury patients, stroke patients, and the elderly. CSIR-CSIO, working relentlessly in the area of Mobility Assistive Gait Device for Rehabilitation (MITRA) has designed and developed an active exoskeleton for lower limbs including actuated hip, knee and ankle joints for both limbs. It is a perfect example of technology serving human needs where it is required most, improving the quality of life of the millions in need of special assistance. The exoskeleton design not only assists humans but also tries to improve their gait. MITRA is a boon to paraplegics, aiding them to stand upright, walk and do exercises for faster rehabilitation. The MITRA device developed by CSIR-CSIO will be available at one-fifth of the cost of the similar imported devices.