Association for Machines and Mechanisms News Bulletin

Volume 6, No. 4 October 2014

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 & National Conference on Machines and Mechanisms, iNaCoMM, and the workshops on Industrial Problems on Machines and Mechanisms, IPRoMM regularly.

Inside This Issue

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Message from the Editor-in-Chief

The Volume 6, No. 3, July 2014 issue of the Bulletin is published in time due to scrupulous efforts of Dr. Ranjit Kumar Barai of Jadhavpur University, Kolkata (ZVP East), Dr. G. Sarvanakumar Secretary AMM, and other office bearers of AMM. The current Bulletin Volume 6, No. 4, October 2014 is being published with the active support of authors, researchers and students who have contributed to this issue. Dr. Shital S. Chiddarwar (ZVP West), Dr. G. Sarvanakumar Secretary AMM, Dr. C. Amarnath, President AMM and other office bearers of AMM have given active support for this issue. Dr. Ashitava Ghoshal, Vice President AMM, have elaborated about the Mangalyan Mission, latest proud achievement of ISRO and India in his address.

This issue consists of three contributed articles. “Design and development of a humanoid robot” explains about the current research work in the area of design and development of humanoid robot being undertaken at innovation lab of VNIT Nagpur. This article is written by a group of undergraduate students of mechanical and electronics engineering of VNIT Nagpur. A technical brief on “Study of dynamic interaction between manipulator and omni-directional platform” written by Prof. G.R. Nikhade of Ramdeobaba College of Engineering Nagpur is also included in this issue. The brief article entitled “Rebis –Reconfigurable Bipedal Snake Robot” written by Ajinkya Kamat, Rohan Thakker and Sachin Bhrambe of VNIT Nagpur explains about the technology developed for fabrication and programming of a novel reconfigurable snake robot. The Editor-in-Chief sincerely acknowledges the office bearer and Editorial Board members for peer reviewing technical articles and briefs. The review comments were utilised to revise the articles for inclusion in the bulletin. Our special thanks to Dr. C. Amarnath, President AMM, for special review comments.

AMM members are requested to contribute articles and send same to the editorial team. Constructive suggestions, comments for improvement in the Bulletin of the AMM are most welcome.

On behalf of the Editorial Team of the Bulletin of AMM, I express my sincere gratitude towards all concerned for their support, wishes and suggestions for bringing out of this Bulletin. Wish you all Happy Seasons Greetings!

Prof. Santanu Das
Editor–in–Chief

From the Desk of the Vice President

Let us start by congratulating ISRO and the Mangalyaan team at ISRO for successfully placing an orbiter around Mars. Using the workhorse, Polar Satellite Launch Vehicle or PSLV, the Mangalyaan (also called Mars Orbiter Mission) was launched on November 5, 2013. After a series of orbit raising maneuvers around Earth and spending more than 300 days in space, it was successfully inserted into Mars orbit on September 24, 2013. The Mangalyaan spacecraft carries five payloads to take colour pictures, investigate the surface composition, detect possible presence of methane, study the composition of the upper atmosphere and study the escape mechanism of gasses from the Martian atmosphere. From the last reports in newspapers, all the five payloads appear to be working.

The Mars Orbiter Mission is unique in many ways – ISRO is the first agency to successfully place an orbiter around Mars in its first attempt, it is the first Asian country to do so and it is the most inexpensive of all known Mars missions. From a science and orbital mechanics viewpoint, the Mangalyaan used least amount of fuel to get to Mars using the so-called Hohmann or minimum energy transfer orbit (for details see http://www.isro.org/mars/mission-profile.aspx). As a technology demonstrator, it has validated a host of technologies from deep space communications for interplanetary missions to navigation and autonomous control (to take into account the time delay of about 13 minutes for signal to travel from Mars to Earth). As in any other spacecraft, it has several mechanisms to deploy solar panels, antennae and other instruments, to initiate rocket burns for trajectory corrections and insertion into Mars orbit and all these have withstood the extreme cold for more than 300 days and worked perfectly. It is also hoped that useful science data will come from the payloads.

Rarely has any ISRO activity excited the nation as a whole as the Mangalyaan mission. It has enthused many youngsters and adults, made them feel proud to be an Indian and this is perhaps the most important contribution of the Mangalyaan mission.

Prof. Ashitava Ghosal
Vice President - AMM
Professor of Mechanical Engineering
Indian Institute of Science, Bangalore

About the Association of Machines and Mechanisms (AMM)

The AMM headquarter is currently located at the Department of Engineering Design, IIT Madras. A new set of office bearers have taken charge of the affairs of AMM. 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. 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 decentralise the AMM official activities and to organise workshops under the aegis of AMM to popularise 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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Progress is impossible without change, and those who cannot change their minds cannot change anything.

--- George Bernard Shaw

About the International Federation for the Promotion of Mechanism and Machine Science (IFToMM)

How IFToMM can be reached

- Through your local Member Organization, to become active in IFToMM
- Through an IFToMM Technical Committee Chairperson, to participate in a specific activity
- Through the IFToMM Executive Council
- Through the IFToMM Secretary General:
  Prof. Teresa Zielinska, Warsaw Uniwersity of Technology, MEiL, ul.Nowowiejska 24, 00-665 Warsaw, Poland

IFToMM Presidents

From left to right: Giovanni Bianchi (1984-1987 and 1988-1991), Arcady Bessonov representing Ivan I. Artobolevsky (1969- 1971 and 1972-1975), Bernard Roth (1980-1983), Jorge Angeles (1996-1999), Kenneth J. Waldron (2000-2003 and 2004-2007), Leonard Maunder (1976-1979), Adam Morecki (1992-1995), Marco Ceccarelli (IFToMM Secretary General 2004-2007, President 2008-2011). Toshiko Nakamura – current President

Main activities of IFToMM

- meetings, conferences, publications, direct collaboration
- 47 IFToMM Members of territory and national Organizations

- 13 Technical Committees:
  - Biomechanical Engineering
  - Computational Kinematics
  - Gearing and Transmissions
  - Linkages and Mechanical Controls
  - Micromachines
  - Multibody Dynamics
  - Reliability
  - Robotics and Mechatronics
  - Rotordynamics
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  - Transportation Machinery
  - Tribology
  - Vibrations
- 4 Permanent Commissions:
  - Communications, Publications and Archiving
  - Education
  - History of MMS
  - Standardization of Terminology

- 6 affiliated Journals and 2 book series:

Mechanism and Machine Theory
http://www.journals.elsevier.com/mechanism-and-machine-theory/
Problems of Mechanics http://pam.edu.ge
Open-access Mechanical Sciences
http://www.mech-sci.net
Chinese Journal of Mechanical Engineering
http://www.cjmenet.com
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Book series on MMS
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Book series on History of MMS
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- A World Congress every 4 years

IFToMM

International Federation for the Promotion of Mechanism and Machine Science

Mission
To promote research and development in the field of Machines and Mechanisms by theoretical and experimental methods, along with their practical application

Vision
To provide leadership for cooperation and development of modern results in the Mechanism and Machine Sciences by assisting and enhancing international collaboration

IFToMM webpage:
http://www.iftomm.org

IFToMM, April 2014

Bodies of IFToMM

General Assembly

The General Assembly is the supreme body of the Federation and determines its policy. It is composed of the Chief Delegates of IFToMM Members and members of the Executive Council.

Executive Council

The Executive Council manages the affairs of the Federation between the sessions of the General Assembly. It is elected every four years, meets annually, and is composed of the President, Vice- President, Secretary-General, Treasurer, and six ordinary members.

Commissions and Committees

Each Permanent Commission and Technical Committee is composed of a Chairperson, appointed by the Executive Council, a Secretary and members, nominated by the Chairperson and appointed by the Executive Council. A Chairperson shall not serve for more than two terms consecutively. The general goals for the work of the Commissions and Committees are aimed at promoting their fields of interest by attracting researchers and practitioners, including young individuals, in order to:

- define new directions in research and development within their technical areas;
- establish contacts between researchers and engineers;
- initiate and develop bases and procedures for modern problems;
- promote the exchange of information;
- organize national and international symposia, conferences, summer schools, and meetings.

Member Organizations

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Welcome to Taipei, China-Taipei, venue of the 14th IFToMM World Congress, 25-30 October, 2015,

www.iftomm2015.tw

IFToMM supported Conferences (selection)

Int. Symposium on History of Machines and Mechanisms (HMM)
Workshop on Computational Kinematics (CK)
Rotordynamics Conference
CISM-IFToMM Symposium on Robot Design, Dynamics, and Control (ROMANSY)
Mechanical Transmission Applications (MeTrApp)
Symposium on Robotics & Mechatronics (ISRM)
European Conf on Mechanism Science (EUCOMES)
Asian Conference on MMS (ASIAN MMS)
Summer Schools

Conferences under IFToMM patronage (selection)

Local conferences of the IFToMM Members
Symposium on Theory and Practice of Robot and Manipulators (SYROM)
IFToMM-FeIbIM Int. Symposium on Multibody Systems and Mechatronics (MUSME)

Joining IFToMM Member Organizations gives the following benefits:

international contacts for potential developments of joint projects;
reduced registration fees for IFToMM supported conferences;
participation and contribution in IFToMM activities and publications;
flow of information on IFToMM activities.

You are kindly invited to join IFToMM and its activities.

ReBiS – Reconfigurable Bipedal Snake Robot

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A snake that walks seems counterintuitive, at first. However, a ReBiS Robot (Fig. 1) has been designed and developed at Visvesvaraya National Institute of Technology, Nagpur. This snake robot has the ability to walk. It achieves this by transforming from a snake to a bipedal configuration and hence named as the Reconfigurable Bipedal Snake (ReBiS) Robot. Unlike other reconfigurable robots, which consist of modules that attach and detach at different locations to change the configuration, all the reconfigurations are achieved by ReBis without any rearrangements of the modules. This eliminates the requirement of complicated mechanisms and additional actuators to attach and detach the modules, making the robot lighter, more efficient and easy to manufacture. This novel idea that one can achieve re-configuration without rearrangement has changed the way one thinks about reconfigurable robots.

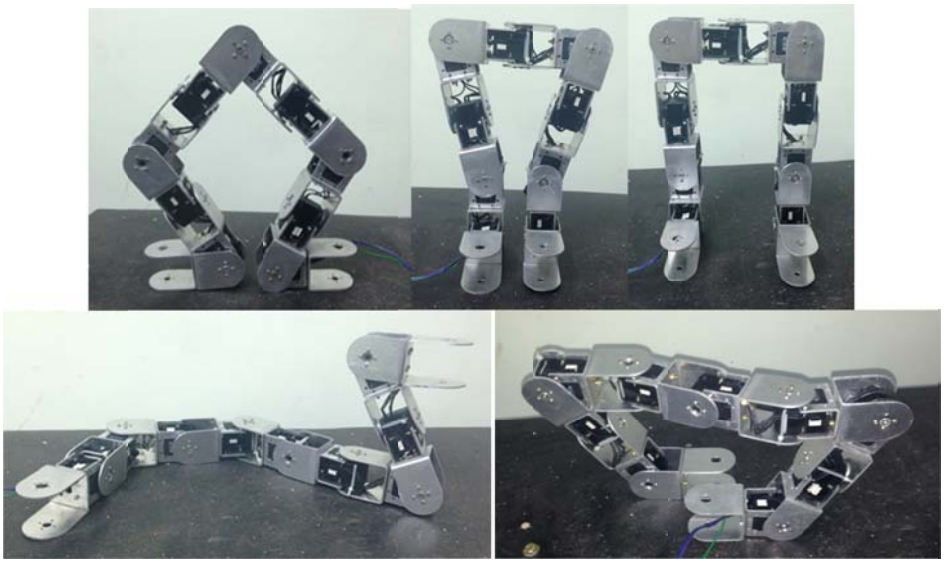

Fig. 1 ReBis Reconfigurable Bipedal Snake Robot

The ReBiS robot developed can inherently perform side winding, lateral undulation, linear progression and rolling motions like other snake robots. The currently available Snake robots are able to move underwater and navigate on rough terrains containing sand, grass or stones; where a typical wheeled robot cannot traverse. The ReBis robot transforms itself into various walking configurations according to requirements such as climbing stairs, or motion planning for navigating through a terrain with many obstacles. The developed ReBiS robot has a modular architecture consisting of identical independent modules having a single motor. Due to this flexible plug and play sort of architecture, addition or deletion of degree of freedom to robot is very easy. The mechanical links of the robot were fabricated on the CNC milling machine using aluminium sheet metal. The team of students have used high torque Dynamixel servo motors as its actuators. They have developed ROS (Robot Operating System) framework on Ubuntu 12.04 as a control software of the robot. They have designed a novel 4 DOF walking gait for one of the configurations of ReBiS for achieving desired stability without lateral shifting of the center-of-mass of the robot. Also they have implemented Genetic Algorithm (GA) to obtain optimal walking gait for 9 d.o.f. From

experimentation, it is revealed that this new walk has an additional advantage that the centre of mass is only shifted when both the feet are on the ground. SLAM (Simultaneous Localization and Mapping) has been developed using a Stereo Camera mounted on the robot. This has enabled the robot to autonomously create a map of an unknown environment. The developed ReBiS robot has potential applications like surveillance in nuclear power plants, inspection areas which are dangerous for humans to enter. It can also be used for search and rescue operations during natural calamities such as earthquakes and for archaeological explorations. The details about fabrication, control architecture, kinematic analysis and stable gait generation are available at the website www.rebis.inobotics.com. This research and development work was funded by VNIT Nagpur.

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Study of Dynamic Interaction between manipulator and Omni-Directional Platform

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A team of students have designed and simulated an Omni-directional mobile robotsfor welding operation. These robots find great potential in manufacturing and service industries in applications like material handling, welding process, medical science, navigation**,** and marine engineering due to its great manoeuvrability. In view of these advantages, they have designed and simulated Omni-WMR (Figure 1). It consists of a 5 d.o.f. SCORBOT ER-4 manipulator mounted on the omni-directional platform with four mecanum wheels. The mecanum wheel is a kind of omni-directional wheel consists of number of rollers mounted at the peripheral of the wheel at a certain angle made with wheel axis. This arrangement of rollers makes the platform to move in forward/backward, lateral, diagonal as well as instant rotation in clockwise/anticlockwise direction by rotating the individual wheels in specific direction. Along with the capability of Omni-WMR to move in any direction, there are certain vital issues like dynamic instability, structural complexity and dynamic interaction between manipulator and mobile platform needs to be resolved carefully for successful completion of any task.

The team members have done the study of dynamic interaction between manipulator and mobile platform as it is utmost important to ensure stable motion during task execution. This necessarily interprets the effect of manipulator dynamics on the platform motion and vice-versa. They have developed the kinematic and dynamic model for manipulator and omni-directional platform. Further, these models were utilized to develop a combined dynamic model of OMR for computing the variations in torque developed at manipulator joints as well as at platform wheels. From dynamic interaction study, it was observed that the mounting position of manipulator, spatial motion of end-effector and higher operating velocities does affect mutual torque dependency.

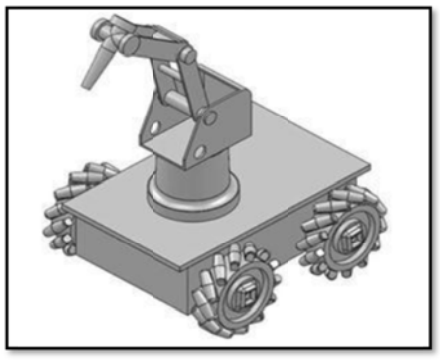

Fig.1 Omni-WMR

Further, they have considered dynamic instability of mobile robots as it is a great concern in regards with the safety of the operator, system and quality of work. The forces developed at the links of the manipulator during the task introduced the tip-over about transverse axis, roll-over about longitudinal axis as well as instability about vertical axis of the Omni-WMR. All these mode of instability were resolved by determining the suitable stable region for positioning the manipulator on the platform. The coordinates of stable region were computed from the reactive moment developed at the contact point between the wheel and ground. The interesting outcome of this study is that, it gives the dimensions of the platform which would avoid tip over using the maximum torque required. Finally, the results obtain from developed dynamic model were validated in simulation environment using SIM-MECHANICS toolbox of MATLAB and SOLIDWORKS compatibility with SIMULINK. The modeling of such highly non-linear system in simulation environment was efficiently done, and results of dynamic interaction study were validated.

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Design and Development of a Humanoid Robot

Sai Teja Manchukanti, Prasad Vagdargi, Akash Singh, Shivam Shrivastava, Manish Saroya, Manish Maurya, Anshul Paigwar and Shivraj Dalu

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A team of students have designed and developed a **humanoid robot** in the Innovation Lab at VNIT Nagpur (Fig. 1). The Height of the humanoid is 55 cm, weight is 3.5 kg, having 22 Degrees of Freedom. The control of the developed humanoid is done by an Intel Atom 1.6Ghz Processor with Operating on Robot Operating System (ROS) platform. The main parts of a humanoid robot i.e. arms, legs and the chest assembly were designed by considering the kinematic needs and actual aesthetics in a human body. The parts were modelled in 3D by using SolidWorks 2013, in which the parts were tested for their strength and reliability. The parts were then converted into sheet metal for fabrication. Then they generated the CNC codes for the designed parts and fabricated them on the milling machine of our FMS lab. The other parts were laser-cut (Aluminum) and 3D Printed (ABS Plastic) according to the size, accuracy and strength desired.

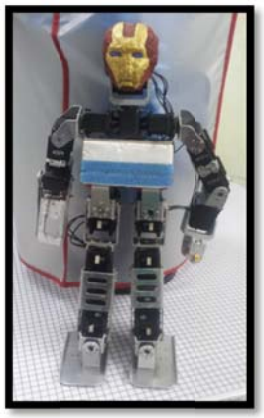

Fig. 1 Humanoid developed at Innovation Lab of VNIT

The kinematic analysis, gait analysis and balancing of the humanoid were the crucial issues. Authors have derived forward and inverse kinematic relations for this humanoid using basics of the kinematic analysis. The balancing of the humanoid was done by using the concept of Zero Moment Point (ZMP), according to which the dynamic equivalent of center of mass should lie within the stable polygon of the contact surface. The evaluation of the stability of motion was done by continuous computation of ZMP and checking stability condition. They have obtained ZMPin real time using Force-Sensitive Resistors embedded in the feet of the humanoid. In order to achieve stable walking gait for the humanoid, they have done trajectory interpolation using splines and fitting according to the constraints for that motion. The modelled highly non-linear gait function was solved using optimization toolbox of MATLAB. For obstacle detection and distance estimation during walking, the angular view of a single camera was used. To filter the noise and interference due to light, HSV workspace was used for adaptive thresholding. The Canny's edge detection algorithm was used for the object recognition. To incorporate dynamic gait determination, obstacle detection and avoidance and dynamic stability of the humanoid, high computation performance is expected from the processor. Hence, they have mounted a mini computer with an Intel Atom Processor in the chest of the humanoid. A TIVA C Series embedded microcontroller board was used to

interface the processor to the motors, sensors and other accessories like speakers and camera. To obtain the current angular parameters such as position, velocity and acceleration, they have used a 9 Axis Inertial Measurement Unit. A circuit was also designed according to the features and requirements which essentially contains Wireless control module using Dual Direction X-Bee radios, Half Duplex circuit used for buffers and communication with the Dynamixel Motors, Power surge protection and discharge protection for the Lithium Polymer Battery and Heat Dissipation fans and fins. The software framework developed for this humanoid makes use of is based on Linux Mint 13. They have selected it as an operating system due to its open source support and compatibility with Robot Operating System (ROS). ROS acts as an intermediary control platform between the hardware and the control system module.ROS Timers were used for scheduling data output tasks to the sub-controller in a synchronous manner. The suitable communication protocol was developed using concept of subscriber node and a publisher node. Authors have completed the fabrication of humanoid and now testing of algorithms is in process. They have achieved stable gait for walking of the humanoid. The humanoid can write as per one's desire. They are planning to incorporate adaptive learning capabilities in the humanoid using artificial intelligence. Also, they are putting efforts to make it adaptive in gripping and complaint for activities like weight lifting. This research and development work is funded by the Centre of Excellence, Combedded Systems of Department of Electronics Engineering of VNIT Nagpur.

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IFToMM

IFToMM 2015 World Congress
Oct. 25-30, 2015, Taipei, Taiwan
http://www.iftomm2015.tw

Call for Paper

The 14th IFToMM World Congress will be held in Taipei, Taiwan, on Oct. 25-30, 2015. IFToMM Wolrd Congress is held every 4 years and is the largest congress on mechanism and machine science. It will provide opportunity for researchers, scholars and students with interests in the theory and practice of mechanisms and machines for new ideas, sharing experiences, and discussing future developments.

TOPICS OF THE CONGRESS

Papers are welcome on the general areas of the theory and practice of machines and mechanisms, but not limited, to the topics of the IFToMM Technical Committees and Permanent Commissions, namely:

- Biomechanical engineering
- Computational kinematics
- Design methodology
- Dynamics of machinery
- Education
- Gearing and transmissions
- History of MMS
- Linkage and mechanical controls
- Mechatronics
- Micromechanisms
- Multibody dynamics
- Reliability of machines and mechanisms
- Robotics
- Rotor dynamics
- Standardization of terminology
- Sustainable energy systems
- Transportation machinery
- Tribology
- Vibration

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Secretary General: Tyng Liu
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PRESENTATION AND PROCEEDINGS

The official language is English. Registered participants will receive one Digital Proceedings which will be Engineering Index (EI), DOI and ISBN numbered.

PAPER SUBMISSION

All papers must be submitted electronically and they will be reviewed. Authors are requested to submit a full length paper, 4 pages (minimum) to 10 pages (maximum). The abstracts are NOT acceptable. The format will follow the IFToMM template that is available in the congress webpage. Best Paper awards will be given.

IMPORTANT DATES

Full version of the paper should be submitted through the Conference Web site.
On-line Submission System Open: 01 Sep. 2014
Full Paper submission: 15 Jan. 2015
Provisional decision: 15 Apr. 2015
Final version submission: 31 May 2015
Final decision: 15 Jul. 2015

REGISTRATION FEES

Early registration will be before 25 August 2015.

	Early Reg.	Regular Reg.
Delegate from IFToMM MO:	US$500	US$600
Delegate from non-IFToMM MO:	US$550	US$650
Student:	US$150	US$200
Accompanying Person:	US$150	US$200

IFToMM Young Delegate Program will provide support to young researchers as ruled in IFToMM webpage.

CONGRESS LOCATION

The island of Taiwan lies about 180 Km off the southeastern China. Taipei City, the capital of Taiwan is a city of fascinating contrasts – a mix of modern and traditional with a generous dash of energy and friendly smile.
It will be held in Taipei International Convention Center which situated in central Taipei, Xinyi District, near Taipei 101, with convenient transportation. For more information, please visit the Tourism Bureau site at: http://www.taipeitravel.net/en/scene/

ACCOMMODATION

A variety of hotels with special rate in different standards with the room rate ranging from US$133 to US$387 will be listed on the IFToMM 2015 website.

TRAVEL INFORMATION

Taipei can be reached by flight from all around the world to Taiwan Taoyuan International Airport (TPE) and Taipei Song Shan Airport (TSA). TICC is located on Xinyi line of MRT.
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http://www.taoyuan-airport.com/english/index.jsp
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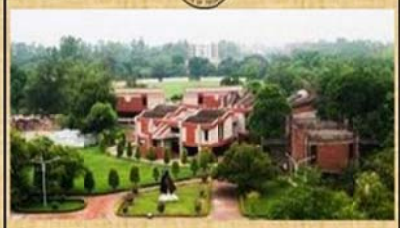
Ministry of Foreign Affairs, Taiwan
City Government of Taipei, Taiwan

Contact: iftomm2015@elitepco.com.tw /
IFToMM Web: www.iftomm.org / Conference Web: http://www.iftomm2015.tw

2nd International and 17th National Conference
on
Machines and Mechanisms
(iNaCoMM-15)
December 16-19, 2015
organized by
Department of Mechanical Engineering



IIT Kanpur

Under the aegis of

Association for Machines and Mechanisms

&

IFToMM
International Federation for the Promotion of Mechanism and Machine Science

Introduction

The Department of Mechanical Engineering, IIT Kanpur, under the aegis of the Association for Machines and Mechanisms (AMM), and International Federation for the Promotion of Mechanism and Machine Science (IFToMM) is hosting the 2nd International and 17th National Conference on Machines and Mechanisms (iNaCoMM 2015). The convention will be held on campus during December 16th - 19th, 2015.

Highlights of iNaCoMM-15

iNaCoMM 2015 is the 17th National and 2nd International in the series of biennial conferences on Machines and Mechanisms organized under the aegis of AMM and IFToM. The convention aims at bringing together researchers, industry experts and students, working on various aspects of design and analysis of machines and mechanisms, to deliberate via oral and poster presentations on recent, novel advances.

iNaCoMM 2015 will feature eminent researchers from India and overseas, as plenary speakers. The Conference is planned to commence with an introductory lecture on history and evolution of machines and mechanisms followed by a series of workshops on haptics, static balancing, precision mechanisms, and/or smart material-based mechanisms.

Each day thereafter will commence with a plenary talk by an eminent scientist followed by interesting morning and afternoon presentation/poster sessions on analysis and design of rigid body and compliant mechanisms, advances in biomedical devices, dynamics/control/vibration analysis of multi-body systems (special session) and machines, health monitoring, applications for rural environment and agriculture, mechatronic, micro- and nano- systems, and numerous other topics.

The day will culminate with another plenary lecture followed by soothing, recreational performances by our students from Music, Dance and Dramatics Clubs. Professional and Classical, music and dance nights are also planned.

Numerous industry representatives will also showcase recent technological advances in hardware and software.

Scope

The conference will cover following broad areas, but not limited to

- Agricultural and Industrial Applications
- Analysis and Synthesis of Mechanisms
- Compliant Mechanisms
- Design and Analysis of Biomedical Devices
- Dynamics and Control of Multi-body Systems
- Dynamics and Vibration Analysis in Machines
- Fault Diagnosis and Health Monitoring
- History of Machines and Mechanisms
- Mechanisms and Machines for Rural, Mechatronic Systems
- Micro-, Nano-Machines and Mechanisms
- Modeling and Simulation
- Robotics
- Theoretical and Computational Kinematics
- Tribology
- Vehicle Dynamics

Call for Papers

Authors are invited to submit a two-page extended abstract at the conference website

(www.inacomm2015.org)

by **May 1st, 2015**. The official language is English. Acceptance of the abstracts will be communicated by **May, 15th, 2015**. Full paper submissions followed by the camera ready prints in the Conference template are expected by **November 15th, 2015**.

Important Dates

Submission of Abstract	**May 1, 2015**
Acceptance of Abstract	**May 15, 2015**
Submission of Full Paper	**July 1, 2015**
Notification of Decision & reviewer comments.	**Oct. 1, 2015**
Final submission of Camera-Ready Prints addressing of reviewer comments.	**Nov. 15, 2015**
Registration	**Nov. 15, 2015**

(one author must register for inclusion of paper in Conference Proceedings)

Registration Fees

Delegates from	India (INR)	Others (USD)
Full time research scholar	2000	200
Research Organizations	5000	300
Others (Academic Institutions)	7000	450
Concession (IFToMM Members)	500	50

Advisory Committee

Agrawal Sunil K.	Columbia University, New York
Amarnath C.	IIT Bombay
Ananthasuresh G. K.	IISc Bangalore, India
Bandyopadhyay S.	IIT Madras
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Sen, Dibakar	IISC Bangalore
Sridhara, C. D.	ISRO, India
Venugopal, S.	IGCAR, India

Accommodation

On campus accommodation is available on payment basis at IIT Kanpur guest house/student hostels on first cum first served basis.

Organizing Committee

Patron: Director IIT Kanpur

Organizing Chairs

Anupam Saxena
P K Panigrahi (Head, Mechanical Engineering)

Overall Organization

P. Venkitnarayan
Neeraj Sinha
Shikha Prasad

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Behera Laxmidhar
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Bhattacharya Shantanu
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Sharma Ishan
Upadhyay Chandrashekhar
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For updates, please visit

www.inacomm15.org

About IIT Kanpur

IIT Kanpur is a mini-academic city, a self sustained, lush green campus spread across 1055 acres hosting about 14, 000 inhabitants. The campus is well-equipped with infrastructure catering to our academic, culinary, residential and recreational requirements. It offers an innate picturesque ambience that is consistently energizing and calming.

IITK experiences all seasons – the scorching heat of the summer, the wet, humid afternoons of the rainy season, and the chilly and hazy nights of the winter. Our hallmark is the presence of peacocks on campus, often lurching on the green grounds or resting on high branches.

Tourism sites in and around Kanpur

India is an experience! A visit to IIT Kanpur comes with a unique advantage of exploring the rich and diverse heritage of Northern India. Kanpur is home to several historical sites, e.g., Bithoor, Ghatampur and Shivrajpur. Visits to the mystic ghats of Varanasi, ancient ruins of Kaushambi, architectural splendor of Khajuraho, clouds touching down in Nainitaal, moonlit Taj and the transcendent beauty of the Himalayas are bound to leave one enriched and craving for more.