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.

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Message from the Editor-in-Chief

Rural Engineering Problems*

"India needs production by the masses and not mass production"

The above line, once said by the Father of the Nation, Mohandas Karamchand Gandhi, appropriately speaks of the manner in which sustainable growth in our country can be achieved. It points to a path leading to prosperity and has a deeper meaning than what may be conveyed literally. It may appear that mass production using machinery and new technology is desirable, but this thought of 'Bapu' reflects his vision of self-reliance and rural development. He always favoured the use of machinery to empower individuals to earn their livelihood and develop a sense of patriotism at the same time. His philosophy of self-reliance and his paradigm of using technology for social progress of rural India have worked effectively during the British rule.

In 'dual society' system as prevailing in India, small prosperous elite of urban areas is mostly the key beneficiary whereas, large number of people residing in rural areas are not only economically backward but also technologically deprived. In fact people residing in rural areas continue to use such tools and equipments in their day to day activities which have become either obsolete or are inefficient. Since such problems are local in nature where the masses do not have sufficient technical knowledge, these go mostly unattended and the rural masses continue to use obsolete technology, which affects the overall quality of the end products.

There is a need for promotion of rural engineering that would result in focusing on the basic necessities and problems of people which will also strengthen the rural economy and make rural masses self-dependent. However, in the absence of relevant background of such problems, it normally becomes difficult to analyze these. Moreover, technology dissemination process also differs from generation to generation and this requires understanding of the basic background and knowledge base of end user or the beneficiary.

In present scenario, the dissemination of rural technologies becomes very important and it can be achieved through effective channelization of the technological innovations in rural areas of the country. At the grassroots level, technological advancement is possible through appropriate dissemination of technology. The new innovations should also aim at developing and promoting technology-based education in the rural parts of the country. The technology should help to eliminate arduous nature of work and must be suited to the rural background of a particular region. It must improve the productivity and restrain migration to urban areas.

Rajesh Sharma, Editor-in-Chief

* The readers may also refer to the keynote lecture delivered by Saha, S.K. and Chaudhry, H. at the Nat. Conf. Emerging Trends in Mechanical Engineering, SVNIT, Surat, June 4-5, 2007, pp. 1-10

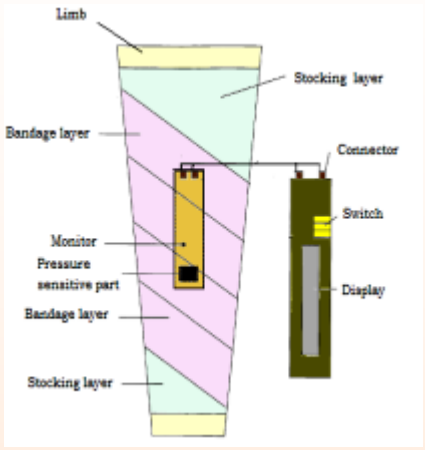
Textile Column (Coordinated by Dr. Apurba Das, IIT Delhi)

Smart Medical Bandages

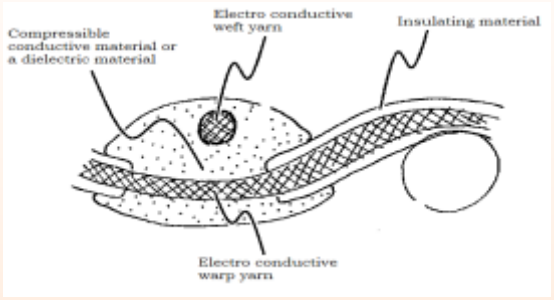
Apurba Das and Riddha Das
Department of Textile Technology, IIT Delhi

Continued from the previous issue (Vol. 2 issue 4) …….

(i) Bandage with integrated pressure sensor: In this bandage, a pressure sensor has been integrated for providing an indication of the pressure applied by a bandage to a human or animal body.



Bandage with integrated pressure sensor



Electro-conductive yarn as pressure sensor

ii) Electro-conductive yarn as pressure sensor: The Textile pressure sensing element was constructed from electro-conductive yarns as a single sheet of fabric. The elements include multiple compressible junctions. Each junction comprises two overlapping electro-conductive yarns separated by a gap. The gap is filled with a resilient compressible material. The sensor may be a capacitive sensor where the gap is filled with a dielectric material. By measuring the capacitance of the overlapping conductors and the size of the gap, pressure can be determined at that junction. Alternatively, the sensor may be a resistive sensor, where the gap is filled with a compressible conductive material, whose resistance varies with compression and resistance is measured to determine applied force.

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5) Taylor, M. (2008), Bandage Pressure Sensor, United States Patents Application Publication, US 2008/0306407 A1.
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Congratulations

Prof. G. K. Ananthasuresh from the Department of Mechanical Engineering, IISc Bangalore, an AMM life-member and the Chair of the IFToMM Technical Committee for Micromachines, is a recipient of the prestigious Shanti Swarup Bhatnagar Award for his contributions in compliant micromechanisms and bio-design. He is one of the nine scientists who received this award for the year 2010. The AMM community congratulates Prof. Ananthasuresh for this achievement and feels proud of him.

Prof. S.K. Saha from the Department of Mechanical Engineering IIT Delhi, Vice-President of AMM and a member of the IFToMM Technical Committee for Multibody Dynamics, has been appointed as Technical Editor of the IEEE/ASME Transactions on Mechatronics. He is one of the forty Technical Editors for the journal.

ISM Dhanbad bags first prize at DRDO Robotics Competition

Saurabh Mittal
Indian School of Mines Dhanbad

The team of Indian School of Mines Dhanbad won the DRDO Students Robotics Competition held at CVDRE facility of DRDO in Chennai held during 28th-30th Oct. 2010 jointly with IIT Madras and IIT Bombay. The robot was fabricated by Badal Singh, Arun Kumar and Saurabh Mittal in the robotics laboratory of ISM Dhanbad, and was adjudged one of the best among the 14 teams who had participated in the finals. The robot had to traverse a distance of 500m detecting and avoiding static obstacles, and manoeuvring over rough surfaces, sandy patches, and even climbing stairs autonomously, carrying a payload of 10Kg throughout its course. The objectives and the applications of this design exercise is to develop innovative and cost-effective systems that serve and protect military, law enforcement and security professionals while carrying out Low Intensity Conflict / Explosive Ordinance Disposal (LIC/EOD) tasks in undesirable, hazardous, and potentially life-threatening environments.

In the first round, the CAD model developed in ProEngineer was selected and DRDO sponsored ₹ 1.00 lakh for the development of the robot. Tri-Star wheel mechanism, one of the most efficient drives, was used for climbing uniform stairs. Tri-Star wheel assembly consists of three wheels arranged in an equilateral triangle coupled to a common drive shaft through gears. On normal flat track each wheel in this assembly rotates about their axis and on striking the stairs, the wheel assembly automatically rotates about its center thus starts climbing over the corrugations or stairs. The innovation lies in the fact that gear reduction of 6:1 provides high speed while moving on flat surface and it gives high torque while climbing. Nylon gears and wooden frames were used to reduce the weight, and center of weight was kept low to avoid overturning.

The salient features of this robot (as shown in Fig. 1) are the combination of GPS for positioning, webcam for colour detection, ultrasonic sonar sensors for obstacle detection, and wireless device for E-stop (emergency stop). Sensing and interpretation of the terrain and environment have been the most challenging tasks and the Hough transforms have been used for image processing. The laptop fuses the data received from multiple sensors and communicates to the micro-controllers for motor controls and a fault tolerant architecture is implemented along with robust algorithms and error handling routines.

The suspension and the steering design for this vehicle is one of the areas of research as the motion is jerky and difficult to steer due to large number of wheels. The robot can carry out operations such as target identification, minefield detection & neutralisation in contaminated environments and can also be implemented for indoor domestic use where stair climbing is a major hurdle in automation.

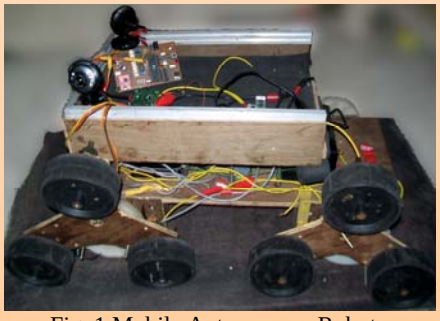


Fig. 1 Mobile Autonomous Robot

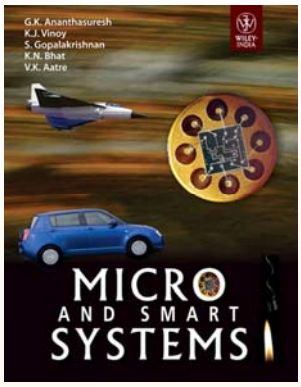
Key Features of the Robot:

(a) Navigate both in smooth as well as in rough terrain.
(b) Payload carrying capability is 10Kg.
(c) ATMEL AVR ATMEGA 16 processor for better control.
(d) Vision sensor (Webcam).
(e) Differential GPS for getting the position of the robot.
(f) Speed reduction possible is 6:1.
(g) Tri-Star wheel provides most efficient drives for climbing stairs.
(h) Nylon gears and wooden frames to reduce the overall weight of the robot.
(i) It can plan its motion autonomously in the presence of natural and man-made obstacles and hazardous environments without any intervention from human operators.
(j) Ultrasonic sonar sensors for obstacle detection and wireless device for E-stop.
(k) Presence of fault tolerant architecture along with robust algorithms and error handling routines.

Book Review

MICRO and SMART SYSTEMS

G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Aatre



Review Report

Modern day teaching and research in micromechanism and microsystems is growingly multidisciplinary in nature. This book acts as a bridge between various fields with emphasis on analytical and computational modelling. The contents of the book are well-grounded in current research trend and the lucid way of presentation of the subject matter makes it attractive even to those who are not well acquainted with some of the topics. The book starts with an introduction on miniaturization and its applications. Then the book delves into the more intricate topics with special reference to micromechanical structures, microsensors, actuators, control and scaling effects. The book gradually caters to various other dimensions with emphasis on microsystems and smart materials.

The analysis of multiphysics, electronics, control, and scaling effects as well as finite element helps the reader to have a good basic knowledge about microsystems. Different types of micromechanism examples are illustrated in this book. This book will surely appeal to a very wide range of engineers from diverse backgrounds. The book will be very handy for undergraduates or postgraduate students, whoever wants to have a grasp of the subject.

Dr. Subhasis Bhaumik, Associate Professor, Bengal Engineering & Science University Shibpur, Howrah

Forthcoming Events

Call for Papers

Robotics Science and Systems (RSS) 2011 will bring together researchers working on algorithmic and mathematical foundations of robotics, robotics applications, and analysis of robotic systems. The conference is single-track, and the final program will be the result of a highly selective review process, to give attendees an opportunity to see the best research in all areas of robotics. The program will include invited talks as well as oral and poster presentations of refereed papers. The main conference will be preceded by one and a half days of workshops and tutorials.

Important Dates

Abstract Submission**:** January 10, 2011
Full Paper Submission: January 17, 2011
Rebuttal Phase: March 7-14, 2011
Paper Notification: April 15, 2011
Conference Dates: June 27-30, 2011

Conference Location

The conference will be held on Campus at the University of Southern California, in Los Angeles, California, USA.

Broad Areas for Paper Submission

- Kinematics, Dynamics, and Control
- Planning and Algorithms
- Manipulation
- Human-Robot Interaction and Human Centered Systems
- Field Robotics
- Distributed Systems
- Medical Robotics
- Biological Robotics
- Mechanisms
- Robot Perception
- Mobile Systems and Mobility
- Estimation and Learning for Robotic Systems

Competitiveness of Technology and Automation based Indian Industries: A Perspective View

Dr. Ashish Mohan, Engineering and Product development, JCB India Headquarters

Automation and mechanization in Indian industries, especially in the non-automobile sector like manufacturing, mining, textiles, etc., despite of all the potential strategy and synergy in political system, and values and maturity of industry, cannot be considered to be at a level it should have been. India's strengths and advantages in manufacturing lies in (1) availability of a large set of cheap, albeit unskilled, labour force, and, (2) macroeconomic stability. However, it critically lacks (1) genuine and dynamic participation by the private sector, (2) a large and impressive diaspora of skilled knowledge workers creating valuable knowledge linkages, and (3) extension of institutions of a free market economy into these sectors, in large. Consequently, the automation in these industries has mostly been negligible and insignificant.

To be competitive in the modern economic scenario, the Indian firms must present before the world a real differentiating value proposition system in its manufacturing industries. This is implacable also because in order to achieve its vision of becoming a developed economy by 2020, manufacturing sector must have a greater share in India's GDP. Noticeably, there do not exist many success stories of Indian firms in the core industries of manufacturing sector. The objective immediately becomes to investigate:

Why are Indian manufacturing industries, in large, characteristically laggarding, with low productivity and operating at sub-optimal profits; and as a consequence of it not having a desirable share in the national growth and GDP?

The answer lies in the fact that there has not been an appropriate application of the latest technology, and mechanization in the Indian industries. The automation in the industries is amateur and there is a complete absence of technology management in it.

In order to revive its laggarding manufacturing sector, Indian industries must incorporate automation in the technology. A three-pronged approach is suggested here for the revitalization of Indian manufacturing industries:

(1) Absorption and adaptation of Knowledge in Technology (through collaborations)

India's competence in the conventional methodologies must lend synergy to the excellence of the global players in research and automation. Thus, for a sustainable growth and prosperous manufacturing base in the industry, Indian firms must enter into collaborations with major global giants. Collaborators work jointly to evolve a framework for management of technology and implement it in a more cohesive manner, and hence are more sustainable. The automobile sector of Indian industries is one such sector which presents showcase examples of successful and sustainable growth and productivity through technical collaborations with foreign companies. Thus,

- Honda, the Japanese auto major, has a successful Joint Venture with Hero group and combined Hero-Honda has more than 50% share in Indian two wheeler market. Honda is further planning to expand its production capacity to 160,000 units;
- Maruti Suzuki India Ltd (MSIL) has more than 55% share in the passenger car market of India. Suzuki has planned an additional investment of US$ 2.03 billion by 2010 to increase production and sales.

To be continued to the next issue.

Forthcoming Events

IFToMM 2011 World Congress

June 19 -25, Guanajuato, MÉXICO

The 13th IFToMM World Congress will take place in the city of Guanajuato, on June 19 - 25, 2011. This congress is held every 4 years and it is the largest conference for mechanism and machine science. The aim of the congress is to gather researchers, scholars, practitioners and students with interests in the general area of the theory and practice of machines and mechanisms.

Topics Of The Congress

Papers are welcome on the general areas of the theory and practice of machines and mechanisms, with particular reference to the topics of the IFToMM Technical Committees and Permanent Commissions, namely:

Computational kinematics
Gearing and transmissions
Human-machine systems
Linkages and cams
Mechatronics
Micromechanisms
Nonlinear oscillations
Robotics
Rotor dynamics
Transportation machinery
Reliability of machines and mechanisms
Education
History of MMS
Biomechanics
Design methodology
Dynamics of machinery
Tribology
Multibody dynamics.

Important Dates

Final version submission 14 Jan. 2011
Final decision 25 Feb. 2011

Organized By

IFToMM – Mexico
Universidad de Guanajuato

Congress Location

Guanajuato City lies in the central part of Mexico. It is a colonial city known for its architectural and cultural heritage, *(http://www.vamosaguanajuato.com/gto/esp/.)*
Guanajuato is accessible by air, car and bus.
The Guanajuato international airport (IATA code: BJX) is 25 km southwest of Guanajuato, about 25 minutes drive.
The details are at:
(http://www.aeropuertosgap.com.mx/english /airports/guanajuato-airport)

The Mexico City international airport (IATA code: MEX) is 350 km southeast of Guanajuato, about 5 hours drive.
(http://www.aicm.com.mx/home_en.php)

Report on Robotics Workshop

Organizing Institute: Bengal Engineering & Science University Shibpur, Howrah, West Bengal

Dates of Workshop: 13-14 and 20-21 November 2010

A four day robotics workshop was organized for undergraduate students by the Robotics Society and School of Mechatronics & Robotics, Bengal Engineering & Science University (BESU) Shibpur during 13, 14, 20 and 21 November 2010. The workshop highlighted the fundamental topics essential in the field of Robotics and Automation. The students got exposure to the theoretical concepts as well as practical hands-on and demonstrations through different hardware interfaces. About fifty students participated in this workshop. Various topics were covered during this workshop which include: fundamentals, basic electronics, mechanisms and motion transmission, control system, mobile robotics, sensors and actuators, PLC and industrial automation, autonomous robots, image processing, AI techniques, microcontrollers, underwater robotics, competition-based engineering education, undergraduate projects, R&D activities. Some of the experts who delivered lectures include Prof. Ashok Mallik (Ex-IIT Kanpur), Prof. S. K. Saha (IIT Delhi) and Dr. P. K. Pal (BARC Mumbai). The valedictory session was chaired by Prof. Amitabha Ghosh (Ex-Director, IIT Kharagpur, Honorary Professor IIT Kanpur and BESU Shibpur).

Contributed by: Dr. Subhasis Bhaumik, BESU Shibpur Howrah

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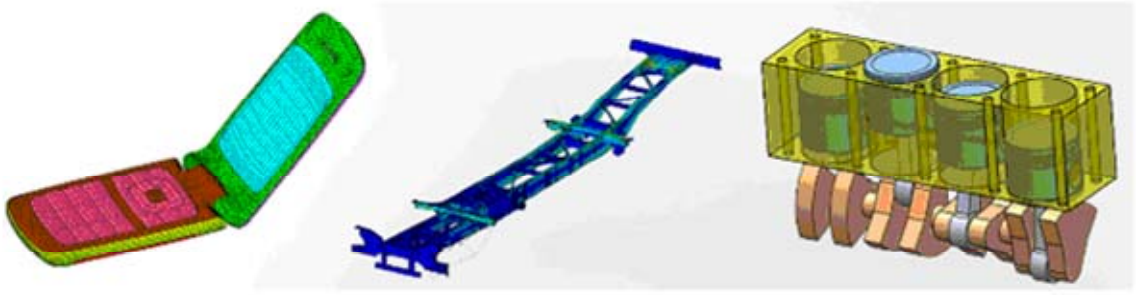

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