

# Association for Machines and Mechanisms News Bulletin

Volume 8, No. 2

April 2016



## 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.

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## Message from the Editor-in-Chief

Volume 8, No. 2, April 2016 issue of the Bulletin of the Association of Machines and Mechanisms (AMM) is now ready for publication. Dr. R. Ranganath, Zonal Vice President (South), has kindly taken the responsibility to bring out this issue.

Dr. G. Sarvana Kumar, Secretary AMM, Dr. C. Amarnath, President AMM and other office bearers of AMM have extended their support as usual to bring out this issue.

Two articles are included in this issue. The first one is on "6m Aperture Unfurlable Antenna" written by N.S. Murali, Milind Undale and Subash Yadav from ISRO, Bangalore. The second article is submitted by Sumit Kumar, Sri Narayan, Kamod Kumar Sah and Riyaz Rafique on "Mechanism for Biologically Inspired Four Legged Robotic Vehicle". They are from Sri Satya Sai University of Technology & Medical Sciences, Sehore, M.P. Hope both these two articles would be of interest to the Machines and Mechanisms community.

AMM members are requested to contribute articles for the July 2016 issue. Constructive suggestions, comments for improvement of the Bulletin of the AMM are also requested.

The Editor-in-Chief sincerely acknowledges the role of office bearers and members of the Editorial Team for obtaining and reviewing the write ups. I wish to express my sincere gratitude to all concerned for their help to bring out this issue of Bulletin.

I reiterate again that members of the AMM may think whether an International Journal of the AMM can be thought of in near future to promote the activity of Machines and Mechanisms community further.

**Prof. Santanu Das**  
Editor-in-Chief

## 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](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 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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**Purity, patience, and perseverance are  
the three essentials to success and,  
above all, love.**

**--- Swami Vivekananda**

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

## How IFTToMM can be reached

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



IFTToMM 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 (2008-2011 and 2016-2019), Yoshiko Nakamura (2012-2015)

## Main activities of IFTToMM

- meetings, conferences, publications, direct collaboration
- 47 IFTToMM 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
  - Sustainable Energy Systems
  - Transportation Machinery
  - Tribology
  - Vibrations
- 4 Permanent Commissions:
  - Communications, Publications and Archiving
  - Education
  - History of MMS
  - Standardization of Terminology
- 5 affiliated Journals and 2 book series:
  - Mechanism and Machine Theory
  - <http://www.journals.elsevier.com/mechanism-and-machine-theory/>
  - Open-access Mechanical Sciences
  - <http://www.mech-sci.net>
  - Chinese Journal of Mechanical Engineering
  - <http://www.cjmenet.com>
  - Journal of Vibration Engineering & Technologies
  - <http://www.jve-in.com/>
  - Mechanics Based Design of Structures and Machines
  - <http://www.tandf.co.uk/journals/titles/15397734.asp>
  - Book series on MMS
  - <http://www.springer.com/series/8779>
  - Book series on History of MMS
  - <http://www.springer.com/series/7481>
- A World Congress every 4 years



## 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

### IFTToMM webpage:

<http://www.iftomm.org>

IFTToMM, January 2016

## Bodies of IFTToMM

### General Assembly

The General Assembly is the supreme body of the Federation and determines its policy. It is composed of the Chief Delegates of IFTToMM 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.

### EC 2016-2019

President: Marco Ceccarelli (Italy); Vice-President: Chang Shao-Hung (China-Taipei); Secretary General: Zielinska Teresa (Poland); Treasurer: Carretero Juan Antonio (Canada); Past President: Yoshiko Nakamura (Japan); EC members: Corves Burkhard (Germany), Ghosal Ashitava (India), Huang Tian (China-Beijing), Merlet Jean Pierre (France), Viadero Fernando (Spain), Can Dede (Turkey)

### 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

ARMENIA  
AUSTRIA  
BELARUS  
BULGARIA  
CHINA-BEIJING  
CROATIA  
DENMARK  
FINLAND  
GEORGIA  
GREECE  
INDIA  
ITALY  
KAZAKHSTAN  
LITHUANIA  
MEXICO  
PERU  
PORTUGAL  
RUSSIA  
SINGAPORE  
SLOVENIA  
SWITZERLAND  
TURKEY  
UNITED KINGDOM  
VIETNAM

AUSTRALIA  
AZERBAIJAN  
BRAZIL  
CANADA  
CHINA-TAIPEI  
CZECH REPUBLIC  
EGYPT  
FRANCE  
GERMANY  
HUNGARY  
ISRAEL  
JAPAN  
KOREA  
MACEDONIA  
NETHERLANDS  
POLAND  
ROMANIA  
SERBIA  
SLOVAKIA  
SPAIN  
TUNISIA  
UKRAINE  
USA



Taipei, China-Taipei, venue of the 11th IFTToMM World Congress, 25-30 October, 2015  
[www.iftomm2015.tw](http://www.iftomm2015.tw)

### IFTToMM supported Conferences (selection)

- Int. Symposium on History of Machines and Mechanisms (HMM)
- Workshop on Computational Kinematics (CK)
- Rotordynamics Conference
- CISM-IFTToMM 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)
- Workshop on Medical and Service Robots (MESROB)
- Summer Schools

### Conferences under IFTToMM patronage (a selection)

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

### Joining IFTToMM Member Organization: gives the following benefits:

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

You are kindly invited to join IFTToMM and its activities

IFTToMM, January 2016

### Congratulations!!

Association of Machines and Mechanisms (AMM) takes pleasure in informing its members that its **President, Prof. C. Amarnath** has been chosen to be conferred with **Professor Emeritus** of **IIT Bombay**.

The Senate of IIT Bombay has recommended this considering his outstanding contribution to the growth and development of IIT Bombay during his long and fruitful tenure at the institution. AMM places on record at this juncture that the association was born in early 1980's during his tenure in IIT Bombay. The title shall be conferred to him during the next senate meeting of IIT Bombay that is scheduled to happen on 21<sup>th</sup> April 2016.

The AMM takes pleasure in congratulating him on this occasion and also wishes him many more successful professional years to come and a long and healthy life.

**The Secretary,  
Association of Machines and Mechanisms**



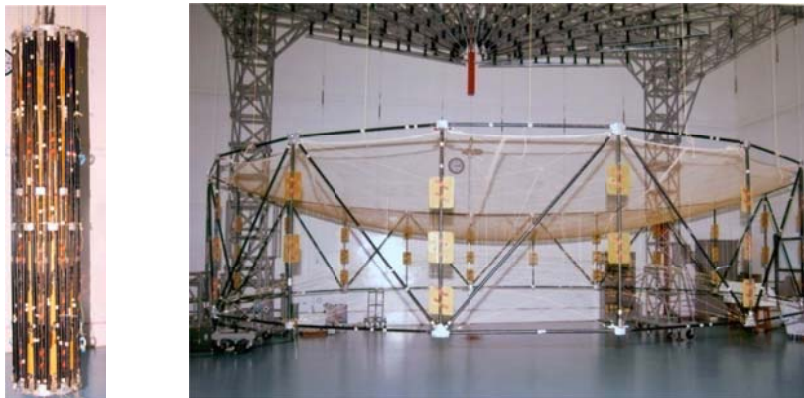
## 6m Aperture Unfurlable Antenna

N S Murali<sup>1</sup>, Milind Undale<sup>2</sup> and Subash Yadav<sup>3</sup>

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### Introduction

ISRO launched its GSAT-6 satellite on 27<sup>th</sup> August 2015 which carried a 6m aperture Unfurlable Antenna as one of its key element. Few days after launch, the antenna was successfully deployed on-orbit and In-Orbit Testing (IOT) of the satellite confirms the antenna meeting all requirements. Unfurlable Antenna (UFA) is an offset parabolic reflector of 6m aperture diameter which is packed to a smaller diameter of 0.4m during launch (Figure 1) and deployed in geo synchronous orbit 36000 kms above earth through remote command from ground. Unfurlable antenna is a unique technology, presently available with couple of nation's worldwide and the 6m Unfurlable antenna was successfully deployed on on-orbit in its maiden attempt.



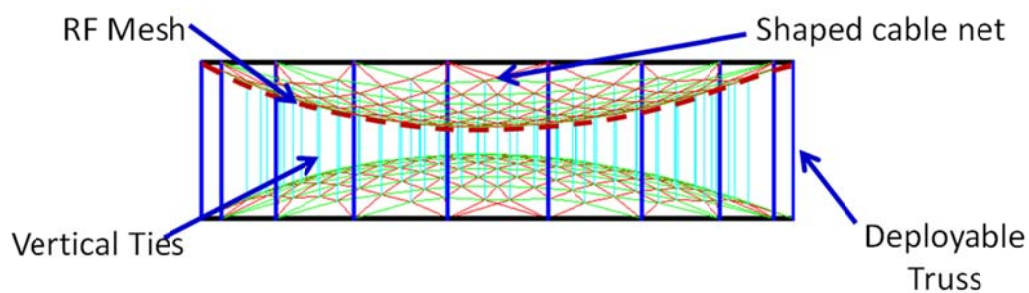
**Figure 1:** Unfurlable Antenna Stowed (left) and Deployed configuration (right)

Large aperture reflectors provide high antenna gain. They are typically made of mesh surface since they can be packed to very small volume and upon deployment are reflective to RF at frequencies below 30 GHz. At frequencies above 30 GHz, RF losses become excessive because of manufacturing limitations in creating a sufficiently fine mesh grid. Due to the limitations in the size of launch vehicle envelope, large reflectors exceeding 4m aperture diameter invariably, need to be stowed to smaller volumes during launch and deployed on-orbit.

Several Unfurlable Antenna's with aperture diameter varying from 4m to 21m<sup>1</sup> has flown till date. The shaping of the mesh is provided by various techniques, including deployable trusses, ribs, or hoops. Harris 4.8 meter Unfurlable mesh antennas have been flown on the NASA Tracking and Data Relay Satellite<sup>2</sup>, operating at S- and K-Band, and also integrated in the Galileo spacecraft (launch 1989) for data transfer at X- and S-Band frequencies. In addition to meeting requirements derived from RF specifications, unfurlable antennas must survive the severe launch and space environmental conditions and maintain their surface profile over the life-time of the payload.

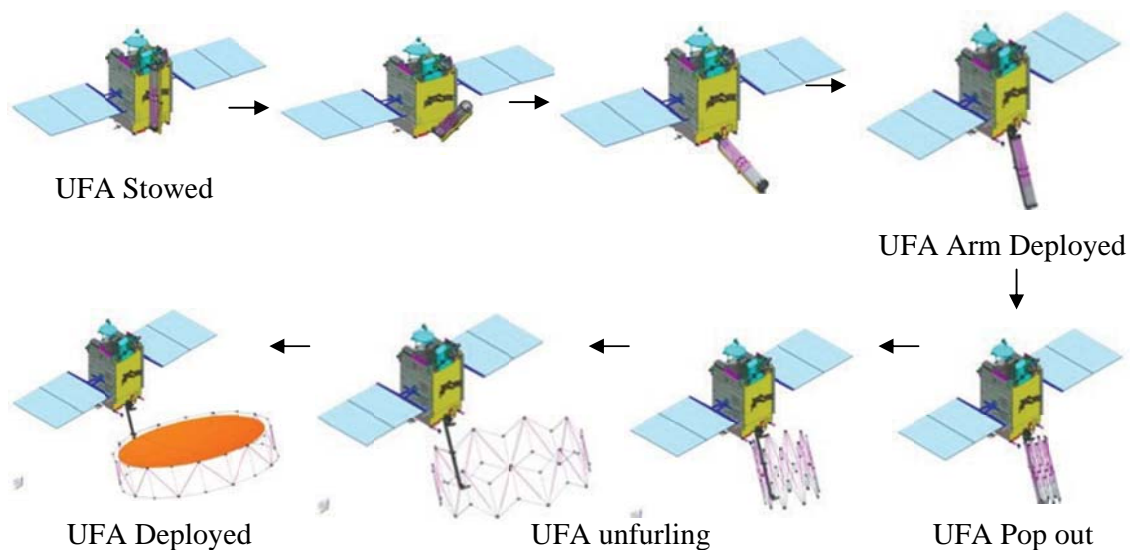
## 6m Aperture Unfurlable Antenna (UFA)

The 6m aperture Unfurlable antenna developed uses a gold plated molybdenum mesh as RF reflective surface. UFA is designed to work in S-band frequency (wave length  $\sim 100\text{mm}$ ). The surface rms tolerance range from 1/100th to 1/25th of the wavelength. Moreover, the reflecting surface has to provide quasi perfect reflection, i.e. with minimum ohmic loss; minimum depolarization and negligible passive inter-modulation product (PIMP) generation in cases with transmit/receive operation on the same antenna. The above aspects were considered during design phase and all the stringent requirements are met by careful selection of materials and adopting unique processes. The achieved reflector mass is 18 kg for a 6m aperture reflector. The aerial density (Mass/aperture size) of reflector is  $0.5 \text{ kg/m}^2$  which is very low as compared to other unfurlable reflectors. The shaping of mesh is obtained by a cable net, which is pulled in its perpendicular direction using cables of varying lengths called vertical ties (Figure 2).



**Figure 2:** Unfurlable antenna RF mesh shaping using cable net

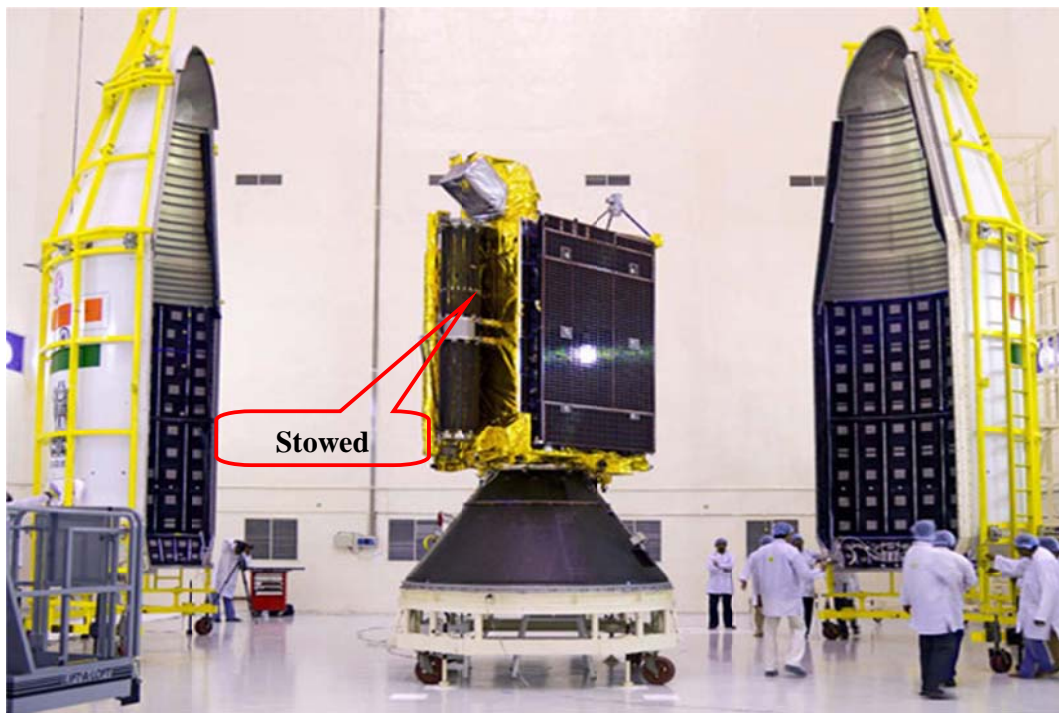
The cable net is compactly packed into a small volume and is stretched during deployment by means of a peripheral deployable truss. The peripheral deployable truss is made of several four bar mechanisms that are connected by gears, converting mutli degree freedom system into a single degree freedom mechanism. A miniature DC motor housed in one of the link of the deployable truss is energized to carry out the deployment. Prior to carrying out the unfurling of the reflector, the stowed stack was positioned away from the spacecraft body by operating a motor and latching in its final position. This was done to meet the optics requirement and later at the final position, the reflector is unfurled to its final position. Figure 3 shows the on-orbit sequence of deployment of Unfurlable Antenna.



**Figure 3:** On-orbit sequence of deployment

## Testing of UFA

A 3 model approach was adopted during realization of UFA, namely, Scaled Model, Engineering Model and Proto Flight Model. The RF surface design, materials and processes used were qualified using a 2m scaled model of the antenna. Thermo elastic distortion tests were carried out inside thermal vacuum chamber on the scaled model to validate the Thermal distortion analysis which predicted the on-orbit thermal distortions. A full scale engineering model was realized using which was subjected to deployment tests and sine vibration tests. Based on the observations from the engineering models improvements were carried out in the flight model. Protoflight model was subjected to deployment tests, thermo vacuum tests, sine and random vibration tests. Figure 4 shows stowed UFA on GSAT-6 with two halves of payload fairing of GSLV-D6.



**Figure 4:** Stowed UFA on GSAT-6 spacecraft with payload fairing of GSLV

## Specifications and Salient Features

- Aperture : 6m
- Focal length/diameter (f/d) : 0.73
- Centre offset : 3.55 m
- Stowed diameter : 0.4m
- Deployed diameter : 6.4 x 6.9 m
- Surface rms : 0.7 mm
- Stowed frequency : 52 Hz
- Deployed frequency : 0.7 Hz
- Mass (Reflector alone) : 18 kg



## Conclusion

A 6m aperture Unfurlable antenna has been successfully deployed in maiden attempt. In-orbit testing of the reflector has been satisfactory and meets all requirements. The development of UFA involves various domains of engineering like mechanism, thermal, structure, electromechanical, manufacturing, electrical, communications, etc.

## References

- [1] G. Roederer and Y. Rahmat-Samii, "Unfurlable Satellite Antennas: A Review", *Ann. Telecommun.*, Vol. 44, No. 9-10, pp. 475-488, 1989.
- [2] <http://tdrs.gsfc.nasa.gov/Tdrsproject/>

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# Mechanism for Biologically Inspired Four Legged Robotic Vehicle

Riyaz Rafique<sup>1</sup>, Sumit Kumar<sup>2</sup>, Sri Narayan<sup>2</sup> and Kamod Kumar Sah<sup>2</sup>

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Mechanism for biologically inspired four legged robotic vehicle is a newly fabricated linkage based parallel mechanism for legged locomotion. As the name suggests, the leg mechanism is inspired from the prior work “Adjustable mechanism for walking robots with minimum number of actuators”, authored by Professor Anirban Guha and Professor C. Amarnath.

The leg mechanism is a single degree of freedom mechanism which is a combination of Hoecken mechanism and a parallel mechanism, here parallel mechanism is deployed to trace the same curve traced by Hoecken mechanism. In this project there are two actuators for powering four legs. One actuator is responsible for powering the two legs in left side and other actuator is responsible for powering the two legs in right side. The cranks of front leg of right side and rear leg of left side are parallel and in the same way the other two cranks are parallel but are at about 180 degree with respect to the first two cranks for moving forward or backward. The primary motivation behind this new design was to develop a biologically inspired four legged vehicle with only rotary joints and utilizing least actuators.

The initial modeling of leg mechanism was done in AutoCAD and then the further dynamic simulation was verified by Autodesk Inventor 2015. After verifying the prototype of leg mechanism a low cost prototype of the robot was fabricated. Students have learned about real application of mechanisms during this project and have learned the concerned softwares. They are inspired and committed to work further in the field of mechanisms and machines with greater enthusiasm.

This model had bagged first prize in a national level technical festival "**Technospark 2k16**", held at Sri Satya Sai University of Technology & Medical Sciences, Sehore, Madhya Pradesh in the event "**Robomania**", a robotics competition held on 25-26th April, 2016. In the event **Robomania** any robot with the best feature was decided to be winner. A fully functional prototype was demonstrated at the event. The low cost prototype was manufactured at the **Sri Satya Sai University of Technology & Medical Sciences, Sehore, Madhya Pradesh**. The students and the mentor acknowledge the help from **SSSUTMS, Sehore, Madhya Pradesh** thankfully.

Figure 1 is a front view of single degree of freedom leg mechanism in which grounded link is shown in black, crank is shown in red and leg is in magenta. Foot trajectory of this leg mechanism for one complete rotation of crank is shown in cyan.

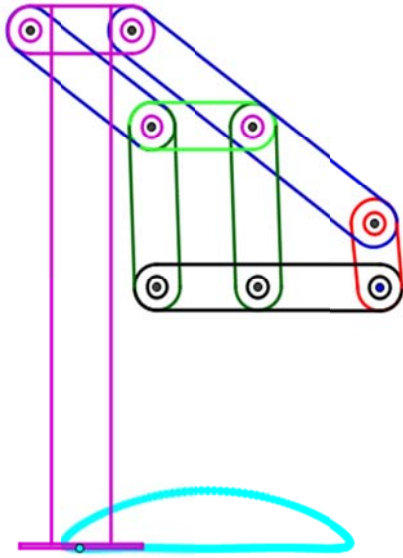


Fig. 1: Front view of single degree of freedom leg mechanism

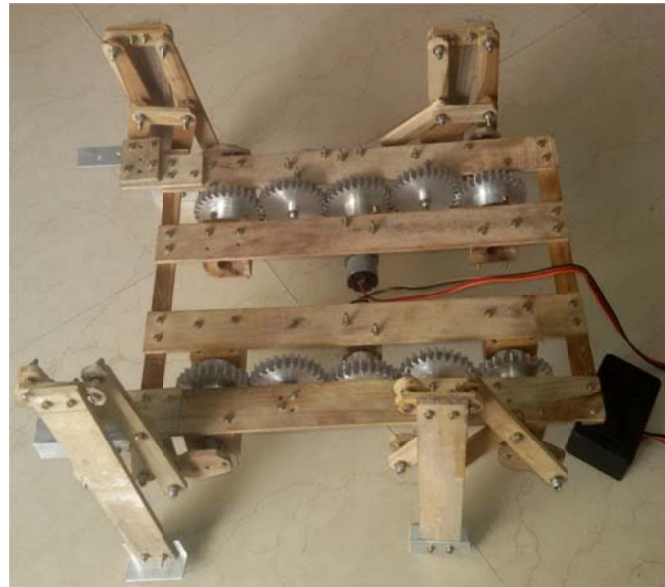


Fig. 2: Prototype of Biologically inspired four legged robotic vehicle

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## INTERNATIONAL FEDERATION FOR THE PROMOTION OF MECHANISM AND MACHINE SCIENCE

GEORGIAN COMMITTEE OF IFTOMM

"Mechanics 2016" International Conference

June 23-25, 2016, Tbilisi, Georgia

<http://www.gciftomm.org.ge>

Dear colleagues

International Federation for the promotion the of machines and mechanisms science (IFTOMM) and Georgian Committee of IFTOMM with the assistance and support of Georgian Technical University, Institute of Machines Mechanics, Georgian Aviation University, Ak. Tsereteli State University, Kutaisi National University and Georgian Engineering Academy will held on June 23-25, 2016 in Tbilisi, Georgia, an International Scientific Conference "Mechanics 2016".

The conference will be held in accordance with the Resolution of the International Scientific Conference "Mechanics 2014" (19-21 June 2014) that was organized under the patronage of IFTOMM, Georgian Committee of IFTOMM, Georgian Technical University and Institute of Machines Mechanics.

**We are honored to invite you to participate in the conference.**

**Under the patronage**  
of International Federation for the Promotion  
of Mechanism and Machine Science,  
Georgian Technical University,  
Institute of Machines Mechanics,  
Georgian Aviation University,  
Georgian Engineering Academy.

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of Georgian Committee of IFTOMM.  
**Co-chairman:**  
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Tamaz Natriashvili - Director of Institute of  
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Sergo Tepnadze - Rector of Georgian  
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Merab Iremadze - Vice-rector of Ak. Tsereteli  
State University,  
Amiran Aptsiauri - Rector of Kutaisi National  
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**Technical Program chair:** Otar Gelashvili  
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Mechanical Engineering of GTU  
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D. Tavkhelidze (Georgi)  
R. Turmanidze (Georgia)  
A. Sharvashidze (Georgia)  
M. Tsikarishvili (Georgia)

### Topics of the conference

- ♦ General Mechanics
- ♦ Applied Mechanics
- ♦ Hydroaeromechanics
- ♦ Mechanics of aircrafts
- ♦ Mechanics of rigid deformed body
- ♦ Mechanics of technological machines
- ♦ Mechanics of transportation machinery
- ♦ Mixed problems of mechanics
- ♦ Economics and mechanics of engineering
- ♦ History of Mechanics

### Presentation and proceedings

The working languages of Conference are:  
English, Russian and Georgian.  
Official language for drawing the papers is  
English.

### Paper submission, presentation and publication

All papers will be considered and reviewed.  
Authors are requested to submit a full paper  
up to 6-10 and would be drawn up in  
accordance with requirements of  
<http://www.iftomm.org/journals>, or  
<http://www.pam.edu.ge> "For authors".

### Deadlines

Application submission **February 20, 2016**  
Full paper submission **March 14, 2016**  
Registration fee: **May 2, 2016**  
Registration: **June 22-23, 2016**  
Conference work **June 23-25, 2016**

Accepted and positively evaluated by  
organizational committee of conference  
reports in case of registration fee payment will  
be published in Proceedings of Mechanics  
2016

Abstracts and full papers should be submitted  
through the Conference to e-mail address:  
[mechanics2016@gciftomm.org.ge](mailto:mechanics2016@gciftomm.org.ge)

### Registration

The registration fee makes US \$ 350

The registration fee includes:

- expenses on conference technical support;
- Coffee break, banquet, cultural program for participants;
- Kits for participants;
- Publication of a special scientific issue a;

Mail service (including the postage for foreign  
participants to send of scientific issue)

At payment of registration fee the author  
(authors) receives a single Proceedings.

Transportation, meals and accommodation at  
the expense of participants

The payment will be transfer till to **May 2, 2016** on account  
INTERMEDIARY: HSBC BANK USA  
SWIFT: MRMDUS 33  
TBC BANK'S CORRESPONDENT  
ACCOUNT: # 000-305022  
BENEFICIARY'S BANK: HEAD OFFICE  
SWIFT: TBCBGE 22  
VAKE BRANCH OF JSC TBC BANK  
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GEORGIA  
SWIFT: TBCB GE 22830  
BEN'S ACCOUNT:  
GE20TB060000075070147  
NAME OF BENEFICIARY "GEORGIAN  
COMMITTEE OF THE INTERNATIONAL  
FEDERATION FOR THE THEORY OF  
MACHINES & MECHANISMS"  
Destination: International Conference  
"Mechanics-2016" registration fee

### Conference location

Tbilisi is the capital and the largest city of  
Georgia, lying on the banks of the Mtkvari  
River with a population of roughly 1.5 million  
inhabitants. Founded in the 5th century by the  
monarch of Georgia's Vakhtang Gorgasali,  
Tbilisi has served, with various intervals, as  
Georgia's capital for more than a thousand  
years. <http://en.wikipedia.org/wiki/Tbilisi>  
Tbilisi International Airport is located on  
distance of 25 km from Tbilisi

### Accommodation

We recommend the two hotels "Leville"  
(daily 40-80 US \$) and "Tiani" (daily 80-130  
US \$), located in adjacent of GTU.

Also is possible to make room booking on  
arbitrary Tbilisi hotels

<http://www.hotels.com.ge/?lang=>

### Secretariat

For any specific information please use the  
e-mail address

[mechanics2016@gciftomm.org.ge](mailto:mechanics2016@gciftomm.org.ge)

or make call +995 555 372583 Malkhaz  
Nikoladze

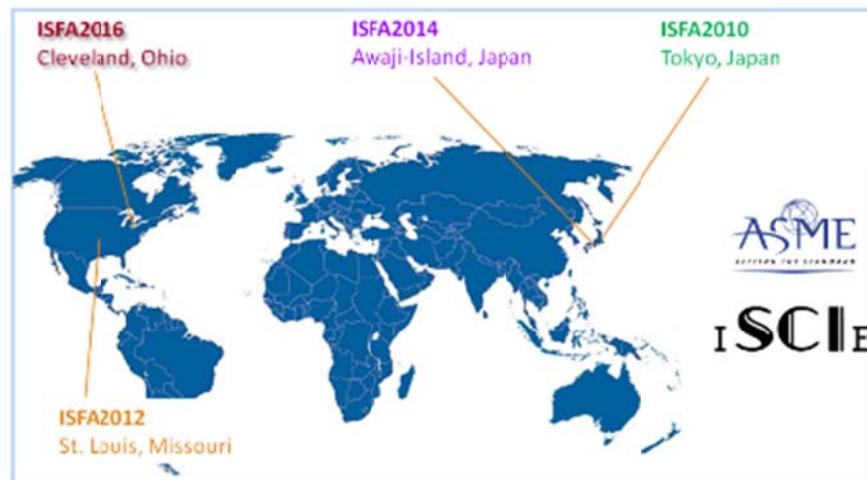
### 2016 International Symposium on Flexible Automation (ISFA 2016)

■ August 1 - 3, 2016 ■ Cleveland, Ohio

Hosted by Case Western Reserve University

(<http://engineering.case.edu/conference/ISFA2016>)

A warm “welcome” from the Case Western Reserve University (CWRU) to you to join us in the **2016 International Symposium on Flexible Automation**, to be held during August 1–3, 2016 at the InterContinental Hotel near the CWRU campus in Cleveland, Ohio.



The **ISFA** conference was initiated in 1986 under co-sponsorship of the American Society of Mechanical Engineers (ASME) and the Institute of Systems, Control and Information Engineers (ISCIE) in Japan. Since then, the Symposium has been held every two years, and the title "Flexible Automation" was selected as a general term to describe automation technologies that are essential to meeting the increasing requirements of modern manufacturing and other related fields, such as dynamical systems, robotics, logistics, biomedical systems, and health care systems. While many of these requirements such as flexibility, artificial intelligence, mechatronics, 3D design and modeling, lead time reduction, and lean manufacturing, were identified over more than three decades ago, they still pose challenges and continue to motivate research in the field. In addition, newly emerged ideas and technologies, such as unmanned vehicle control, Internet of Things (IoT), cloud computing and manufacturing, additive manufacturing, image processing and pattern recognition, cyber-physical systems, security, and environmental sustainability present both new challenges and opportunities that broaden the scope of research and impact the continued advancement of flexible automation.

The theme of the **ISFA 2016** conference is "**Flexible Automation: Smart and Connected**" and aims to inspire research on energy-efficient and intelligent automation, enhanced by the cloud infrastructure.

### Conference Programs

Below is a list of Call for Papers (CFPs) for technical sessions to which paper submissions are invited:



- Session on Additive Manufacturing Sensing and Control
- Session on Metal Cutting and Machine Tools
- Session on Digital Design and Manufacturing
- Session on Flexible and Reconfigurable Manufacturing Systems
- Session on Flexible Automation in Manufacturing Systems
- Session on Industrial Robotics
- Session on Manufacturing Controls and Machine Automation
- Session on Mechatronics and Precision Manufacturing
- Session on Manufacturing Process Control
- Session on Methods and Systems of Tribology Diagnostics and Monitoring
- Session on Metrology for Manufacturing
- Session on Nanomanufacturing and Nanoinformatics
- Session on Precision Manufacturing
- Session on Sensing and Information Extraction
- Session on Smart and Sustainable Manufacturing
- Session on Smart Manufacturing
- Session on Virtual Augmented and Mixed Reality
- Other Topics

### Important Dates

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- 
- **February 12, 2016** Submission of manuscript via conference website
- **April 29, 2016** Notification of paper review results
- **June 3, 2016** Submission of revised manuscript and registration of presenting author

### Paper Submission

We encourage you to submit a high-quality manuscript to the 2016 ISFA. Both theoretical and applied papers from the academic, industrial, and government sectors are welcome. Submission can be in the form of long paper (8 pages maximum) or short paper (4 pages maximum). Only long papers are eligible for consideration of the Best Paper Awards.

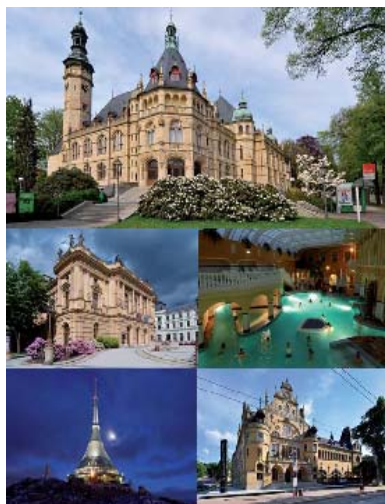
Please submit your paper(s) through **PaperCept** by the specific deadline to one of the 17 organized sessions. If you feel your paper does not fit into any of these organized sessions, submit to the Session entitled "Other Topics."

The official language of the conference is English. To submit a paper, you must first register a **PIN**. Papers must be uploaded as PDF files that conform to the conference paper format as illustrated in the **Paper Template** in Microsoft Word. Note that the maximum file size is 6 MB.

At least one author must register for the 2016 ISFA before the final manuscript can be uploaded. A single author can upload a maximum of two papers. Authors of accepted papers are expected to attend the 2016 ISFA and present their work. If you have any questions, please contact:

Dr. Robert G. Landers, Program Chair, [landersr@mst.edu](mailto:landersr@mst.edu)  
 Dr. Keiichi Shirase, Program Co-Chair, [shirase@mech.kobe-u.ac.jp](mailto:shirase@mech.kobe-u.ac.jp)

## Forthcoming Events



### History of Liberec

Its history goes back to the time when trade routes to Germany and Poland led through the location. As traders found crossing Jeřábeky hřeben too hard, it was necessary to set up a resting place. At that time Liberec used to be an open market village. The first notes on a town date back to 1352. In the first half of the 16th century it gradually changed into a vassal town. Liberec used to be the second biggest town in Bohemia. There were 3 consulates, 50 textile factories and 60 metalworking factories. Nowadays Liberec offers various tourist attractions. The city boasts of numerous important buildings, such as the City Hall, F. X. Šalda Theatre, Museum of Northern Bohemia, Jeřábek Viewing Tower, Babylon Leisure Centre and other cultural and historical sights. Liberec is also an ideal place for walks or hiking tours in its environs or in the Jeřábek hory. Liberec is less than 1 hour from Prague...

 **TECHNICAL UNIVERSITY OF LIBEREC**  
Faculty of Mechanical Engineering



### Address of Organizing Committee

Technical University of Liberec  
Department of Textile Machine Design  
Studentská 2  
461 17 Liberec, Czech Republic

Telephone: +420 48 535 3773  
Fax: +420 48 535 3514  
E-mail: TMM2016@tul.cz

[www.tmm-conf.org](http://www.tmm-conf.org)



## XII. International Conference on the Theory of Machines and Mechanisms

September 6–8, 2016  
Liberec, Czech Republic



The International Federation  
for the Theory of Machines  
and Mechanisms



### Topics of the Conference

Papers classified by the scientific steering committee will be presented in parallel sessions related to the following topics:

- Control theory of mechanism and machines
  - Design and synthesis of planar and spatial mechanisms
  - Dynamics of mechanism and machines
  - Kinematics and gears
  - Computational methods
  - Robot dynamics
  - Microactuators
  - Vibration and noise in machines
  - Optimal design of mechanisms and machines
  - Control and monitoring systems of machines
  - Accuracy and reliability of mechanisms and machines
  - Health and diagnostics
  - The introduction of IT in machines
- Scientific conferences on related but technical university or centers

### Accompanying Events:

### Collaboration:

The conference is organized under the patronage of:



ROMANIAN ASSOCIATION OF THEORY OF MACHINES



ROBOTICS SOCIETY OF ROMANIA



VITO, AKA BUREAU OF INNOVATION

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Department of Mechanism Theory and Dynamics of Machines,  
RWTH Aachen University  
and

University and Department of Mechatronics,  
University Politehnica Timisoara (UPT)

### With support of:

IFTOMM Germany

Romanian Association for Theory of Machines and Mechanisms

Robotics Society of Romania

Website: <http://www.mtm-robotics-2016.igm.rwth-aachen.de/>

## Conference Topics

We are looking for original, high-quality contributions addressing (but not limited to) the following topics:

- MTM

Mechanisms – analysis and synthesis  
Dynamics of mechanisms and machines  
Mechanical Transmissions, Biomechanics,  
Precision mechanics, Mechatronics,  
Micromechanisms and Microactuators  
Computational and Experimental Methods  
CAD in mechanism and machine design

- Robotics

Mechanical design of robot architecture  
Parallel robots, Mobile robots,  
Micro and Nano robots,  
Sensors and actuators in robotics,  
Intelligent control systems  
Biomedical engineering  
Teleoperation, haptics, virtual reality



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## ADDRESS FOR CORRESPONDENCE

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Department of Mechanical Engineering  
Visvesvaraya National Institute of  
Technology Nagpur  
Maharashtra, India - 440010  
Email : ipromm2016@gmail.com  
Website: www.ipromm2016.org  
Phone no: +91-712-280 1163/1167

## XII IPROMM

National Workshop  
on

**INDUSTRIAL PROBLEMS ON  
MACHINES & MECHANISMS:**  
*"Challenges in Manufacturing"*



Organised by  
Department of Mechanical  
Engineering  
Visvesvaraya National Institute of  
Technology, Nagpur

under the aegis of  
Association of Machines &  
Mechanisms

December 22-23, 2016

## ABOUT WORKSHOP

IPROMM essentially concentrates on industrial problems and practical solutions to the design of machines in specific areas. The workshops held so far had covered textile, mechanical handling, agricultural machinery, home appliances and precision instruments and micro-mechanisms. The 11<sup>th</sup> IPROMM covered CAD Simulation in Automobile and Allied Industry. The main purpose of organizing this workshop is to bring engineers from industry and academia together on a single platform. It will also provide an opportunity to the researchers to share the on-going research with industry persons through paper presentations. This workshop will give impetus to researchers and help them in handling problems related to manufacturing. At the same time it will be an opportunity for the students to interact with industry persons and get involved in some real life problems and their solution. This will facilitate sharing of knowledge related to design & manufacturing between industry & academia.

## SCOPE OF THE WORKSHOP

The workshop broadly covers following topics:

- ❖ Layered Manufacturing / Advanced Manufacturing
- ❖ CAD/CAM/CNC
- ❖ Biomedical Engineering
- ❖ Aerospace Technology
- ❖ Unconventional Energy
- ❖ Robotics and Automation
- ❖ Fluid Machines
- ❖ Mechatronics
- ❖ Materials Engineering : Nano materials and composites
- ❖ Basic Mechanical Designs
- ❖ Design of Mechanisms & Machines

## ABOUT VNIT AND NAGPUR

Visvesvaraya National Institute of Technology, Nagpur is one of the oldest among thirty one National Institutes of Technology in the country. VNIT Nagpur is a premier technological institute of central India situated in lush green campus of 220 acres. The campus is well equipped with infrastructure catering to our academic, research, culinary, residential and recreational necessities. Nagpur is pleasant and calm during December. Distance of VNIT campus from airport is 7.5 km and that from railway station is 6 km. VNIT campus is easily accessible through auto or taxi.

## INSTRUCTIONS FOR AUTHORS

Scientist and Researchers are invited to submit one page abstract of their original work within the scope of the workshop at the workshop website ([www.ipromm2016.org](http://www.ipromm2016.org)). The abstract should be typed using MS-WORD within the area of 150mm\*220mm of an A4 size paper in single spacing with Times New Roman 12 point and should include the title of the paper, names of the authors with full affiliation and e-mail id of the corresponding author. Intimation of acceptance of abstract will be communicated to corresponding author. Authors will have to submit full length camera ready paper for double blind review. Authors of accepted paper will be asked for oral or poster presentation.

Best paper award may be given in different categories.

## IMPORTANT DATES

Submission of abstract : 30<sup>th</sup> June 2016  
Acceptance of Abstract : 10<sup>th</sup> July 2016  
Submission of Full Paper : 31<sup>st</sup> August 2016  
Acceptance of Paper : 10<sup>th</sup> October 2016  
Submission of Camera Ready Paper: 25<sup>th</sup> October 2016  
Registration : 1<sup>st</sup> December 2016

## REGISTRATION

Research Scholars (Student Category)	: Rs. 1500/-
AMM Members	: Rs. 3000/-
Non AMM Members	: Rs. 4000/-
Industry Participant	: Rs. 6000/-

## SOUVENIR AND EXHIBITION

A souvenir containing the technical program, invited talks and abstracts of contributed papers and information about AMM events and other sponsoring bodies, would be published on this occasion. An exhibition shall be arranged for displaying products and equipments. Manufacturers and Suppliers who would like to exhibit/ advertise their products and equipment may please contact Organizers for further details.

For regular updates please visit:  
[www.vnit.ac.in](http://www.vnit.ac.in)  
[www.ipromm2016.org](http://www.ipromm2016.org)

## CONFERENCE FEE

1750zł	-cost of participation
1350 zł	- fee for PhD student
850 zł	- fee for accompanying person

Author or co-author cannot be treated as an accompanying person.  
The conference fee includes: accommodation, food, conference materials and accompanying events.

## CONFERENCE OFFICE

Institute of Engineering of  
The State Higher Vocational School in Nowy Sącz ul.  
Zamenhofa 1a [tkadziolka@pwsz-ns.edu.pl](mailto:tkadziolka@pwsz-ns.edu.pl)  
33-300 Nowy Sącz  
Phone: +48 18 547 29 08  
e-mail: [tmm2016@pwsz-ns.edu.pl](mailto:tmm2016@pwsz-ns.edu.pl)  
<http://it.pwsz-ns.edu.pl/tmm2016/>

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kindly invite to participate in the  
Jubilee  
**25th**

International Conference on  
Theory of Machines and Mechatronic  
Systems  
on  
**September 18 – 21, 2016**

Accommodation:

Hotel "Perła Południa", Rytyro  
33 – 343 Rytyro 380 Poland  
<http://www.perlapoludnia.pl>



25<sup>th</sup>

## INTERNATIONAL CONFERENCE ON THEORY OF MACHINES AND MECHATRONIC SYSTEMS

**NOWY SĄCZ / RYTRO**  
**SEPTEMBER 18 – 21, 2016**  
ANNOUNCEMENT No 1



The remains of the castle from XIV<sup>th</sup> century situated in Rytyro

## IMPORTANT DATES

**30.04.2016** – Registration and abstract  
**15.05.2016** – Conference fee  
**31.05.2016** – Full paper submission

Conference fee should be transferred to:  
Państwowa Wyższa Szkoła Zawodowa  
w Nowym Sączu  
ul. Staszica 1, 33-300 Nowy Sącz  
NIP: 734-25-59-820  
Bank: PKO SA oddz. Nowy Sącz  
ul. Jagiellońska 26, 33-300 Nowy Sącz  
Nr konta: 84 1240 4748 1111 0010 4341 0034  
Bank transfer title: "TMM2016 Last name"

Publication of the papers:  
Acta Mechanica et Automatica,  
Archive of Mechanical Engineering,  
International Journal of Applied Mechanics and  
Engineering.

## CONFERENCE TOPICS

- Structure, kinematics and dynamics of mechanisms and machines,
- Synthesis of mechatronic systems,
- Modeling and simulation of mechatronic systems
- Driver and machine controls,
- Dynamics, driver and machine control,
- Mechatronic systems,
- Robots and manipulator systems,
- Biomedical engineering,
- Application of graphs in the theory of machines and mechanisms,
- Ergonomics and systems man – machine,
- Contemporary trends in teaching in the theory of machines, mechanisms and mechatronics,
- History of mechanisms and machine science.



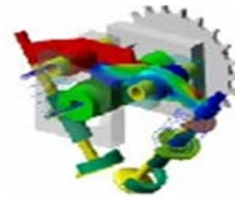
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