

# Association for Machines and Mechanisms News Bulletin

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## Our 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 National Conference on Machines and Mechanisms, NaCoMM, and the workshops on Industrial Problems on Machines and Mechanisms, IPRoMM regularly.

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## Message from the Editor-in-Chief

### ASSISTIVE DEVICES: SOCIAL IMPACT AND TECHNOLOGICAL CHALLENGES

Assistive technology primarily refers to technologies or devices that are used to maintain or improve a person's ability to carry out daily tasks. Assistive technologies help persons with disabilities; perform tasks by compensating for physical, sensory, and cognitive impairments, and by promoting self-management and independence. Assistive technologies can be as simple as an amplification device to address hearing loss, a cane to help with balance and support, or a device that improves sight. In severe cases, assistive technologies "make the difference between being able to live independently and having to get long-term nursing or home-healthcare."

With an upsurge in longevity, a growing population of older adults and an association between age and disability, the need for assistive technologies is expected to increase dramatically. Approximately 23% of adults aged 45-64 years have some form of disability; for those 65 to 69 years old, the likelihood of being affected by a disability nearly doubles to 45%. Approximately 74% of adults aged 80 years old and over have a disability. As assistive technologies may reduce reliance on informal care, decrease functional decline, and lower health-related costs, they can benefit caregivers and society at large, as well as persons with disabilities.

Presently robotic systems are widely used as assistive devices. Although robots and robot systems are versatile manipulation aids, they appear to be less acceptable to people with disabilities than simpler and less flexible assistive devices, such as prosthetic limbs. There are many reasons for the lack of success of general purpose robotic aids in this community. Such electromechanical systems tend to be very complex, unreliable and expensive. Another key obstacle is the difficulty that the users have in controlling such complex systems. But efforts have been taken by the researchers to improve the technology of assistive devices so that it becomes attractive to use by the disabled.

Some technological challenges related with assistive device manufacturing and control include compatibility with user's biomechanical features, safety, effective motion transfer, low power consumption, easily chargeable battery, high performance signal processing and control methodology, and availability of small size powerful actuators etc. It is very difficult to accommodate all such contradictory performance, manufacturing and control challenges to develop an efficient assistive device for people with disability. Along with a massive social impact, area of research and development is also huge in the area of assistive technologies.

Different mechanisms are being used to make those assistive devices useful for the disabled persons. Now-a-days different electromechanical devices are being used for rehabilitation service of stroke and neuromuscular patients. Robotic surgery has replaced real doctors by more sophisticated device where unavailability of doctor and chance of error at the time of critical operation can easily be avoided. A simple buttonhook device, although not useful to most people, can assist someone who finds it difficult to manipulate buttons.

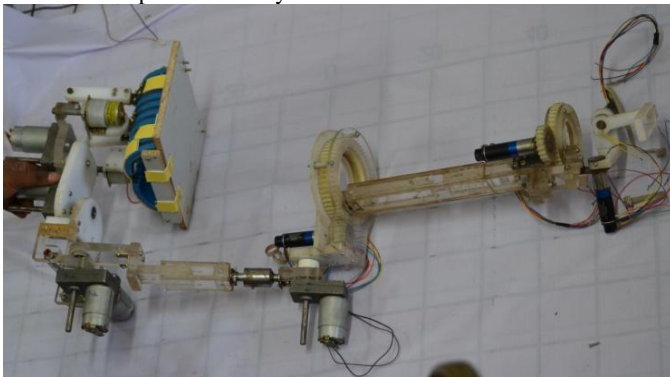
**Subhasis Bhaumik**  
Editor-in-Chief

## Hand Exoskeleton Device

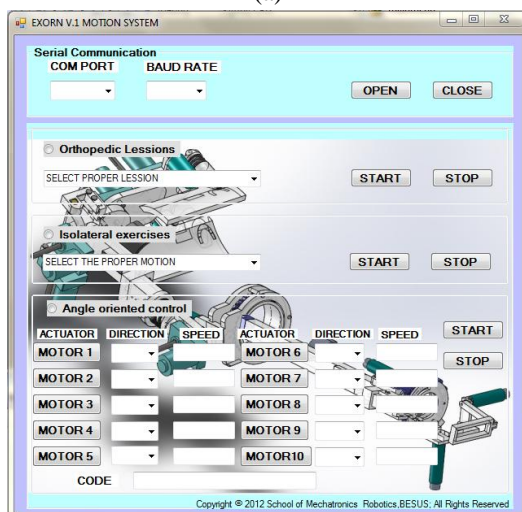
by  
Soumya Kanti Manna  
School of Mechatronics & Robotics  
BESU Shibpur Howrah

Stroke is one of the leading causes of mortality and morbidity worldwide. It is seen that a major stroke is viewed by more than half of those at risk as being worse than death. Paralysis is a condition caused due to complete loss of muscle function of one or more muscle groups. It is already proved that if they are under the process of rehabilitation for several months after stroke, their active range of motion as well as muscle strength can increase significantly. A repetitive and early training session will improve the neuro-motor functionality. The training includes all the orthopaedic and neurological lessons so that it will be compatible to the human muscle movement.

It is true that people of advanced countries have started using robotic devices for rehabilitation. In our laboratory, we are developing an exoskeleton device (Exorn), as shown in Fig. 1(a), which has ten degrees of freedom to control joints starting from shoulder girdle to wrist to provide better redundancy, portability and flexibility to the human arm motion. A 3D conceptual model is being designed to make the system wearable by human arm. All the joints are simple revolute joints with desired motion limit. Forward kinematics of the whole system has been formulated for getting the reachable points in 3D space and desired dexterous workspace. A proper and simple Graphical User Interface (GUI) and the required embedded system have been designed for providing physiotherapy lessons to the patients. See Fig. 1(b). A predefined resolved motion rate control structure with independent joint control was used so that all movements can be controlled in a predefined way.



(a)



(b)

Figure 1 Exeskeleton device

## Active Ankle Foot Prosthesis

by  
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School of Mechatronics & Robotics  
BESU Shibpur Howrah

According to a survey, there are around seven million transfemoral amputations conducted each year worldwide. To this huge number of amputee available prosthetic services are however limited. Most of the prosthetic devices are passive which provide only a partial support. As such there is a need of designing active prosthetic units which could improve the lives of amputees. One of the most significant limitations of current prosthetic technology is the inability to provide net power at the ankle joints which impairs the ability of the prosthesis to restore biomechanically normal locomotive function during many locomotive activities, including level walking, walking upstairs and slopes, running and jumping. The elevated metabolic demand and slower preferred speeds of transtibial amputees are likely due to the inability of their conventional passive prostheses to produce power at the ankle. We are developing an active ankle prosthesis (Fig. 2) which is basically a myoelectric controlled device. Sensor fusion comprises of EMG sensors, inertial sensors like accelerometer and gyro meter, pressure sensor, foot switch and joint angle measuring sensors. Ankle should provide balance during standing, produce sufficient positive work during gait cycle. Along with sagittal plane movement, there should be certain amount of lateral movement. Proper sensor fusion and myoelectric signal based control were carried out so that prosthetic part becomes more natural and acceptable to amputee. Wearable, low power and low cost designing are the main objectives. Proposed design will be of immense importance to lower limb prosthesis in general and transtibial amputees in particular for its low cost and active nature. Design concept can also be utilized in gait analysis, orthotic design in spinal cord injury and cerebral palsy and human computer interaction.

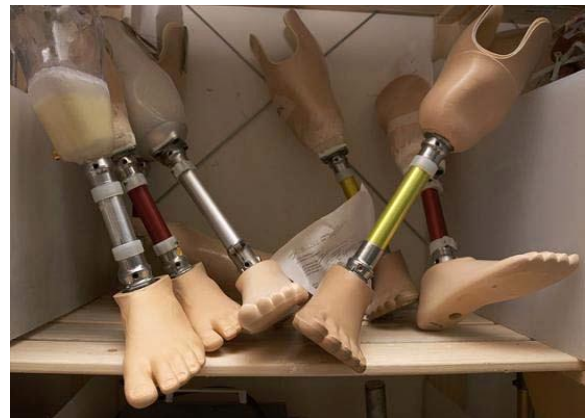


Figure 2 Active ankle foot prosthesis



## CNC Technology: For Prototyping Your Designs

by

S. Viswesh, SVP Laser Technologies Pvt. Ltd., Chennai

With increasing development in computer hardware and software technology, we now have access to sophisticated software and analysis tools for advanced designs. While every student has done design and analysis, and studied mathematics behind various mechanisms like multi-bar-linkages, involute and cycloid gears etc., very few of us have physically fabricate or build prototypes of the mechanisms we study or design. The main bottle neck is typically the lack of good manufacturing infrastructure. A good manufacturing infrastructure needs experienced manufacturing engineers, quality machine tools, experienced machine operators, raw material stock availability, etc. Only big size companies can afford such an infrastructure. Use of CNC prototyping machines is the best solution to this situation. Parts of a project can be designed in the computer with a CAD/CAM program, and then cut automatically using a CNC machine to produce a finished part. There are two types of CNC prototyping machines to achieve such prototypes.

**Additive** machines (also called 3D printers) are easy to use and can make very complex shapes, but often parts are limited to ABS plastic material.

**Subtractive** prototyping machines can make components in a wide range of materials like wood, plastics, composites and soft-metals. Components like linkages, gears, cam profiles, slots etc. can be easily fabricated in wood or acrylic or aluminium material. It was Sir Isaac Newton's hobby to make wooden models of various designs he observed or designed. Starting to "make" things is an important step towards product development and inventions. See Fig. 3 for prototypes made out of different materials.

### Sample Projects that can be made using CNC Machine



Acrylic & Nylon



Wood



Metals

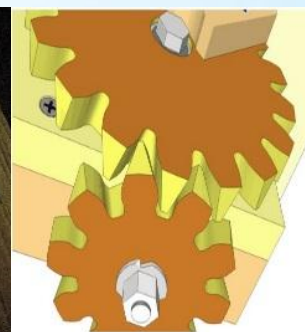
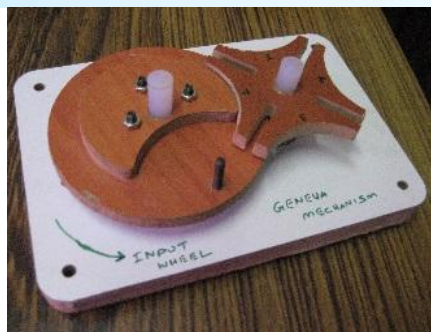


Figure 3 Prototypes out of different materials

In order to easily create prototypes even without having a CNC machine, we have set up [eCNCshop.com](http://eCNCshop.com). This is an online CNC machine shop where one can upload the CAD drawings and receive custom machined parts at the door-steps. A wide range of materials and manufacturing process (CNC milling, turning, plasma, Laser, water-jet, EDM, rapid-prototyping, PCB making, bending, powder coating etc. to name a few) are supported.

## Reports

### Advances in Robotics (AIR-2013)

by

Majid Koul, IIT Delhi

The first International Conference on Advances in Robotics (AIR-2013) was held under the aegis of Robotics Society of India (RSI) at the R&DE (Research and Development Establishment), a wing of DRDO (Defence Research and Development Organization) in Pune, between 04-06 July 2013. The conference was first of its kind and attracted people from academia, research laboratory and industry. The conference became a launch pad for the much needed interaction and integration between people from academia, research laboratories and industries of the country. Especially in the area of robotics, from teaching to research and development, a general feeling of interactions through such specific conferences was felt. Chief Guest Dr. R. Chidambaram (Principal Scientific Adviser to the GoI) insisted upon a grid to be established in the area of robotics, which would link the researchers from academic institutions, national research labs and the industries of the country, for an overall steep growth and progress in the field.

**Conference on “Developments in Robotics, Applied Mechatronics, Manufacturing & Automation”  
(DRAMA-2013), NITTTR, Bhopal, September 16-17, 2013**

by

**Sharad Pradhan, NITTTR Bhopal**

In the era of new economic structure, significant achievements have been made worldwide in the field of mechanical engineering like design, manufacturing, robotic and mechatronic systems, production and automation etc., and still considerable innovative research is being continued to address the technical and economic challenges in our country. In such a scenario, an attempt was made to share and discuss the recent developments and scope of Robotics and Mechatronics in Mechanical Engineering and its allied areas. The Conference aimed to share and discuss new technological developments, recent researches, innovations, applications and information in robotics, mechatronics, manufacturing, design and industrial automation that could lead to future expansions. The DRAMA 2013 included technical presentations, plenary talks, exhibitions, as well as attractive social events.

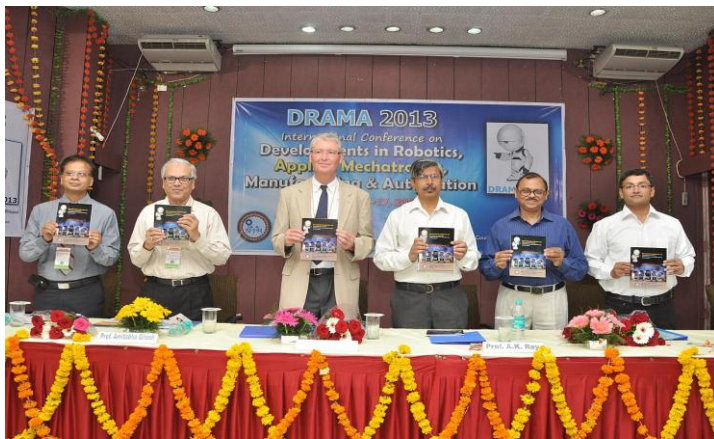


Figure 4 Release of conference souvenir



Figure 5 Group photo after the conference

The conference began with inspirational messages from key persons. The stalwarts of academia present to grace the event were Prof. B. Corves, University Professor and Director of the Department of Mechanism Theory and Machine Dynamics of RWTH Aachen University, Germany, Prof. Amitabha Ghosh, Chairman, BOG NITTTR Bhopal, Prof. Ajoy Kumar Ray, Vice Chancellor, Bengal Engineering and Science University, Shibpur, Prof. P.B. Sharma, Vice Chancellor, Delhi Technological University, Prof. G.K. Ananthasuresh, IISc. Bangalore, Prof. S.K. Saha, IIT Delhi, Prof. Subhasis Bhaumik, BESU Shibpur, Prof. C.S. Kumar, IIT Kharagpur, Dr. S. N. Shome and Dr. Nagahanumaiah, CMERI Durgapur, Prof. Anupam Saxena, IIT Kanpur, Dr. Santhakumar and Dr. I.A. Palani, IIT Indore, Dr. Bharatendu Seth, Ex-IIT Bombay, Prof. Daga, BIST Bhopal, Mrs. Asha Nair, CRISP Bhopal, Dr. Geeta Lathkar, MGM’s College of Engineering, Nanded. In total 6 technical sessions were organized with 4 parallel sessions for the delegates. Twelve keynote addresses by experts and 20 presentations were made by students, research scholars and faculty of various institutes.

During the sessions, the experiences and ideas shared by experts proved to be healthy for assessing the current practices in the areas of Mechanical Engineering and checking the initiatives being undertaken by various agencies for this. It is of particular importance that all of the ideas generated and reported during the two-day conference be implemented by the respective authorities and organisation in the respective regions. The discussions that infused the delegates with a different perspective of the subthemes may serve as an inspiration in developing better strategies and equipments for both the academicians and industry participants. A concerted effort will bring these initiatives to a higher stage, reaching out to more people and changing the lives of many. It is hoped that such new research trend will not only bring positive changes in the minds of the researchers but also in the society.

## AMM in Last Six Years (2008-2013) from the Patron's Perspective

by  
Subir Kumar Saha, IIT Delhi

I still remember NaCoMM 2007 in IISc Bangalore when Prof. Amarnath (President of AMM) approached me to take some responsibility for AMM (I was then Zonal Vice-President of North India). I took the role of Vice-President of AMM and immediately decided to appoint Zonal Vice-Presidents from leading colleges/institutes other than IITs/IISc mainly to engage the faculty members and students of those institutes, and all around them. It is very important for the growth of such association that we work together in terms of sharing information and knowledge in the area of mechanisms and machines. Another activity planned then was to bring out quarterly news bulletins to share the information/knowledge so that our members feel value for their memberships. It took about a year before the first news bulletin in its new avatar started appearing both in print and soft versions. Since January 2009 we have so far 20 issues (including this one) published. All of them are available through our website, <http://www.ammindia.org>. We spend a good amount of time to bring out the news bulletins but often find lack of interesting articles. Hence, many of us quite often wonder if it is worth continuing or not. In case the readers feel positive about the AMM news bulletins kindly contact me ([saha@mech.itid.ac.in](mailto:saha@mech.itid.ac.in)) and encourage us to continue our efforts. Please contribute interesting articles time to time for the news bulletins also.

Other than the above activities, I experienced successful conferences, NaCoMM 2009 in NIT Durgapur and NaCoMM 2011 in IIT Madras, before AMM decided to make it international. The 1<sup>st</sup> International and 16<sup>th</sup> NaCoMM will be held in IIT Roorkee during Dec. 18-20, 2013 where all readers are cordially invited to attend even if they may not have papers to present. There will be many international speakers including the President of IFToMM, Prof. Y. Nakamura from the University of Tokyo, Japan. AMM also organizes IPRoMM series of conferences targeting industrial problems, which were held at IIT Madras in 2008, MNIT Jaipur in 2010, and it is planned to be in ITS Eng. College, Greater Noida during Feb. 26-27, 2014. All are encouraged to submit papers in IPRoMM 2014 ([www.its.edu.in/ipromm2014/ipromm2014.html](http://www.its.edu.in/ipromm2014/ipromm2014.html)).

AMM tries to attract young talents through Mechanism Design Contests started from NaCoMM 2009, where any student or a group of students who made some functional mechanism(s) are encouraged to submit and present their systems during NaCoMM (from now on iNaCoMM) conferences. TA/DA are provided to those who are invited to present their mechanism(s). For more see <http://www.nacomm2013.org/contest.html>

With the above summary, I hope our members will take full benefit of the activities of AMM by actively participating in all the events, including writing articles for this news bulletin so that we feel connected even if we cannot attend one of the conferences or workshops conducted by the AMM.

Greetings for the happy festival season and see you soon in iNaCoMM!

## Forthcoming Events

### General Body Meeting of AMM Indian Institute of Technology Roorkee 6 pm, December 18, 2013

A General Body Meeting (GBM) of AMM would be held on the first day of iNaCoMM 2013. The date and time of the meeting would be as stated above. The exact venue will announced during the conference.

The agenda of the GBM are as follows:

1. Election of the next group of office bearers (i.e., President, Vice-President, Secretary, Treasurer). Nominations for these posts may please be posted to the current Secretary, at: [sandipan@iitm.ac.in](mailto:sandipan@iitm.ac.in), till December 16, 2013.
2. Identification of the hosts for iNaCoMM 2015, IPRoMM 2016.
3. Policy regarding discounts on registration fees of AMM conferences to IFToMM members.
4. Making iNaCoMM an annual event from the year 2016/2017.
5. Any other matter with the permission of the Chair.

All AMM members are requested to attend the above meeting.





## **National Conference on Industrial Problems on Machines and Mechanisms (IPRoMM-2014)**

**February 26-27, 2014**

Organized by Mechanical Engineering Department  
ITS Engineering College, Greater Noida (UP)  
in association with  
Association for Machines and Mechanisms (AMM)

The conference on Industrial Problems on Machines and Mechanisms (IPRoMM) 2014 is one of the series of national events organized biannually under the aegis of Association for Machines and Mechanisms (AMM), an affiliate of the International Federation for the Promotion of Mechanism and Machine Science (IFTToMM), on different themes of interest of industrial problems on machines and mechanisms. Realizing the vicinity of ITS Engineering College, Greater Noida to automobile industry and those associated with Agricultural Machines and Human Orthopaedic Support systems, the theme of this conference has been chosen as CAD Simulations in Automobile and Allied Industry. The aspect of Computer Aided Design (CAD) simulations has been chosen as it is an almost indispensable component in today's design and analysis of almost any system, particularly, in automobile designs, vehicle and crash simulations, safe vehicle designs, driver simulators, biomechanics, etc.

In order to attract the experts from the specific industry it is planned to have keynote lectures by engineering heads of different companies around the National Capital Region (NCR), and the panel discussion bringing industry and academia together. Academicians working in the CAD design and simulation of automobile components and allied areas are encouraged to submit papers to report their case studies and applications of their theories. Students working in these areas, e.g., simulating vehicles or their components to have an energy-efficient system or sub-systems are also encouraged to submit posters so that the young talents are exposed to the industry experts. Keeping in mind the above theme and objectives, the conference will accept papers and posters in the following areas:

- Mechanism analysis and synthesis for automobiles;
- Mechatronics for improved performance and safety of vehicles;
- Automotive chassis;
- Noise, vibration and harshness in automobiles;
- Balancing of vehicle components;
- History of automobile machines and mechanisms;
- Application of FEM in vehicle design, crashworthiness, etc.;
- Multibody system modelling for vehicles;
- Drivers' simulators;
- Mechanisms and machines for rural, agricultural and industrial applications;
- Bio-medical devices and mechanism kinematics;
- Students' competitions on vehicles, etc.

For details please visit [www.ipromm2014.org](http://www.ipromm2014.org).

## **ABU Robocon 2014 & DD-National Robocon 2014 Pune, India**

The next International Robocon - 2014 is scheduled to be held in Pune India on Sunday 24th August 2014, with the theme "A Salute to the Parenthood". The details for the contest are available on <http://www.roboconindia.com>.

In order to select two teams (as a host country India can have two teams), the Doordarshan (DD)-National Robocon 2014 will be held during March 6-8, 2014. See above website for registration and rules.

The newcomers in the competition may visit <http://www.roboconhelp.com> to get help in terms of availability of raw materials and online guidance.

## **IMSD 2014 and ACMD 2014 Busan, Korea**

The joint conference will be held in Busan, Korea during June 30-July 03, 2014. For more, visit <http://imsdacmd2014.ksme.or.kr/main/>

## **ISSS International Conference IISc, Bangalore**

Indian Institute of Science and Institute of Smart Structures and Systems, along with others, are planning a major event to showcase 100 small and smart innovations of the Young India at ISSS International Conference to be held in Bangalore during 15-18 July, 2014. The event will both be a contest and showcasing event where 100 students teams, both undergraduate and master's, demonstrate their working devices or systems. The emphasis of this contest is to have working prototype of an innovative device that uses smart materials and/or electronics with or without mechanical components. There will be attractive prizes for best prototypes and innovations. The student teams will be assisted by college teachers who are in turn helped by experienced researchers in India's research organizations. Interested student teams or faculty should send an e-mail to [ananthasuresh@gmail.com](mailto:ananthasuresh@gmail.com) for further details.

## **MAMM – 2014 Timisoara, Romania**

The 3<sup>rd</sup> Conference on Microactuators and Micromechanisms (MAMM-2014) will be held in Timișoara, Romania during October 02-04, 2014 which will be organised by Politehnica University of Timisoara, Department of Mechatronics under the patronage of IFTOMM (International Federation for the Promotion of Mechanism and Machine Science). Topics include

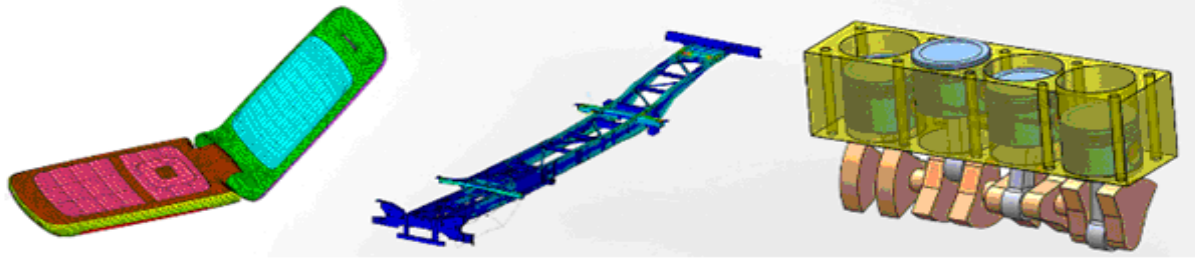
- Microactuators and micro-assembly;
- Micro sensors involving movable solids;
- Micro-opto-mechanical device;
- Mechanical tools for cell and tissue studies;
- Micromanipulation and micro-stages;
- Micro-scale flight and swimming;
- Micro-robotics and surgical tools;
- Micron-scale power generation;
- Miniature manufacturing machines;
- Micromechatronics and micro-mechanisms;
- Biomechanics micro and nano scales and control issues in microsystems etc.

Authors are invited to submit a full paper by February 28, 2014. Website: <http://mamm-2014.mec.upt.ro/>,  
E-mail: [mamm-2014@mec.upt.ro](mailto:mamm-2014@mec.upt.ro)

## **Advances in Robotics (AIR) 2015 BITS Goa, India July 01-04, 2015**

Advances in Robotics (AIR) 2015, the 2nd International Conference of Robotics Society of India (RSI), will be held in BITS, Goa Campus during July 01-04, 2015. More details will appear soon in <http://www.rsindia.org>.

# HEXDOLF



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Today, **RecurDyn** continues to lead the multi-physics CAE field by creating interdisciplinary CAE software that integrates MFBD, Lubrication, Control, and Design Optimization, all in a single framework.

**Function Bay Dynamics (I) Pvt. Ltd.**

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