

## Message from the Editor-in-Chief



### Objectives and Activities

The main objective of AMM is to contribute to Mechanical Design at all levels starting from academic research to industrial initiatives, thereby enhancing the quality and reliability of indigenous machines.

With this in view, AMM organises the International and National Conference on Machines and Mechanisms, iNaCoMM, and the workshops on Industrial Problems on Machines and Mechanisms, IPRoMM regularly.

#### Contact Details

Prof. P M Pathak  
Secretary, AMM



*On behalf of the new editorial team, first and foremost, I extend our warm wishes for the festive season to our beloved readers. Secondly, I express our sincere acknowledgment to the Governing body for inducting us into the new editorial team for AMM News Bulletin. Also, we would like to express our heartfelt appreciations for Prof. Santanu Das and his editorial team for their sincere efforts, contributions and time spared for publishing regular issues of AMM News Bulletin.*

*Dear Readers, the new editorial team is in place and we assure you that we will offer our best to meet your expectations. The newsletter has established itself as an amalgamating medium for the rapidly evolving research community on Machines, Mechanisms and Robotics. It is thus an honour for me to be the new Editor-in-Chief of the newsletter and continue the excellent work of past editors, in collaboration with Dr. Ashish Singla, Dr. Nirmal Baran Hui, Dr. B. Vinod and Dr. Shantipal S. Ohol. On behalf of the AMM Editorial Team, I extend warm welcome to the readership of this news bulletin.*

*An enormous amount of work has been done into the advance of this bulletin and it is my sincere belief that you will see it being reflected in the forthcoming editions. The news bulletin aspires to have strong impact in the domain of machines, mechanisms and allied fields. We are presently witnessing significant issues in real world which are highly complex in nature. As researchers, we aim to seek ways to apply science and technology in the field of machines and mechanisms to meet such challenges. The timely and effective dissemination of the efforts of the scientific community is, thus of utmost importance. We welcome contributions in form of discussions and short reports demonstrating their practical usefulness into solving real world challenges from our intelligent and attentive readers.*

*Report of workshop conducted on Rehabilitation and Wearable Robotics at IIT Ropar by PunjROBOTICS is presented in the current issue. Further, to help future researchers in locating mentors in the domain of Machines, Mechanisms, Robotics and Automation, a database of student and researcher community has been set-up by AMM and details of PG and PhD thesis, conferences and workshops organized and projects awarded has been assimilated as much as possible and recorded in the current issue. Hope the readers find it useful.*

Nov 06 2019

Prof. S. Sanyal  
Editor-in-Chief

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## About the Association of Machines and Mechanisms (AMM)

The AMM headquarter is currently located at the Department of Mechanical & Industrial Engineering, IIT Roorkee. AMM invites both individual and corporate membership from Indian academia, research organizations and industry. Membership benefits and other information about AMM are available at [www.ammindia.org](http://www.ammindia.org). The body of Zonal Vice Presidents (ZVPs) is active over the past several years with representations from the four corners of the country. They are playing the role of nodal agencies so as to decentralize the AMM official activities and to organize workshops under the aegis of AMM to popularize the mechanism science in their respective regions. They also form the editorial team of this news bulletin. AMM invites contributory articles from its members and others working in the various fields of mechanisms science for this quarterly news bulletin. Interested people can contact the editorial team.

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# About the Association of Machines and Mechanisms (AMM)

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*Design is not how it looks like and feels like. Design is how it works*

*\*\*\* Steve Jobs*

## Report of Workshop on Rehabilitation and Wearable Robotics

Under PunjROBOTICS, a workshop was conducted on Rehabilitation and Wearable Robotics on October 11, 2019 at IIT Ropar. The PunjROBOTICS platform was set-up by Dr. Ekta Singla and her team at IIT Ropar in 2016 in order to formulate a common platform to coordinate local activities in robotics area. The workshop has been sponsored technically by AMM, where eminent personalities from India and abroad had participated.



**Dr. Ekta Singla, Organizing Secretary, delivering the opening remarks at the workshop**



**Prof S K Das, Director IIT Ropar welcoming and addressing the participants**



**Various UG, PG, PhD students and faculty members as participants in the workshop**

During this one day workshop, current issues and challenges faced by different research groups in the field of rehabilitation and wearable robotics were focussed upon. More than 30 participants including UG, ME, PhD students and faculty members of different engineering colleges had attended the workshop. Four expert talks were delivered by experts from academia, industry and research organizations like CSIR and DRDO. The workshop commenced with the opening remarks by Dr. Ekta Singla, organizing secretary, IIT Ropar. She emphasized on the importance of this workshop and the importance of PunjROBOTICS in bridging the gap and enhance interdisciplinary research in this area. Thereafter, the workshop was inaugurated by Prof. S K Das, Director, IIT Ropar.

The first expert talk was given by Prof. Ahmed Chimori, LIRMM-CNRS, France on the following topic of “Control of Wearable Robotic Devices: Overview, Challenges and Applications”.



**Prof. Ahmed Chemori, LIRMM-CNRS, France giving his expert talk.**



**Dr. Ashish Singla, TIET Patiala, felicitating the speaker after the talk.**



**Dr. Neelesh Kumar, Principal Scientist, CSIO Chandigarh, during his expert talk.**

### Talk 1: Control of Wearable Robotic Devices: Overview, Challenges and Applications

**Abstract:** Assisting disabled and elderly people in daily activities using wearable devices has gained a particular interest these last decades due to the highly increasing rate of dependent people. The rise in life expectancy is set to continue; combined with the decrease in birth rates, this should accelerate more the aging of the population. Consequently, this will certainly have a great impact on the development of assistive wearable devices. Thanks to the latest advances in portable device technologies in terms of compact/miniaturized design, low cost and energy consumption, their wearability has known an important progress.



**Prof. Gurvinder S Virk, Endoenergy Systems Mohali, during his expert talk.**



**Mr. S Nagarajan, Scientist D DEBEL Bangalore, during his expert talk.**



**Experts of the workshop having panel discussion with participants.**

The talk was focused on wearable robotics challenges, recent advances in this field, and some proposed control solutions for exoskeletons. The proposed control solutions were illustrated through numerical simulations as well as real-time experiments.

The second expert talk was delivered by Dr. Neelesh Kumar, Principal Scientist, CSIR-CSIO Chandigarh. The details of the talks are as given below:

### **Talk 2: Mobility Assistive Gait Device for Rehabilitation-MITRA**

**Abstract:** Recent trends in medical technology is witnessing the sprung in use of Robotic methods for different applications of rehabilitation, classified as resistive, assistive and augmentative. 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 wearer's intent based on neuro-bio-signal is gaining popularity among researchers.

Exoskeletons are the devices that reside in the category of wearable robotics with an external structural mechanism with joints and links corresponding to those of the human body. 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.

The third expert talk was given by Prof. Gurvinder Singh Virk, former Technical Director at InnoTecUK, Cambridge and now working as the Founder of Endo-energy Systems at Mohali. Prof. Virk focussed on the overview and importance of regulatory issues to be followed in medical and non-medical applications. The details of the talk given by Prof. Virk is as follows:

### **Talk 3: Wearable Assistive Exoskeletons for the Elderly**

**Abstract:** The current trend in robotics is to develop new markets in service and medical sectors. In this respect, the global ageing societal concerns are a major driver for realizing the new robot products. The potential for eventual commercialization is high but the new markets have to be created and developed. The presentation will describe applied research to develop commercially viable wearable assistive robots for elderly persons so that they stay independent living in their own homes for as long as possible. Medical and non-medical applications need to be considered and an overview of the regulatory issues in the urgently needed new robot products will also be described.



Certificate distribution ceremony at the end of the workshop followed by the group photograph of the participants

The fourth talk was given by Mr. S Nagarajan, Scientist D at DRDO-DEBEL Bangalore. Mr. Nagarajan has shared his experience, issues and challenges involved in making the lower-extremity exoskeleton being developed at DEBEL, Bangalore for load augmentation of soldiers. The details of the talk are as given below:

#### Talk 4: Modelling and Simulation of Augmentative Exoskeleton

**Abstract:** Soldiers are often required to carry heavy loads and perform strenuous activities resulting in increased fatigue, energy expenditure and reduced efficiency. Implementation of augmentative exoskeletons will result in improving their combat operational efficiency, which has to overcome many technological challenges like sensing, actuation, control strategies, human machine interface and simulation.

The presentation discusses about the significance of modelling and simulation for design and development of augmentative exoskeleton. The main objective of simulation is to ensure that there is an optimal force distribution between human and exoskeleton. It also provides insights into the design of mechanical structure, sizing of actuators and control strategy with respect to various biomechanical activities. Even though there is a long way before we could achieve these grandiose objectives there has been a many significant steps taken towards this direction which will be discussed along-with various solved and unresolved challenges.

**Panel Discussion:** A good amount of time in the workshop was kept for panel discussion, where all the experts from different domains shared the ideas, issues involved and the challenges faced by them. Many of the workshop participants utilized this opportunity to take the advice of the experts and clear their doubts on specific topics. The workshop concluded with distribution of certificates to all the participants along with a group photograph.

## Setting up of AMM Database

As it was mentioned in the beginning, the new editorial team was built recently for AMM Newsletter. The new team came up with the idea of developing a comprehensive database for student and researcher community, working in the field of machines, mechanism, robotics and automation area. This will help in locating the ideal mentors in specific areas, the suitable manpower required for different projects and the internship option available in relevant industries and research organizations. At initial stage, the following categories are included in the database:

1. ME Thesis
2. PhD Thesis
3. Conference/Workshop/STTP/FDP Announcement
4. Projects
5. Project Vacancy (JRF/SRF/PDF)
6. Summer Internship for Students

## 1. ME Thesis

S. No.	Student Name	Supervisor Name	Year	ME/MTech/MS Thesis Title	Affiliated College/University	Any Collaborative Work with Industry	Journal/Conference Publication
1	Ebin Mathew	Dr. T K Bera and Dr. Ashish Singla	2019	Modelling, Control and Experimentation for Vibration Suppression of Single Link Flexible Manipulator	Thapar Institute of Engineering and Technology, Patiala	-	-
2	Ashwin Dhawad	Mr. Chaitanya Tiwari, Dr. Sivakumar Palanivelu, Dr. Ashish Singla	2019	Mass and Grade Estimation of Commercial Vehicle using Kalman Filter	Thapar Institute of Engineering and Technology, Patiala	Tata Motors	-
3	Naval Gupta	Dr. T K Bera and Dr. Ashish Singla	2019	Cam Gear Walk Off in a Diesel Engine	Thapar Institute of Engineering and Technology, Patiala	Cummins Technologies India Pvt. Ltd	-
4	M. Sadiq A. Pachapuri	Dr. B. S. Manjunath	2011	Design and Finite Element Analysis of Flexural Bearing	Visvesvaraya Technological University, Belagavi, Karnataka	-	Futuristic Trends in Mechanical Engineering (FTME-2011), National Conference on Recent Advances in Mechanical Engineering - July 2011
5	Ankit Nakoria	Prof. Vijay Kumar Gupta	2019	----	PDPM IIITDM Jabalpur		
6	Aman Shree	Prof. Vijay Kumar Gupta	2018	Design and modelling of Stewart Platform based biped	PDPM IIITDM Jabalpur		
7	Rohit Gautam	Prof. Vijay Kumar Gupta	2018	Classification of EEG Signals for Different Hand Movements	PDPM IIITDM Jabalpur		
8	Rommel Nath	Prof. Vijay Kumar Gupta	2018	Ocean Energy Harvesting for Indian Ocean Waves	PDPM IIITDM Jabalpur		
9	Anil Kumar Gillawat	Dr. Hemant Jayantilal Nagarsheth	2010	Kinematics and Dynamics of Open Link Mechanisms	NIT Surat		

## 2. PhD Thesis

S. No.	Student Name	Supervisor Name	Year	Thesis Title	Affiliated College/University	Journal/Conf. Publication
1	Anil Kumar Gillawat	Dr. Hemant Jayantilal Nagarsheth	2019	Mathematical Modeling, Analysis and Optimization of Human Upper Limb Extremities	Thapar Institute of Engineering and Technology, Patiala	6

### 3. Conference/Workshop/STTP/FDP Announcement

S. No.	Conference/Workshop/Summer School/FDP/STTP	Dates	Venue	Details of Organising Member	Any Other Details
1	4th International and 19th National Conference on Machines and Mechanisms (iNaCoMM-2019)	Dec 5-7, 2019	IIT Mandi	Dr. Rajeev Kumar, Organizing Secretary, IIT Mandi	<a href="http://iitmandi.ac.in/iNaCoMM2019/">http://iitmandi.ac.in/iNaCoMM2019/</a>
2	The 6th Joint International Conference on Multibody System Dynamics and The 10th Asian Conference on Multibody Dynamics (IMSD-ACMD2020)	Nov 1-5, 2020	IIT Delhi	Prof S K Saha, Conference Chair, IIT Delhi	<a href="http://imsdacmd2020.iitd.ac.in/">http://imsdacmd2020.iitd.ac.in/</a>

### 4. Projects

S. No.	PI Name	Co-PI Names	Year	Project Title	Affiliated College/University	Funding Agency	Journal/Conf. Publication
1	Dr. Ashish Singla	Dr. T K Bera (TIET, Patiala), Prof S K Saha (IITD), Prof S P Singh (IITD)	2018-2021	Design and Development of a Three-Link Rigid-Flexible Manipulator for High Speed Operations	Thapar Institute of Engineering and Technology, Patiala and IIT Delhi	DST-SERB	P. V. Nandihal, V. Kumar, S. K. Saha, A. Singla, S. P. Singh, T. K. Bera, "Dynamic Modeling and Experimental Validation of a Single-Link Flexible Manipulator", ECCOMAS 2019 Multibody Dynamics Conference, Germany

Categories 5 and 6 will be updated in the next issue of the newsletter.

A Google form has been prepared for updating the details and can be accessed by all at the following link:

<https://docs.google.com/spreadsheets/d/1DnNFzDCKFSII--ilqFQqTHBodv7vF-zDZydaOCogxvo/edit?usp=sharing>

*Note: Intents are invited for hosting workshop on Industrial Problems on Machines and Mechanisms (IPRoMM 2020) and 5th International and 20th National Conference on Machines and Mechanisms (iNaCoMM 2021). Intent can be mailed at [secretary@ammindia.org](mailto:secretary@ammindia.org) duly forwarded by institute authority. All the intents received will be discussed during the general body meeting of AMM to be held at IIT Mandi during iNaCoMM 2019.*

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