15th National Conference
on
Machines and Mechanisms

(NaCoMM 2011)

November 30-December 02, 2011
Chennai, India

Department of Engineering Design
Indian Institute of Technology Madras, Chennai

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भारतीय प्रौद्योगिकी संस्थान
चेन्नै – ६०० ०३६

दूरभाष : ००९१-४४-२२५७ ०६९४ / ००९१-४४-२२५७ ८००१
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प्रो. भास्कर राममूर्ति
Prof. Bhaskar Ramamurthi
निदेशक
Director

November 23, 2011

MESSAGE

It is indeed heartening that the twenty-seven year old Association for Machines and Mechanisms affiliated to IFToMM has been holding Conferences and Workshops in India regularly in the important area of Machines and Mechanisms. Such regular national meets of experts in various technological areas are very much needed in India at its current stage of growth. I am particularly happy that the Department of Engineering Design, IIT Madras is hosting the 15th edition of the Conference this year in our campus. I wish the Conference all success.

(Bhaskar Ramamurthi)

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International Federation for the Promotion of Mechanism and Machine Science

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Dear Participants of IFToMM India conference NaCoMM 2011,

It is an honour for me, as IFToMM President, to address these few words of welcome and wishes to the participants for a fruitful conference during AMM conference NaCoMM 2011 in Chennai during November 30 - December 2, 2011.

This conference is an important forum for discussing one of the topics of IFToMM activity, even with the aim to promote IFToMM and MMS. The IFToMM patronage of this conference has a particular significance for the fact that this event has been organised successfully with the typical IFToMM-familiar atmosphere in order to provide suitable environment for starting and enhancing collaborations and disseminating recent advances in MMS not only in India. I congratulate Professor. Sandipan Bandyopadhyay and his team for the very successful organisation of this conference.

IFToMM cares for both scientific and social activity with an intention to promote both MMS disciplines and IFToMM. I am sure that all the participants will contribute successfully to the above mentioned goals by sharing studies and results with other colleagues. Therefore, I thank the participants and organisers for having supported the IFToMM's high standard for this conference with your active participation.

Another important event will be the 2015 IFToMM World Congress that will be held in Taipei, China-Taipei in June, 2015 where we hope to have a large participation of colleagues from all around the world, even from those countries that are not yet IFToMM member organisations. It is my pleasure to invite all participants to join the IFToMM World Congress 2015 too.

I wish you a wonderful time in Chennai, both from technical and social aspects!

Sincerely yours

Professor Marco Ceccarelli
President of IFToMM (2008-2011)
www.iftomm.org

Cassino, 17 October 2011

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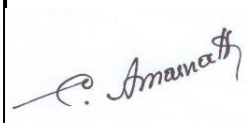
Message from the AMM President

The growth of modern Indian industry depends vastly upon our ability to construct and implement sophisticated manufacturing systems incorporating therein the latest technological innovations to enhance productivity and efficiency. This effort, in turn requires a strong R&D effort to develop and comprehend theories and tools required for the design of such systems. Scientists and engineers addressing such issues can enhance their capabilities through constant interaction for the exchange of ideas and it is here that the Association for Machines and Mechanisms (AMM) plays a vital role.

Established in 1984, AMM has been organising biennial NaCoMM conferences to facilitate propagation and exchange of experiences in the area. NaCoMM has moved with the times and recent conferences cover not only traditional areas but the more modern ones like mechatronics, robotics and several others that define the modern sectors of mechanical engineering. Today's machinery are a far cry from those of a few decades ago and incorporate sensors and digital controllers and operate at higher speeds. Such advances demand amongst others development and understanding of new analytical tools.

I am sure that the presentations and deliberations at NaCoMM 2011 will facilitate critical assessment of the developments in the area, a vital step in selecting appropriate tools for practitioners and designers.



C. Amarnath

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To:
NaCoMM 2011 Conference Chair
Dr. Sandipan Bandyopadhay
Assistant Professor
IIT Madras, India

Cluj-Napoca, Romania, 23.11.2011

Dear Dr. Bandyopadhay,

On behalf of Technical Committee Computational Kinematics, we would like to express our support for the organizing of NaCoMM 2011 - 15th National Conference on Machine and Mechanisms- which will be held in Madras, Chennai, India, between November 30- December, 2, 2011.
In my opinion, this event sponsored by IFToMM is a very important initiative for discussing specific aspects in the field of machine and mechanism science.
NaCoMM 2011 Conference has many connections with IFToMM through well known personalities such as Prof. Ceccarelli, Prof. Husty, Prof Kecskemethy, Prof. Saha and Prof. Ghosal. It is worth to be mentioned that this year the NaCoMM 2011 conference will start with a one-day workshop, focussing on the kinematics of mechanisms and robot manipulators organized by Prof. Manfred Husty, an active member of the TC CK.
This conference contributes to the increase of the visibility regarding the importance of the science of Mechanisms in India.
We congratulate you for the efforts to organize this important event and we wish you a very successful conference!

Sincerely yours,

Prof. Dr.-Ing. Doina Pisla
Chair of IFToMM Technical Committee Computational Kinematics

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Welcome Message

On behalf of the all the committees of National Conference on Machines and Mechanisms (NaCoMM 2011) and IIT Madras, we extend a warm welcome to all the delegates. NaCoMM 2011 is the fifteenth in the series of conferences held over the past three decades with the aim of providing a platform to bring together people who use, develop, analyse, and, design machines and mechanisms, as well as teach these subjects at various levels. NaCoMM 2011 is being organised under the aegis of the Association for Machines and Mechanisms (AMM) and the International Federation for the Promotion of Mechanism and Machine Science (IFToMM), of which AMM is a member.

NaCoMM 2011 has been successful in attracting about 170 abstracts, of which 123 made it to the final round of reviews. Thanks to the 100 reviewers in India as well as 8 other countries, 281 reviews were conducted in the double-blind mode. Finally 63 papers were selected for oral presentations and 20 others for the interactive poster session. The papers cover a variety of topics, such as, analysis and synthesis of mechanisms, design of machines and machine elements, health monitoring of machine components, dynamics and controls, robotics, parallel manipulators, compliant mechanisms, applications of mechanisms in rural implements, space technologies, biomedical devices etc. Such a rich variety of topics as well as the quality of the contents, ensured by rigorous reviews, should make this collection of contributions significantly interesting to beginners and experts alike.

The conference includes a workshop on kinematics conducted by Univ.-Prof. Dr. Manfred L. Husty, Professor of Geometry and CAD, University of Innsbruck, Austria. There were three keynote lectures delivered by eminent academicians, Prof. Ashitava Ghosal, (Department of Mechanical Engineering, Indian Institute of Science, India), Prof. Dr.-Ing. Andrés Kecskeméthy, (Chair of Mechanics and Robotics, University of Duisburg-Essen, Germany) and Prof. Marco Ceccarelli, (President, IFToMM, Laboratory of Robotics and Mechatronics, University of Cassino, Italy).

A large number of people contributed towards the success of the conference. Firstly, we would like to thank all the authors for their contributions to NaCoMM 2011. They are solely responsible for the quality of the contents of this title. The Programme Committee members did a tremendous job by completing the reviews timely enough for the proceedings to be prepared well in time. Members of AMM and several friends abroad contributed to the review process. The Advisory Committee also played an enthusiastic role in helping the conference organisation at different levels, throughout the past year. We would like to thank various Government of India agencies as well as private organisations for supporting the event through participation and sponsorships, and the IIT Madras administration for providing the facilities towards the organisation of the event. We would like to thank the colleagues in the Organising Committee, the faculty and staff of Department of Engineering Design for their efforts towards organising the conference. A large number of colleagues and student volunteers from different departments of IIT Madras helped the conference via academic contributions, as well in its organisation. We also acknowledge the contribution of Narosa Publishing House in bringing out the proceedings of the conference on time.

We hope you find your stay here professionally beneficial and personally pleasant.

- **NaCoMM 2011 Organising Committee**

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B-4 Robotics 1 7

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30-Nov-11

8.00-9.00	9.00-10.00	10.00-10.30	10.30-12.00	12.00-12.15	12.15-13.00	13.00-14.00	14.00-15.30	15.30-16.00	16.00-17.30	18.15-20.15
Registration	Inauguration	Tea	Workshop Session-1	Break	Workshop Session-2	Lunch	Workshop Session-3	Tea	Workshop Session-4	Cultural event

01-Dec-11

09.00 -09.45	Keynote 1	
09.45 -10.00	Tea Break	
10.00 -11.30	**A-1** Mechanisms 1	**B-1** Machine Elements 1
11.30 -11.45	Group Photograph	
11.45 -13.00	**A-2** Mechanisms 2	**B-2** Parallel Manipulators 1
13.00 -14.00	Lunch	
14.00 -14.45	Keynote 2	
14.45 -16.00	**A-3** Dynamics and Control	**B-3** Design of Machines 1
16.00 -16.15	Tea Break	
16.15 -16.30	Tech Talk : B&R Automation	
16.30 -18.00	**A-4** Compliant Mechanisms	**B-4** Robotics 1
19.30 -22.00	Tech Talk : Autodesk Banquet Dinner	

02-Dec-11

09.00 -09.45	Keynote 3	
09.45 -10.00	Tea Break	
10.00 -11.30	SMDC* Demo	
11.30 -11.45	Break	
11.45 -13.00	Poster Session	
13.00 -14.00	Lunch	
14.00-15.30	**A-5** Machine Elements 2	**B-5** Robotics 2
15.30-15.45	Tea Break	
15.45-16.45	**A-6** Design of Machines 2	**B-6** Parallel Manipulators 2
16.45-17.15	Valedictory	
17.30-18.30	AMM GBM	

A,B: session codes

***S**tudents **M**echanism **D**esign **C**ontest

Venue for events

Registration	Reception Desk, IC&SR Building
Workshop	Auditorium, IC &SR Building
Session A	Auditorium, IC&SR Building
Session B	Hall 3, IC&SR Building
Poster	Ground Floor Lobby, IC&SR Building
SMDC Demo	Hall 2 & Ground Floor Lobby, IC&SR Building
AMM GBM	Auditorium, IC&SR Building
Lunch	AC Dining Hall, IC&SR Building
Cultural Event	Central Lecture Theatre (CLT)
Banquet Dinner	Asiana Hotel, Semmenchery, Chennai
Tech Talk	B&R Automation – IC&SR Auditorium Autodesk –Asiana Hotel

Program Schedule

Nov 30, 2011

Registration	**08.00-09.00**
	Venue: Reception Desk, IC&SR Building
Inauguration	**09.00-10.00**
	Venue: IC&SR Auditorium
Tea Break	**10.00-10.30**

Kinematics Workshop — **Univ.-Prof. Dr. Manfred L. Husty**
Professor of Geometry and CAD
University of Innsbruck, Austria

Topics to be addressed:

1. Basics from Algebraic Geometry and Kinematics: ideals, affine and projective varieties, standard bases (e.g. Groebner), elimination, dimension and primary decomposition, and, forward and inverse kinematics of serial and parallel robots using the algebraic approach, singularities.
2. Applications to special robots: Analysis of 3-UPU (SNU and TSAI) manipulators, inverse kinematics of general 6R-serial robots and over-constrained 6R linkages.

Workshop Session-1	**10.30-12.00**
	Venue: IC&SR Auditorium
Break	**12.00-12.15**
Workshop Session-2	**12.15-13.00**
	Venue: IC&SR Auditorium
Lunch	**13.00-14.00**
	Venue: AC Dining Hall, IC&SR Building
Workshop Session-3	**14.00-15.30**
	Venue: IC&SR Auditorium
Tea Break	**15.30-16.00**
Workshop Session-4	**16.00-17.30**
	Venue: IC&SR Auditorium
Cultural Event	**18.15-20.15**
	Venue: Central Lecture Theatre

Carnatic Guitar Recital: Vanipriya J, V.S. Raghavan and Sunil Kumar

Kucipudi Dance Recital: Kalpana Jayanti and group

Dec 01, 2011

Keynote 1	**09.00-09.45**
	Venue: IC&SR Auditorium

B. M. Belgaumkar Memorial Lecture

An Object-oriented Framework for SE(3) Motion Planning in Multibody Systems

Professor Dr.-Ing. Andrés Kecskeméthy
Chair of Mechanics and Robotics
University of Duisburg-Essen, Germany

Tea Break	**9.45-10.00**

A-1: Mechanisms 1	**10.00 -11.30**
Chair : Marco Ceccarelli	**Venue:** IC&SR Auditorium
10.00-10.15	General Method of Optimization Kinematic Synthesis of Planar Lever Mechanisms Based on its Structural Properties by Example of the Eight-Link Mechanism *Nickolay N. Krokhmal and Oleg N. Krokhmal*
10.15-10.30	Evaluation of the Polycentric Above Knee Prosthesis *S.S. Chauhan and S.C. Bhaduri*
10.30-10.45	An Optimization Approach for Path Synthesis of Four-bar Grashof Mechanisms *Ahmed Saeed Mohsen Alhazz and Jonnalagadda Srinivas*
10.45-11.00	Link Geometry Synthesis for Prescribed Inertia *Yoganand Garimella and Dibakar Sen*
11.00-11.15	Design Optimization of Toggle Mechanism by Mathematical Model *Narendra Arun Akhadkar*
11.15-11.30	A Reliability Based Robust Multi-objective Optimal Synthesis of Linkage Mechanisms Considering Tolerances *P. V. Chowdary, Gurunathan Saravana Kumar, and Palaniappan Ramu*

Dec 01, 2011

B-1: Machine Elements 1	**10.00 -11.30**
Chair : N. Siva Prasad	**Venue:** Hall 3, IC&SR Building
10.00-10.15	On the Anti-Loosening Characteristics of M16 Threaded Fasteners under Vibratory Conditions *Bikash Panja and Santanu Das*
10.15-10.30	Application of Neural Network in Condition Monitoring of Ball Bearings *Atul Andhare, Tejas Lakhe, Tejas Umbarkar, and Vishal Vadabhat*
10.30-10.45	Experimental Study on Micro-Textured Thrust Pad Bearing *Ismail Syed, Veeraraju Vanapalli, and Mihir Sarangi*
10.45-11.00	Natural Frequencies of Bending and Torsion Stiff Composite Conical Shells with Delamination *Sudip Dey and Amit Karmakar*
11.00-11.15	Vibration based Fatigue Damage Assessment of Cantilever Beams *A. S. Sekhar and Harish Chandra*
11.15-11.30	Identification of Unbalance and Looseness in Rotor Bearing Systems using Neural Networks *Mudireddy Chandra Sekhar Reddy and A.S. Sekhar*

Group Photograph	**11.30-11.45**

A-2: Mechanisms 2	**11.45 -13.00**
Chair : Andrés Kecskeméthy	**Venue:** IC&SR Auditorium
11.45-12.00	A Nonlinear Elastic Transmission for Variable-Stiffness-Actuation: Objective and Design *Soumen Sen and Antonio Bicchi*
12.00-12.15	Analysis of Positional Error due to Joint Clearances in Four Bar Mechanism *Hemant Jawale and H Thorat*
12.15-12.30	Curvature Based Mobility Analysis and Form Closure of Smooth Planar Curves with Multiple Contacts *Rama Krishna K and Dibakar Sen*
12.30-12.45	A Framework for Analysis and Dynamic Visualisation of Mechanisms *Arjun Nagarajan and Sandipan Bandyopadhyay*
12.45-13.00	A History of TMM in Italy *Marco Ceccarelli*

Dec 01, 2011

B-2: Parallel Manipulators 1	**11.45 -13.00**
Chair : Manfred L. Husty	**Venue:** Hall 3, IC&SR Building
11.45-12.00	Novel Design Solution to High Precision 3 axes Translational Parallel Mechanism *T A Dwarakanath and Gaurav Bhutani*
12.00-12.15	Kinematic Analysis of a 3-UPU Parallel Manipulator Using Exponential Rotation Matrices *Gokhan Kiper and Eres Söylemez*
12.15-12.30	Singularity Analysis of Closed-loop Mechanisms and Parallel Manipulator *Vinu K. S and Ashitava Ghosal*
12.30-12.45	Forward and Inverse Kinematics of a Hybrid Series-parallel Manipulator *Sachit Rao and Jagannath Raju*
12.45-13.00	A Complete Kinematic Analysis of the 3-RPS Parallel Manipulator *Josef Schadlbauer, Manfred Husty, and Dominic R. Walter*

Lunch	**13.00-14.00**
	Venue: AC Dining Hall, IC&SR Building

Keynote 2	**14.00-14.45**
	Venue: IC&SR Auditorium

K. Lakshminarayana Memorial Lecture

From Equations to Embodiments -3 Case Studies

Professor Ashitava Ghosal
Department of Mechanical Engineering & CPDM
Indian Institute of Science, Bangalore, India

Dec 01, 2011

A-3: Dynamics and Control	**14.45 -15.45**
Chair : P.M.Pathak	**Venue:** IC&SR Auditorium
14.45-15.00	Deployment Dynamics and Latch-Up Shock Estimation of Large Antenna Hold Down Mechanism *Lakshmi Narayana Burra, B.P. Nagaraj, G.Nagesh, and C.D. Sridhara*
15.00-15.15	Control and Stability Analysis of a Walking Knee-less Biped with Torso *Abdul Jaleel, Tripuraneni Varun, and Arun D. Mahindrakar*
15.15-15.30	Symbolic Computation and Simulation of a Spatial Pendulum *Vinay Gupta and Subir K. Saha*
15.30-15.45	Design and Development of Novel Two Axis Servo Control Mechanism *Chinmay Dharmadhikary, Mrinmay Atre, Aniruddha Katti, Shubham Shambharkar, and Shailaja Kurode*

B-3: Design of Machines 1	**14.45 -16.00**
Chair : Dibakar Sen	**Venue:** Hall 3, IC&SR Building
14.45-15.00	Design of Bed for Bedridden Patients: Analysis and Synthesis of Mechanisms *Atul Andhare, Anil Onkar, and Pramod Padole*
15.00-15.15	Development of Post Harvest Food Processing machine *Kazi Syed Zakiuddin and J.P. Modak*
15.15-15.30	User Centric Designed Mechanism for Stairs-Climbing Wheelchair (Manual) *Shanu Sharma, Shatrupa Thakurta Roy, and J Ramkumar*
15.30-15.45	Investigation of Autonomous Oscillating Linkages *Willi Rehwald and Kurt Luck*
15.45-16.00	Adjustable Hand-cranked Tricycle for Mobility Disabled *Aditya Soni, Ramanathan Muthuganapathy, and Sandipan Bandyopadhyay*

Tea Break	**16.00-16.15**

Tech Talk : B&R Automation	**16.15-16.30**
	Venue: IC&SR Auditorium

Dec 01, 2011

A-4: Compliant Mechanisms	**16.30 -18.00**
Chair : Prasanna Gandhi	**Venue:** IC&SR Auditorium
16.30-16.45	An SMA-actuated, Compact, Compliant Ring-actuator with Uniform Deformation *Puneet Singh and G.K. Ananthsuresh*
16.45-17.00	A Compliant End-effector to Limit the Force in Tele-operated Tissue-cutting *Santosh D. B. Bhargav, Shanthanu Chakravarthy, and G. K. Ananthasuresh*
17.00-17.15	An Online Interactive Computer Program for Pragmatic Design of Compliant Mechanisms *Ranu Kundu, C. V. Aravind, Sudarshan Hegde, and G. K. Ananthasuresh*
17.15-17.30	Design of Force-amplifying Compliant Mechanism for Resonant Accelerometers *Shyamsananth Madhavan, and G. K. Ananthasuresh*
17.30-17.45	Development of a Meso-scale Dual-axis Steel Accelerometer with Hall-effect Sensors *Sambuddha Khan, P. Muddukrishna, and G. K. Ananthasuresh*
17.45-18.00	Development of Double Parallelogram Flexure Mechanism via Assembly Route *Prasanna Gandhi, Vaibhav Soni, and Kaustubh Sonawale*

B-4: Robotics 1	**16.30 -18.00**
Chair : Asokan Thondiyath	**Venue:** Hall 3, IC&SR Building
16.30-16.45	Performance Evaluation of Wheeled Rover by Analysis and Test *Gaurav Sharma, Srividhya.G, Shamrao , K. Balaji, G. Nagseh,and C.D. Sridhara*
16.45-17.00	Neural Network-based Coordinated Motion Planning of Multiple Mobile Robots *Nirmal Hui*
17.00-17.15	Dynamically Stable Gait Planning of a Three-Legged Vertical Surface Climbing Robot *Tarun K. Hazra and Nirmal Hui*
17.15-17.30	Trajectory Planning of Dual Arm Free Flying Space Robot using Polynomial Approach *Rishikesh Rathi and P. M. Pathak*
17.30-17.45	A Unique Path Tracking Method of a Rectangular Robot *Dilip Kumar Biswas, Subhasish Bhaumik, and Jyotirmoy Saha*
17.45-18.00	Boombot: Low Friction Coefficient Stair Climbing Robot Using Rotating Boom and Weight Redistribution *Sartaj Singh and Ramachandra K.*

Tech Talk by Autodesk **Banquet Dinner**	**Venue:** Asiana Hotel, **19.30-22.00**

Dec 02, 2011

Keynote 3	**09.00-09.45**
	Venue: IC&SR Auditorium

Workspace Evaluation for Analysis and Synthesis of Manipulators

Professor Marco Ceccarelli
President, IFToMM
LARM: Laboratory of Robotics and Mechatronics, DiMSAT,
University of Cassino, Via Di Biasio, Cassino (Fr), Italy,

Tea Break	**09.45-10.00**

Students Mechanism Design Contest	**10.00-11.30**
	Venue: Hall 2 and Ground Floor Lobby, IC&SR Building

Tea Break	**11.30-11.45**

Poster Session	**11.45-13.00**
	Venue: Ground Floor Lobby, IC&SR Building

Lunch	**13.00-14.00**
	Venue: AC Dining Hall, IC&SR Building

Dec 02, 2011

A-5: Machine Elements 2	**14.00 -15.30**
Chair : S. Senthilvelan	**Venue:** IC&SR Auditorium
14.00-14.15	Stability Analysis of a Spinning and Processing Viscoelastic Rotor Model Under the Effect of Tensile Centrifugal Force *S Bose, A Nandi, and S Neogy*
14.15-14.30	Design of a Flexural Joint using Finite Element Method *Abdullah Aamir Hayat, Adnan Akhlaq, and M. Naushad Alam*
14.30-14.45	Prediction of Theoretical Wear in High Contact Ratio Spur Gear Drive *Rama Thirumurugan and G. Muthuveerappan*
14.45-15.00	Stability Analysis of Rotors Using Three-dimensional Finite Elements and HRZ Mass Lumping Scheme *Smitadhi Ganguly, Arghya Nandi, and Sumanta Neogy*
15.00-15.15	Frictional Dissipation at a Small Crack Under Multiaxial Periodic Stresses *Prasun Jana and Anindya Chatterjee*
15.15-15.30	Dedundum Optimization of Asymmetric Spur Gear *Prateek Kumar, Saroj Mandal and Senthilvelan Selvaraj*

B-5: Robotics 2	**14.00 -15.30**
Chair : T.A. Dwarakanath	**Venue:** Hall 3, IC&SR Building
14.00-14.15	Recursive Robot Dynamics in RoboAnalyzer *C.G. Rajeevlochana, Amit Jain, Suril V. Shah, and Subir K. Saha*
14.15-14.30	Modeling and Analysis of Three Degree of Freedom Micropositioning Stage *Jonnalagadda Srinivas and Uppada Sudhakar*
14.30-14.45	Biomimetic Design and Development of a Prosthetic Hand: Prototype 1.0 *Nayan M. Kakoty and Shyamanta M. Hazarika*
14.45-15.00	Shape Optimization of Revolute Single Link Flexible Robotic Manipulator for Vibration Suppression *Sachindra Mahto*
15.00-15.15	Design and Evaluation of Handover Movement Informing Receiver of Weight Load *Takafumi Matsumaru*
15.15-15.30	An Improved Dynamic Modeling of a 3-RPS Parallel Manipulator Using the Concept of DeNOC Matrices *Elahe Yoosefi and Ali Rahmani Hanzaki*

Tea Break	**15.30-15.45**

Dec 02, 2011

A-6: Design of Machines 2	**15.45 -16.45**
Chair : Subir Kumar Saha	**Venue:** IC&SR Auditorium
15.45-16.00	Development and Performance Evaluation of a Light Weight Power Tiller *Subrata Kr Mandal and Atanu Maity*
16.00-16.15	Design of Multiside Tipper Tilting Mechanism *Hemant Gaikwad and Nilesh Awate*
16.15-16.30	Kinematic Analysis of Link System used in Collapsible type In-vessel Handling Machine *Sanjeev Kumar, Jose Varghese, R Vijayashree, S Raghupathy, P Chellapandi, and S C Chetal*
16.30-16.45	Innovative Application of Kinetics for Low-Cost Vehicle Speed Control System using Linear Cable and Open-Coil spring *Keerthivasan R.*

B-6: Parallel Manipulators 2	**15.45 -16.45**
Chair : Ashitava Ghosal	**Venue:** Hall 3, IC&SR Building
15.45-16.00	Task Space Trajectory Planning Among Cooperating Robots through Mirror Motions *T A Dwarakanath, Gaurav Bhutani, and Puneet Srivastava*
16.00-16.15	Test Results with a Binary Actuated Parallel Manipulator *Tao Li, Hao Gu, Conghui Liang, Giuseppe Carbone, Marco Ceccarelli, Christian Löchte, and Annika Raatz*
16.15-16.30	Dual-loop Control for Backlash Correction in Trajectory Tracking of a Planar 3-RRR Manipulator *Abhishek Agarwal, Chaman Nasa, and Sandipan Bandyopadhyay*
16.30-16.45	Trajectory-tracking Control of Semi-regular Stewart Platform Manipulator *Sadiq Mohamed and Sandipan Bandyopadhyay*

Valedictory	**16.45-17.15**
	Venue : IC&SR Auditorium

AMM GBM	**17.30-18.30**
	Venue: IC&SR Auditorium

carnatic guitar recital

about the musicians

Vanipriya J - Electric guitar
V S Raghavan - Mridangam
Sunil Kumar - Kanjira

vanipriya j

Vanipriya received her initial training on Carnatic voice and veena from Smt. Radha Sridhar before taking advanced training from renowned vocalist Sri. Neyveli R. Santhanagopalan. She later trained under Sri. Vijay Arun to learn the nuances of playing Carnatic music on the electric guitar. Since 2002, she has been under the guidance of leading Carnatic violinist Delhi P. Sunder Rajan. Vanipriya has also received training in Western Music Theory and plays the piano and mandolin.

She has performed on All India Radio as a youth artiste, hosted and performed on Doordarshan and at various concerts in Chennai. She has composed music for live theatre as well as a documentary film 'Tamil Nadu – A profile'. Besides being a performing musician, Vanipriya hold an undergraduate degree in mathematics and visual communication, and a graduate degree in computer applications and is a full-time software professional.

v s raghavan

Raghavan had his initial musical training from senior vidwans like Sri. Kumbakonam Rajappa Iyer, Sri K. R. Ganesh, Sri Jayaraman and Sri Dhanvada Anantha Rao. Raghavan has been performing widely across the country and has performed with leading musicians in Carnatic (Mandolin Sri Srinagar, Malady Brothers , Sri O.S.Arun, Sri O. S. Thyagarajan) and Hindustani (Begum Parveen Sultana, Pt. Jasraj) music. He has also performed in jazz ensembles with the likes of Dana Gillespie and Tim Cross. Currently under the tutelage of Sri Patri Satish Kumar, Raghavan also holds a post-graduate diploma in music from Sri. Sathya Institute of higher Learning, Prasanthi Nilayam, Puttaparthy.

sunil kumar

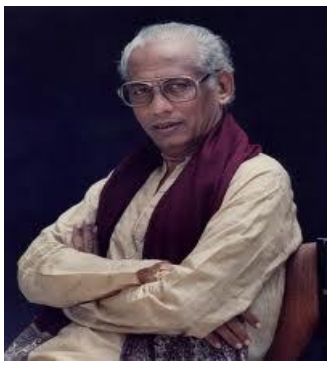
Coming from a family of musicians and music lovers, Sunil had his initial lessons from his father, Thavil artiste Trip licane K Sekar. To hone his skills on the kanjira, he has been under the guidance of Kanjira Maestro V Selvaganesh besides learning Konnakkol from Ghatam Maestro Sri Vikku Vinayakaram. Graded B-High by All India Radio, he has performed at all leading sabhas in Chennai accompanying leading musicians.

Kucipudi Dance Recital

The Dance Form

Kucipudi is a dance form which originated in the Southern Indian state of Andhra Pradesh around the 14th century AD and whose roots can be traced to the classical sanskrit text *Natyasastra* which is dated to around 2nd century BC. Performed to classical Indian music, it shares several elements with another South Indian dance form, Bharatanatyam but has its own distinctive characteristics. True to its dance drama tradition, Kucipudi employs the pravesa daruvu as a means of introducing the main characters, makes full use of all the four forms of expression (aharyas) and draws on compositions of all kinds, viz., kritis, kirtanas, javalis, sabdams, padams, ashtapadis, tarangams and tillanas. Its movements are typically fast-paced and the jatis are scintillating. One of the unique features of a Kucipudi recital, namely, the tarangam, where the dancer executes intricate jatis while standing on a brass plate, will be performed today.

The Gurus



The name Dr. Vempati Chinna Satyam is synonymous with Kucipudi in its modern era. He is credited with modernizing the art form and transforming it from a local and regional dance into a universal art form performed all over the world. He has 15 well-acclaimed and well-received dance dramas to his credit and has choreographed over 180 solo pieces. Through his vast repertoire, love for his students, commitment for his art and single-minded devotion to his calling, he has left a lasting legacy to the art form as well as to his innumerable disciples who have set up Kucipudi dance schools in all corners of the globe. Deservedly, he is the recipient of several national awards and honours including the coveted title *Padmabhushan* given by the Government of India.

A true chip of the old block, Guru Vempati Ravishankar is the younger son of Guru Dr. Vempati Chinna Satyam and received rigorous at the Kucipudi Art Academy, Madras and has imbibed the nuances and intricacies of art form during his long association with his father. He is a versatile artist and has performed numerous leading characters in his father's productions. He is also an accomplished solo artist and has received accolades for his performances in prestigious national and international festivals. He is an acclaimed choreographer and has two major dance dramas, three thematic compositions and over 50 solo items to his credit. Sri Vempati Ravi Shankar continues the vision of his father, Dr. Vempati Chinna Satyam, by propagating the art as a dedicated teacher, a captivating performer, and an innovative choreographer.

The Dancers and the Items

Today's dance recital is being performed by senior disciples of Guru Dr. Vempati Chinna Satyam and Guru Sri Vempati Ravishankar. The items and the dancers are as follows:

1. Jayamu jayamu- in ragas Hamsadhwani and Bilahari, tala Adi by Vasanthi, Subhasree & Manjusha
2. Krishna sabdam - in raga Mohana, tala Adi by Geetha Nair
3. Kamakshi stuti - in ragamalika, tala Adi by Priyanka
4. Vedaleri vayyarulu - in raga Kedaragowla, tala Adi by Kalpana Sreenivas
5. Koluvaitiva - in raga Ramapriya, tala Adi by Vasanthi and Subhasree
6. Marakata manimaya - in ragas Sankarabharanam and Arabhi, tala Adi by Geetha Nair & Priyanka
7. Parulanna mata - in raga Kapi, tala Rupakam by Kalpana Sreenivas
8. Tillana - in raga Hindolam, tala Adi by Kalpana Sreenivas, Geetha Nair, Priyanka & Vasanthi

Chennai

Tamil Nadu constitutes the south-eastern extremity of the Indian peninsula. Chennai is the capital city of the state, besides being an important district. The district city is one of the metropolises of India and serves as the gateway to the culture of South India. In spite of being the capital of a Tamil-speaking state, it has emerged as a cosmopolitan city playing an important role in the historical, cultural and intellectual development of India, representing still the distinct components of the highest form of Dravidian civilization. In addition, it holds out an interesting fare of South Indian architecture, music, dance, drama, sculpture and other arts and crafts.

Phone Numbers for Call Taxi operators

If you like to engage call taxi's for your travel needs, the following phone numbers can be used.

Call Taxi operator	**Phone Number**
Fast Track	044-24732020
Zig Zag	044-24749966
Bharathi	044-28142244
Chennai Call Taxi	09941895363
City Call Taxi	044-22434141

Taxi or Auto

If you are carrying a heavy luggage it would be convenient for you to hire an auto or a taxi. Chennai Central has a prepaid auto/taxi service and this is manned by the City Police. The fare to the campus from Chennai Central will be around Rs.150/- for an auto and Rs.250/- for a taxi.

From Hotel Locations

We suggest you to make your way to the Institute in an auto or a taxi since most of these hotels are in a radius of 5kms. Alternatively, you can also take the local buses / suburban trains.

Chennai Tourism

There are many places of interest in and around chennai form art museum to religious places. Chennai Government Museum, Fort St. George , Santhome Cathedral Basilica, Kottam Ramakrishna Mutt, Kapaleeswarar Temple, Marundheeswarar Temple, Kalakshetra Foundation , Dakshinachitra and the Marina beach are places within the city limits. If one is willing to travel a little further the suggested places are Vedanthangal (85 kms) and Mahabalipuram (60 kms)

Chennai Cuisines

The cuisine of Tamil Nadu is counted among the popular cuisines in India. It is enjoyed by the people of the country and equally relished by the foreigners coming to India. Dishes like Idli, Dosa, Sambar, Filter 'Kaapi' (coffee) and Rasam are the most exotic dishes among the south Indian cuisine. The south Indian platter or Thali is also very popular, comprising various vegetables, along with dominant coconut flavour. Another highlight of south Indian cuisine is, Pongal, a sweet dish prepared during the harvest festival 'Pongal'. Saravana Bhavan, Sangeetha and Sri Krishna Sweets are some of the eat-outs where you can treat your taste buds with original south Indian flavours.

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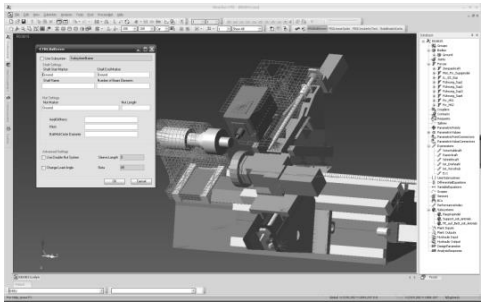

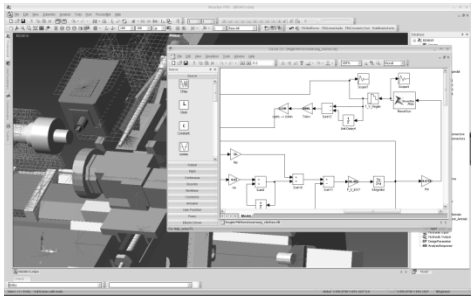

To stay ahead of competition, machine tool (MT) manufacturers are currently forced to perform a paradigm change from conservative developing and testing methods towards the utilization of Computer-Aided-Engineering (CAE) software. In order to facilitate the access to Virtual Prototyping (VP) software tools, FunctionBay, the Technical University of Munich (IWB) and the MT manufacturer FRAMAG have together developed dedicated simulation software which totally focuses on the requirements of the machine tool manufacturing industry.

KEY FEATURES OF RECURDYN/ MACHINE TOOL

• Reduce development cost and risks by detecting machine weak points with a preventive system analysis

• Avoid dynamic stability (vibration) problems of the machine with a frequency response analysis of the machine tool structure based on forced and self-excited excitations

• Predict machine chatter sensitivity and enhance the maximum cutting performance

• Improve the overall machine tool precision and work piece quality; Accelerate the machine clock cycle

• Optimize the controller parameters with a mechatronic simulation on a complete system level.

• Control the machine workspace with a collision detection analysis

• Ease-of-use interface and handling for novice and experienced users

• Comprises predefined and validated machine tool components which can to be used like building blocks

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