

Program Schedule – ACODS 2014

13 – 15 March 2014 , Venue: Outreach IIT Kanpur

Day 1, 13 March 2014 Thursday		
Time	Program	Venue
08:00 – 09:00	Registration	Outreach Foyer
09:00 – 09:30	Inaugural Session	Outreach Auditorium
09:30 – 10:30	Plenary Talk 1 – Challenges & Research Opportunities in UAS Control and Guidance Speaker: Avinash Chander, DRDO Chair: S. C. Srivastava, IITK	Outreach Auditorium
10:30 – 11:00	Tea Break	
11:00 – 11:30	Invited Talk 1 – Development of Wide Area Damping Controller Utilizing Synchrophasor Measurements for Smart Grid Applications Speaker: S. C. Srivastava, IITK Chair: Debanik Roy, BRNS	Outreach Auditorium
	Invited Talk 2 – Control of Unstable Systems Speaker: M. Chidambaram, IITM Chair: A K Sarkar, DRDL Hyderabad	Outreach Hall of Fame
Parallel Sessions		
11:30 – 13:30	Session 1 – Advances in Guidance, Navigation and Control of Aerospace Systems Chair: Seetharama Bhat, IISc Co Chair: Soumendu Raha, IISc	Outreach Seminar Hall I
	Session 2 – Optimal Control Part I Chair: Hari B. Hablani, IISc Co Chair: Prem Kumar P, GE	Outreach Seminar Hall II
	Session 3 – Robotics and Control Part I Chair: Debanik Roy, BRNS Co Chair: Swagat Kumar, TCS Gurgaon	Outreach Hall of Fame

	<p>Session 4 – Intelligent Systems and Control: Part I Chair: B M Mohan IITKgp Co Chair: A K Deb IITKgp</p>	Outreach Auditorium
	<p>Session 5 – Robust Control Chair: Chidambaram Manickam, IITM Co Chair: Ramprasad Potluri, IITK</p>	Outreach Extension
13:30 – 14:30	Lunch	
Parallel Sessions		
14:30 – 16:30	<p>Session 6 – Autopilot Design and Guidance Chair: Hari B Hablani, IITB Co Chair: A Swaroop, NIT Kurukshetra</p>	Outreach Seminar Hall I
	<p>Session 7 – Control , Navigation and Communication of Space Vehicles Chair: Vinod Kumar, ISAC Bangalore Co Chair: Swagat Kumar, TCS</p>	Outreach Seminar Hall II
	<p>Session 8 – Chaotic and Stochastic Systems and Control Chair: Brahma Deo, IITK Co Chair: Ramkalyan Ayyagari, NIT Trichy</p>	Outreach Hall of Fame
	<p>Session 9 – Advances in Estimation Techniques Chair: S Chakraverty, NIT Rourkela Co Chair: Shailaja Kurode, CoE, Pune</p>	Outreach Auditorium
	<p>Session 10 – Systems Theory Chair: S. E. Talole, DIAT, Pune Co Chair: LG Van Willigenburg, Wageningen University</p>	Outreach Extension
16:30 – 17:00	Tea Break	
17:00 – 18:00	<p>Plenary Talk 2 – Identification, Control, and Monitoring of Complex Chemical and Biochemical Systems Speaker: M. Nazmul Karim, TAMU Chair: Ravi Gudi, IITB</p>	Outreach Auditorium
18:00 – 19:00	<p>Plenary Talk 3 – An Anthology of Unmanned Aircraft Automation Successes at Stellenbosch University Speaker: Thomas Jones, Stellenbosch University, South</p>	Outreach Auditorium

	Africa Chair: A K Sarkar, DRDO, Hyderabad	
Day 2, 14 March 2014 Friday		
Time	Program	Venue
09:00 – 09:30	Invited Talk 3 – Iterative learning control & Estimation – a review and some initial results Speaker: Ravi Gudi, IITB Chair: Siddharth Sen, IITKgp	Outreach Auditorium
	Invited Talk 4 – Flight Dynamic and Control Issues of Wrap Around Artillery Rocket in Supersonic Flight. Speaker: A K Ghosh, IITK Chair: R Padhi, IISc	Outreach Hall of Fame
09:30 – 10:00	Invited Talk 5 – Control of Fractional Order Systems Speaker: Siddharth Sen, IITKgp Chair: Malek Ghanes, ENSEA, France	Outreach Auditorium
	Invited Talk 6 – Continuous Integral Sliding Mode Control: A Second Order Sliding Mode Approach Speaker: Bijnan Bandhopadhyay, IITB Chair: B M Mohan, IITKgp	Outreach Hall of Fame
10:00 – 10:30	Tea Break	
Parallel Sessions		
10:30 – 12:30	Session 11 – Robotics and Control Part II Chair: Malek Ghanes, ENSEA, France Co Chair: Arun Mahindrakar, IIT M	Outreach Seminar Hall I
	Session 12 – Distributed Control of Autonomous Multi-Vehicle Systems Chair: Arpita Sinha, IITB Co Chair: Ashwini Ratnoo, IISc	Outreach Seminar Hall II
	Session 13 – Multi-agent Systems and Control Chair: D Ghose, IISc Co Chair: Anupam Shukla, IIITM, Gwalior	Outreach Hall of Fame
	Session 14 – Advances in Fuzzy Based Modeling, Control and Optimization in Dynamical Systems Chair: S Chakraverty, NIT Rourkela	Outreach Auditorium

	Co Chair: M Maiti, Vidyasagar University	
	Session 15 – Emerging Control Systems Chair: B Bandopadhyay, IITB Co Chair: K Dhanalaxmi, NIT Trichy	Outreach Extension
12:30 – 13:00	Invited Talk 7 – Precise Navigation for Proximity Operations and Formation Control of Low-Earth-Orbit Satellites using GPS – A Review Speaker: Hari Hablani, IITB Chair: A K Ghosh, IITK	Outreach Auditorium
	Invited Talk 8 – Energy Management in a Fuel Cell System for Electrical Vehicle Speaker: Malek Ghanes, ENSEA, France Chair: B Bandhopadhyay, IITB	Outreach Hall of Fame
13:00 – 14:00	Lunch	
Parallel Sessions		
14:00 – 16:00	Session 16 – Model Predictive Control Chair: Siddhartha Mukhopadhyay, IITKgp Co Chair: Arun K Tangirala, IITM	Outreach Seminar Hall I
	Session 17 – Advances in Robotics Chair: D Ghose, IISc Co Chair: Arun Mahindrakar, IITM	Outreach Seminar Hall II
	Session 18 – Intelligent Systems and Control: Part II Chair: Bidyadhar Subudhi, NIT Rourkela Co Chair: Petr Husek, University Hospital Ostrava, Czech Republic	Outreach Hall of Fame
	Session 19 – Nonlinear Systems and Control Chair: Indrani Kar, IITG Co Chair: Prem Kumar P, GE	Outreach Auditorium
	Session 20 – Robotics and Control Part III Chair: N Sukavanam, IIT Roorkee Co Chair: K Dhanalaskmi, NIT Trichy	Outreach Extension

16:00 – 16:15	Tea Break	
16:15 – 17:15	Plenary Talk 4 – A highly Interactive 3D Programmable Surface Speaker: Saeid Nahavandi, Deakin University, Australia Chair: K. S. Venkatesh, IITK	Outreach Auditorium
17:15 – 18:15	Plenary Talk 5 – Optimisation and Control of Distributed Multi-satellite Networks Speaker: Klaus Schilling, University of Wuerzburg, Germany Chair: Sitaram Bhatt, IISc.	Outreach Auditorium
19:00 – 22:00	Banquet, Cultural Program and Award Ceremony	Outreach Auditorium + Lawn

Day 3, 15 March 2014 Saturday		
Time	Program	Venue
09:00 – 09:30	Invited Talk 09 – Counter-Intuitive Guidance Strategies Speaker: Debashish Ghose, IISc Chair: N Sukavanam, IIT Roorkee	Outreach Auditorium
	Invited Talk 10 – Control Philosophy of Grid Connected PV System Speaker: Sukumar Mishra, IITD Chair: Santanu Mishra, IITK	Outreach Hall of Fame
09:30 – 10:00	Invited Talk 11 – Towards an Oracle for the User: Prospects and Challenges Speaker: S Mukhopadhyay, IITKgp Chair: R Padhi, IISc	Outreach Auditorium
	Invited Talk 12 – TBA Speaker: K Visakan, Univ. of Sheffield, UK Chair: N Verma, IITK	Outreach Hall of Fame
10:00 – 10:30	Tea Break	

10:30 – 11:30	Plenary Talk 6 – Intelligent Control of Robots in Interacting with Unknown Environments Speaker: Shuzhi Sam Ge, NUS, Singapore Chair: L Behera, IITK	Outreach Auditorium
11:30 – 12:30	Plenary Talk 7 – Next-Generation Smart Grids: Completely Autonomous Power Systems (CAPS) Speaker: Qing-Chang Zhong, Sheffield, UK Chair: Sukumar Mishra, IITD	Outreach Auditorium
12:30 – 14:00	Lunch	
Parallel Sessions		
14:00 – 16:00	Session 21 – Drives and Converters Chair: Santanu Mishra, IITK Co Chair: Ranjan Kumar Behera, IIT Patna	Outreach Seminar Hall I
	Session 22 – Optimal Control Part II Chair: R Padhi, IISc Co Chair: Samit Ray Chaudhuri, IITK	Outreach Seminar Hall II
	Session 23 – Fuzzy and Neural Systems Chair: BM Mohan, IITKgp Co Chair: Nischal Verma, IITK	Outreach Hall of Fame
	Session 24 – Systems Modelling and Control Chair: A Swaroop, NIT Kurukshetra Co Chair: Jayesh Barve, Nirma University	Outreach Auditorium
	Session 25 – Design, Dynamics and Optimization of Active Mechanisms for Dynamical Systems Chair: Bisakh Bhattacharya, IITK Co Chair: Rituparna Datta, IITK	Outreach Extension
16:00 – 16:15	Tea Break	
Parallel Sessions		
16:15 – 18:15	Session 26 – Process Dynamics and Control Chair: Arun K Tangirala, IITM Co Chair: Nishchal Verma, IITK	Outreach Seminar Hall I

<p>Session 27 – Power Systems Chair: Sukumar Mishra, IITD Co Chair: Santanu Mishra, IITK</p>	<p>Outreach Seminar Hall II</p>
<p>Session 28 – Vibration Control Chair: Bishakh Bhattacharya, IITK Co Chair: Malay Banarjee, IITK</p>	<p>Outreach Hall of Fame</p>
<p>Session 29 – Control and Formations of UAVs Chair: A K Ghosh, IIT K Co Chair: Jayesh Barve, Nirma University</p>	<p>Outreach Auditorium</p>
<p>Session 30 – Adaptive Critic Designs for Control Chair: AK Deb, IITKgp Co Chair: BM Mohan, IITKgp</p>	<p>Outreach Extension</p>

Session 1: Advances in Guidance, Navigation and Control of Aerospace Systems

Chair: Seetharama Bhat , IISc,

Co Chair: Soumendu Raha, IISc

Time	Paper Id.	Paper Title	Authors
11:30 – 11:50	76	Gimbal Angle Constrained PN Guidance Law	Ranajit Das, Majumder Santanu Bijoy, Bhattacharjee R N
11:50 – 12:10	14	Hybrid Guidance Algorithm using Flatness and Dynamic Inversion for RLV	Reshma Susan Babu, Rajeev U.P, Letha Kumari
12:10 – 12:30	93	Geometrical Guidance Algorithm for Soft Landing on Lunar Surface	Rijesh M P, Sijo George, Philip N K, Natarajan P
12:30 – 12:50	233	Least Square Estimation of Spacecraft Attitude Along with Star Camera Parameters	Madhumita Pal, M Seetharama Bhat
12:50 – 13:10	192	Evaluation of a Novel Attitude Estimation Algorithm for a High Performance Fighter Aircraft	Raghavendra Kukillaya, Kamali C, Suganya S, Amitabh Saraf
13:10 – 13:30	195	Retro-PN Based Simultaneous Salvo Attack against Higher Speed Nonmaneuvering Targets	Satadal Ghosh, Debasish Ghose, Soumyendu Raha

Session 2: Optimal Control Part I

Chair: Hari B Hablani, IITB

Co Chair: Prem Kumar P, GE

Time	Paper Id.	Paper Title	Author(s)
11:30 – 11:50	172	Computationally Efficient Suboptimal Control Design for Impulsive Systems Based on Model Predictive Static Programming	Chandrashekhar Sakode, Radhakant Padhi

11:50 – 12:10	244	Development of Frequency-dependent Optimal Control in Independent Modal Space	Sanjukta Chakraborty, Samit Ray Chaudhuri
12:10 – 12:30	105	Comparison of Two Methods of Incorporating an Integral Action in Linear Quadratic Regulator	Hanmant Malkapure, Chidambaram Manickam
12:30 – 12:50	38	A Novel Characterization of Solutions of ARE	Sanand Dilip, Harish Pillai
12:50 – 13:10	133	Trajectory Optimization and Control of Reentry Vehicle	Sudin Kadam, Hari B. Hablani
13:10 – 13:30	87	Optimal Control for a Vibrating String with Variable Axial Load and Damping Gain	Ramdas Sonawane, Anil Kumar, S.B. Nimse

Session 3: Robotics and Control Part I

Chair: Debanik Roy, BRNS

Co Chair: Swagat Kumar, TCS Gurgaon

Time	Paper Id.	Paper Title	Author(s)
11:30 – 11:50	109	Towards Optimal Computation of Energy Optimal Trajectory for Mobile Robots	Manas Chaudhari, Leena Vachhani, Rangan Banerjee
11:50 – 12:10	110	"r" and "S" Shaped Curves for Path Planning With Obstacle Avoidance	Saurabh Upadhyay, Ashwini Ratnoo
12:10 – 12:30	55	Control Of Two Link Flexible Manipulator Using Higher Order Sliding Modes and Disturbance Estimation	Amruta Mujumdar, Shailaja Kurode, Bhagyashri Tamhane
12:30 – 12:50	137	Lyapunov Function Based Steering Law for Generalized Voronoi Diagram (GVD) Construction by a Mobile Robot	Arunkumar G K, Srikant Sukumar, Leena Vachhani
12:50 – 13:10	185	Manipulator Control using Human Arm Imitation	Bakul Agarwal, Ayush Varshney, Laxmidhar Behera
13:10 – 13:30	189	Variable Gain Super Twisting Controller for the Position Stabilization of Stewart Platform	Ramesh Kumar P, Bijnan Bandyopadhyay

Session 4: Intelligent Systems and Control: Part I

Session Chair: B M Mohan IIT Kgp

Co Chair: A K Deb IIT Kgp

Time	Paper Id.	Paper Title	Author(s)
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11:30 – 11:50	162	Learning Automata Based Set-Point Weighted Parameter for Unstable Systems	Lalit Musmade, Chidambaram Manickam
11:50 – 12:10	202	Lévy Guided Firefly Algorithm Based Tuning of Decentralised PI Controller of Nonlinear Multivariable System - Coal Gasifier	Kotteeswaran Rangasamy, Sivakumar Lingappan
12:10 – 12:30	173	Robust Satellite Formation Flying Through Online Trajectory Optimization Using LQR and Neural Networks	Girish Joshi, Radhakant Padhi
12:30 – 12:50	12	Optimization of Dual Input Buck Converter Control Through Genetic Algorithm	Sundareswaran K, Kiran Kuruvinashetti, Hariprasad B, Sankar Peddapati, P. Srinivarao Nayak, Vigneshkumar V
12:50 – 13:10	46	Effect of Static Synchronous Series Compensator (SSSC) for Damping Oscillations in Automatic Generation Control with Cuckoo Search Optimised Integral Double Derivative Controller	Sanajaoba Sarangthem Singh
13:10 – 13:30	251	Improved Approach to Area Exploration in an Unknown Environment by Mobile Robot using Genetic Algorithm, Real time Reinforcement Learning and Co-operation among the Controllers	Yesoda Bhargava, Anupam Shukla, Laxmidhar Behera

Session 5: Robust Control

Session Chair: Chidambaram Manickam, IITM

Co Chair: Ramprasad Potluri, IIT K

Time	Paper Id.	Paper Title	Author(s)
11:30 – 11:50	22	Robust Predictive Control of Electro-Mechanical Servo System	Bhavnesht Panchal, Jaywant Kolhe, Venkatesh Parlikar, Sanjay Talole
11:50 – 12:10	149	Robust Predictive Control for Uncertain Piecewise Linear Systems Using Linear Matrix Inequalities	Jean Thomas
12:10 – 12:30	160	Controller Design for Lateral Dynamics of Reusable Launch Vehicle by H-infinity Mixed Sensitivity Approach	Gopal Jee, Akash Yalagach, V. Brinda, Lalithambika VR, Dhekane MV
12:30 – 12:50	2	Robust Control of an Uncertain Nonlinear System with Unobservable Dynamics	Chaity Sarkar, Aparajita Sengupta
12:50 – 13:10	103	Robust Controller Design for First Order Plus Time Delay Systems Using Kharitonov Theorem	Nagineni Varun Chowdary, Chidambaram Manickam
13:10 –	16	A Novel Method on Disturbance Rejection PID	Sahul Venkat, Naveen

13:30		Controller for Quadcopter Based on Optimisation Algorithm	Chander, Thomas Kurian
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Session 6: Autopilot Design and Guidance

Session Chair: Hari B Hablani, IIT B

Co-Chair: A Swaroop, NIT Kurukshetra

Time	Paper Id.	Paper Title	Author(s)
14:30 – 14:50	224	High-Accuracy Integrated GPS-INS Aircraft Navigation for Landing Using Pseudolites and Double-Difference Carrier Phase Measurements	Ritesh kumar Sharma, Hari B. Hablani
14:50 – 15:10	100	Influence of Accelerometer Location on Autopilot Stability of Reusable Launch Vehicle Attitude Control System	Gopal Jee, V. Brinda, Lalithambika VR, Dhekane MV
15:10 – 15:30	130	Autopilot Design for Flexible Tactical Aerospace Vehicle Using Parameter Plane Technique	Siddhardha Kedarisetty, Vignesh Narayanan, Pulak Halder
15:30 – 15:50	248	Development of New-Generation Automatic Control Systems for Wing-in-Ground Effect Crafts & Amphibious Seaplanes	Alexander Nebylov, Vladimir Nebylov, Sukrit Sharan
15:50 – 16:10	187	Nonlinear Autopilot Design and Guidance Validation for Tactical Engagement	Radhakant Padhi, Sirisha Chikkala Venkata Sirisha, A K Sarkar
16:10 – 16:30	29	Air-To-Air Tracking Performance with Inertial Navigation and Gimballed Radar: A Kinematic Scenario	Vinod Saini, Hari B Hablani

Session 7: Control , Navigation and Communication of Space vehicles

Chair: Vinod Kumar, ISAC Bangalore

Co-Chair: Swagat Kumar, TCS

Time	Paper Id.	Paper Title	Author(s)
14:30 – 14:50	234	Real-Time Kinematic Absolute and Relative Velocity Estimation of Geostationary Satellites in Formation Using IRNSS Observables	Vinod Kumar, Hari B. Hablani, Ramalingam Pandiyan
14:50 – 15:10	237	Integrative Control Approach for Agile Spacecraft Maneuvers	Ashok Kumar Kakula, Jasvinder Singh Khoral, Natarajan P
15:10 – 15:30	188	Adaptive Integrator Backstepping Control for Magnetically Actuated Satellite	Atanu Halder, Dipak Kumar Giri, Manoranjan Sinha
15:30 – 15:50	168	Rigid Spacecraft Attitude Tracking Using Finite Time Sliding Mode Control	Pyare Mohan Tiwari, S Janardhanan, Mashuq-un- Nabi
15:50 – 16:10	37	Design of Autopilots for Tactical Aerospace Vehicles: A Comparitive Study	Vignesh Narayanan, Akhilesh Swarup, Pulak Halder
16:10 – 16:30	190	Satellite Payload Motion for Remote Sensing	Saurabh Chatterjee, Hari B. Hablani

Session 8: Chaotic and Stochastic Systems and Control

Session Chair: Brahma Deo, IITK

Co Chair: Ramkalyan Ayyagari, NIT Trichy

Time	Paper Id.	Paper Title	Author(s)
14:30 – 14:50	68	Nonlinear Active Control Based Hybrid Synchronization between Hyperchaotic and Chaotic Systems	Piyush Pratap Singh, Jay Prakash Singh, Binoy Krishna Roy
14:50 – 15:10	69	Hybrid Synchronization of Lu and Bhalekar-Gejji Chaotic Systems Using Nonlinear Active Control	Jay Prakash Singh, Piyush Pratap Singh, Binoy Krishna Roy
15:10 – 15:30	71	Mass and Length Dependent Chaotic Behavior of a Double Pendulum	Mukul Kumar Gupta, Kamal Bansal, Arun Kumar Singh
15:30 – 15:50	220	Sensitivity Analysis of Oscillatory Circuits	Venkat Bokka, Shaunak Sen
15:50 – 16:10	107	Controllability of Semilinear Stochastic System with Multiple Delays in Control	Anurag Shukla, Nagrajan Sukavanum, D. N. Pandey
16:10 – 16:30	223	A Brief Survey of Stochastic Resonance and its Application to Control	Jerome Moses Monsingh, Ramakalyan Ayyagari

Session 9: Advances in Estimation Techniques

Chair: S Chakraverty, NIT Rourkela

Co Chair: Shailaja Kurode, College of Engineering, Pune

Time	Paper Id.	Paper Title	Author(s)
14:30 – 14:50	247	SURF-Based Human Tracking Algorithm with On-Line Update of Object Model	Meenakshi Gupta, Nishant Kejriwal, Laxmidhar Behera, K S Venkatesh
14:50 – 15:10	75	Fault Detection and Isolation Using an Adaptive Unscented Kalman Filter	Manasi Das, Smita Sadhu, T.K. Ghoshal
15:10 – 15:30	84	Comparison of Cartesian and Polar Estimates of the EKF for Different Choices of the Robustness and Sensitivity Metrics	Sourya Roy, Ratna Ghosh, Bhaswati Goswami
15:30 – 15:50	116	In-situ Bias Estimation of Low Grade Gyroscopes for Ship Launched Flight vehicles	Murali Krishna Gurram, Satheesh Reddy G, Kannan Muthukrishnan, Vidyakrishna Vadloori
15:50 – 16:10	54	State and Disturbance Estimation Using Higher Order Sliding Modes for Seeker System	Bhagyashri Tamhane, Shailaja Kurode, Amruta Mujumdar
16:10 – 16:30	56	Gaussian Sum Unscented Gaussian Sum Filter - An Improvement in GS-UKF	Krishna Kumar Kottakki, Mani Bhushan, Sharad Bhartiya

Session10: Systems Theory

Chair: S. E. Talole, DIAT, Pune

Co Chair: LG Van Willigenburg, Wageningen University, Netherlands

Time	Paper Id.	Paper Title	Author(s)
14:30 – 14:50	208	Order Reduction of Interval Systems Using Eigen Spectrum and Factor Division Algorithm	Deepak Kumar, Ankit Jaiswal, Pawan Kumar Singh, Sonam Gangwar, Shambavi Manmatharajan
14:50 – 15:10	117	Theoretical and Numerical Issues Concerning Temporal Stabilisability and Detectability	L.G. Van Willigenburg, Willem L. De Koning
15:10 – 15:30	89	On Observability of Irregular Descriptor Systems	Mahendra Kumar Gupta, Nutan Kumar Tomar, Shovan Bhaumik
15:30 – 15:50	28	Dynamic Model of a MAV with COG Shifting Mechanism	Pradeep Kumar Yadav, Karthikeyan Kalirajan
15:50 – 16:10	176	Review of Five Sets of Piecewise Constant Orthogonal Functions for Function Approximation, Integration and Solution of First Order Differential Equation Using These Function Sets	Anindita Ganguly, Himadri Basu
16:10 – 16:30	104	Subspace Identification of Unstable Transfer Function Model for a Magnetic Levitation System	Sankar Rao Chinta, Chidambaram Manickam

Session 11: Robotics and Control Part II

Chair: Malek Ghanes, ENSEA, France

Co Chair: Arun Mahindrakar, IIT M

Time	Paper Id.	Paper Title	Author(s)
10:30 – 10:50	203	Region Reaching and Obstacle Avoidance for Autonomous Underwater Vehicle without Velocity Measurement	Koena Mukherjee, Indra Narayan Kar, R. K. P. Bhatt
10:50 – 11:10	48	Mobile Robot Navigation Using Evolving Neural Controller in Unstructured Environments	Awahan Patnaik, Khimya Khetarpal , Laxmidhar Behera
11:10 – 11:30	50	Real Time Evaluation of Grid Based Path Planning Algorithms: A Comparative Study	Saranya Chandrasekaran, Koteswara Rao Kandula, Manju Unnikrishnan, V. Brinda, V.R. Lalithambika, M.V. Dhekane
11:30 – 11:50	225	Robot Learns from Human Teacher Through Modified Kinesthetic Teaching	Debarshi Patanjali Ghoshal, Niladri Das, Samrat Dutta, Laxmidhar Behera
11:50 – 12:10	204	On the Topologies Conforming Singular Perturbation in Formation Control of Nonholonomic Robots	Soumic Sarkar, Indra Narayan Kar
12:10 – 12:30	178	Motion Planning for the Three Wheel Mobile Robot Using the Reachable Set Computation under Constraints	Mandar Datar, Vishwanath Ketkar, Manas Mejari, Ankit Gupta, Navdeep Singh, Faruk Kazi

Session 12: Distributed Control of Autonomous Multi-Vehicle Systems

Chair: Arpita Sinha, IITB

Co-Chair: Ashwini Ratnoo, IISc

Time	Paper Id.	Paper Title	Author(s)
10:30 – 10:50	240	Vector Field Based Formation Generation Guidance for Arbitrary Initial Conditions	Vinay Challa, Ashwini Ratnoo
10:50 – 11:10	241	Variable Gain Gradient Based Collision Free Desired Formation Generation	Arindam Mondal, Laxmidhar Behera
11:10 – 11:30	236	Relative Attitude Trajectory Tracking Using Line of Sight Measurements under Spacecraft Position Dynamics	Rakesh R. Warier, Arpita Sinha, Srikant Sukumar
11:30 – 11:50	245	Analysis of Obstacle Based Probabilistic RoadMap Method Using Geometric Probability	Titas Bera, M Seetharama Bhat, Debasish Ghose
11:50 – 12:10	197	Vision Based Alignment to Runway During Approach for Landing of Fixed Wing UAVs	Peter Arun Marianandam, Debasish Ghose

Session 13: Multi-agent Systems and Control

Chair: D Ghose, IISc

Co Chair: Anupam Shukla, IIITM, Gwalior

Time	Paper Id.	Paper Title	Author(s)
10:30 – 10:50	154	Cooperative Rendezvous Guidance Using Sliding Mode Control for Interception of Stationary Targets	Shashi Ranjan Kumar, Debasish Ghose
10:50 – 11:10	165	Development of a Robotic Platform to Implement a Boundary Mapping Algorithm	Achal Arvind, Debasish Ghose, Prathyush Menon
11:10 – 11:30	118	Target Centric Cyclic Pursuit Using Bearing Angle Measurements Only	Sangeeta Daingade, Arpita Sinha
11:30 – 11:50	43	Relative Navigation of Satellites in Formation Using Monocular Model-Based Vision	Vinod Kumar, Hablani Hari B. , Ramalingam Pandiyan
11:50 – 12:10	253	Canopy Clustering Based Multi Robot Area Exploration	Sanjeev Sharma, Anupam Shukla, Ritu Tiwari, Jyoti Yadav
12:10 – 12:30	252	Coalition Formation for Multi-Agent Coordination for Surveillance and Capture of Foreign Intruder using Bacteria Foraging Algorithm	Chiranjib Sur. Anupam Shukla

Session 14: Advances in Fuzzy Based Modeling, Control and Optimization in Dynamical Systems

Session Chair: S Chakraverty, NIT Rourkela

Session CoChair: M Maiti, Vidyasagar University

Time	Paper Id.	Paper Title	Author(s)
10:30 – 10:50	41	Neural Network Based Parts of Speech Tagger for Hindi	Ravi Narayan, S. Chakraverty, V. P. Singh
10:50 – 11:10	246	Numerical Solution of Two Group Uncertain Neutron Diffusion Equation for Multi Region Reactor	Sukanta Nayak, S. Chakraverty
11:10 – 11:30	108	Use of Fuzzy Equations in Technical Diagnostics Problem	Alexander Kucherov, Vladimir Kurenkov, Artem Yakischik
11:30 – 11:50	91	Control of Symmetrical Cascaded Multicell Inverter using Fuzzy Logic	Ponnambalam Pathipooranam, Praveen Kumar. M., Mayank Varshney, Dhanesh Choudhary, Kalyani Chakravarthula
11:50 – 12:10	114	Adaptive Fuzzy Sliding Mode Control for Uncertain Nonlinear Systems	Petr Husek
12:10 – 12:30	61	Support Vector Machine Based Adaptive Calibration Technique for Resistance Temperature Detector	Santhosh K Venkata, Binoy Krishna Roy

Session 15: Emerging Control Systems

Chair: Bijnan Bandopadhyay, IIT B

Co Chair: K Dhanalaxmi, NIT Trichy

Time	Paper Id.	Paper Title	Author(s)
10:30 – 10:50	25	Automatic Generation Control of Single Area Thermal Power System with Fractional Order PID ($PI^\lambda D^\mu$) Controllers	Ismayil C., Sreerama Kumar R., Sindhu T.K.
10:50 – 11:10	126	Robust Controller Design for Discrete Fractional Order System: A Disturbance Observer Based Approach	Shyam Kamal, Bijnan Bandyopadhyay
11:10 – 11:30	194	Multivariable Approach to Bandwidth Sharing in a Multi-source Connection-Oriented Network with Heterogenous Delays	P Baburaj, Bijnan Bandyopadhyay, Andrzej Bartoszewicz
11:30 – 11:50	83	New Results on Delay-dependent Robust Stability of Interval State-Delayed Linear Systems with Nonlinear Perturbations	Ramakrishnan Krishnan, Goshaidas Ray

11:50 – 12:10	152	Beam Balancing Ball Driven by Shape Memory Alloy: Prospective Actuator for Stabilised Control	Josephine Selvarani Ruth D, Sunjai Nakshatharan S, Dhanalakshmi K
12:10 – 12:30	217	Interaction Assessment in Multivariable Control Systems Through Causality Analysis	Abhinav Garg, Arun K. Tangirala

Session 16: Model Predictive Control

Chair: Siddhartha Mukhopadhyay, IIT Kharagpur

Co Chair: Arun K Tangirala, IITM

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	42	Stabilization of 2-D Spider Crane with Non-Convex State Constraints Using MPC	Manas Mejari, Ankit Gupta, Vishwanath Ketkar, Mandar Datar, Navdeep Singh, Faruk Kazi
14:20 – 14:40	115	On the Improvement of Set-point Tracking Performance of Model Predictive Control	Sachin Prabhu, Koshy George
14:40 – 15:00	121	A Computationally Efficient Stabilizing Model Predictive Control of Switched Systems	Hariprasad K, Sharad Bhartiya
15:00 – 15:20	193	A Model Predictive Control Strategy Based on Consistency in Wavelet Projections	Siddhartha Mukhopadhyay, Akhilanand Pati Tiwari
15:20 – 15:40	79	Modelling and Control of Ball and Beam System using Coefficient Diagram Method (CDM) based PID Controller	Kalpana Kalpanakannan, Meenakshipriya Balasubramaniam
15:40 – 16:00	65	Motion Compensation of Airborne Synthetic Aperture Radar	Dushyant Kaliyari, Amit Shukla, Y. S. Rao, Hari B. Hablani

Session 17: Advances in Robotics

Session Chair: D Ghose, IISc Bangalore

Co Chair: Arun Mahindrakar, IIT Madras

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	31	The Fusion of Navigation Solutions from Different Navigation Systems for an Autonomous Underwater Vehicle.	Vaibhav Awale, Hari B. Hablani
14:20 – 14:40	254	Multi-Robot Exploration using Communication Link Density	A. Pal, R. Tiwari

14:40 – 15:00	8	Finite-Time Control of a Quadrotor System	Vijay Muralidharan, Anup Ekbote, Arun Mahindrakar
15:00 – 15:20	183	A Heterogeneous Cyclic Pursuit Based Strategy for Boundary Tracking	Dwaipayan Mukherjee, Purushothama Menon Prathyush, Debasish Ghose
15:20 – 15:40	156	Stabilization of Balanced Circular Motion about a Desired Center	Anoop Jain, Debasish Ghose, Purushothama Menon Prathyush
15:40 – 16:00	235	Robotic Fish Design and Control Based on Biomechanics	Shaurya Shriyam, Anuj Agrawal, Laxmidhar Behera, Anupam Saxena

Session 18: Intelligent Systems and Control: Part II

Session Chair: Bidyadhar Subudhi, NIT Rourkela

Co Chair: Ranajit Das, DRDO

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	85	A GA Based Adaptive Optimal controller for 2DOF Robot Manipulator	Debashisha Jena, Vijay Mokenapalli
14:20 – 14:40	201	Design of PID Controller for Linear Dynamic Continuous Systems Using IGLSM And DE Algorithm	Nancy Namratha Jeldi, Hemalatha Yerramsetty
14:40 – 15:00	216	Practical Realization of Scalar Optimization Function of Shielded Metal Arc Welding Process	Arun Kumar Paul
15:00 – 15:20	128	Optimization of Engineering Design Problems via an Efficient Hybrid Meta-heuristic Algorithm	Kedar Nath Das, Raghav Parouha
15:20 – 15:40	52	Application of Firefly Algorithm for Radial Distribution Network Reconfiguration	Lakshmi Reddy Yeruva, Sathiyarayanan T, Sydulu M
15:40 – 16:00	99	Application of Newton's Method with Analytical Computation of Jacobian Matrix to Solve Multi-linear Pole Assignment Equations	Gopal Jee

Session 19: Nonlinear Systems and Control

Session Chair: Indrani Kar, IIT G

Co Chair: Prem Kumar P, GE

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	66	Design of Nonlinear Flight Controller for a Fighter Aircraft	Lathasree Pinjala, Shaik Ismail, Abhay Pashilkar
14:20 – 14:40	146	An Investigation on the Modelling and Controller Design of a Hydraulic Press	Deepak Kumar Ravi, Tony Thomas A, Parameshwaran R
14:40 – 15:00	80	Application of Optimization Technique for Compensator Design of Launcher Attitude Control	Koteswara Rao Kandula, Dhekane MV, Lalithambika VR, V. Brinda
15:00 – 15:20	206	An Improved MRAC Scheme for Non-linear Design of Adaption Gain ' γ ' Using Heuristic Algorithms	Anuj Abraham, Pappa Natarajan
15:20 – 15:40	82	Adaptive Backstepping Control for a Twin Rotor MIMO System	Paloma Sodhi, Indrani Kar
15:40 – 16:00	155	Fault-tolerant Sliding Mode Control for Uncertain Over-actuated Systems	Deepti Khimani, Machhindranath Patil

Session 20: Robotics and Control Part III

Session Chair: N Sukavanam, IIT Roorkee

Co Chair: K Dhanalakshmi, NIT Trichy

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	166	Design and Control of Shape Memory Alloy Actuated Grippers	Krishna Chaitanya S, Dhanalakshmi K
14:20 – 14:40	167	Control of Shape Memory Alloy Actuated Gripper Using Pulse-Width Modulation	Krishna Chaitanya S, Dhanalakshmi K
14:40 – 15:00	145	Evasion Strategies in Decoy Assisted Engagements	Ragesh R, Ashwini Ratnoo, Debasish Ghose
15:00 – 15:20	15	Modeling Simulation and Control of 6-DOF Parallel Manipulator Using PID Controller and Compensator	Amit Shukla, Hamad Karki
15:20 – 15:40	62	Fuzzy PD+I Based Hybrid Force/Position Control of an Industrial Robot Manipulator	Himanshu Chaudhary, Vikas Panwar, Nagrajan Sukavanam, Rajendra Prasad

15:40 – 16:00	199	A Guidance Law for a Mobile Robot for Coverage Applications: A Limited Information Approach	Twinkle Tripathy, Arpita Sinha
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Session 21: Drives and Converters

Session Chair: Santanu Mishra, IIT K

Co Chair: Ranjan Kumar Behera, IIT Patna

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	101	Fryze Current Controller Based Active Power Filter	Manish Kumar Singh, Jayanti Chaudhary
14:20 – 14:40	242	Design of a Three Phase Squirrel Cage Induction Motor for Electric Propulsion System	Ranjan Kumar Behera, Ravi Prakash, M. J. Akhtar, Sanjoy K. Parida
14:40 – 15:00	72	Design and Development of Control System for Three Phase Induction Motor Using PIC Microcontroller	Dattatray S. Sutrave, BN Jamadar, S R Kumbhar, P M Gavhane
15:00 – 15:20	255	Routing scheme for Voltage Stabilization in Cyber Physical Energy Systems	Anuj Nandanwar, Meher Preetam Korukonda, Laxmidhar Behera
15:20 – 15:40	153	Multi Objective Economic Emission Load Dispatch Using Teacher-Learning Based Optimization Technique	Dinesh Varma Tekumalla, Vinod Kumar D M
15:40 – 16:00	94	Modeling Simulation and Control of Semi Active Suspension Model for Automobiles under Mat Lab Simulink Using PID Controller	Dhananjay Rao Kuna

Session 22: Optimal Control Part II

Chair: Venkat Ryali, GE

Co Chair: Samit Ray Chaudhuri, IIT Kanpur

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	175	State Constrained Model Predictive Static Programming: A Slack Variable Approach	Nitin Bhitre, Radhakant Padhi
14:20 – 14:40	64	Integrated Optimal Control of Reusable Launch Vehicle and Actuation System Using Linear Quadratic Regulator	Santhi Elizebeth Skariya, Baby Sebastian, Narayanan Namboodiripad M.N.
14:40 – 15:00	219	Three Dimensional Trajectory Optimization of a Homing Parafoil	Arun Vishnu Suresh Babu, Vineeth Chandran Suja, Vinay Challa Reddy

15:00 – 15:20	174	Extension of Model Predictive Static Programming for Reference Command Tracking	Prem Kumar, Radhakant Padhi
15:20 – 15:40	232	Multi Response Optimization of Induction Hardening Process -A New Approach	Mohan Misra, Bishakh Bhattacharya, Onkar Singh, A Chatterjee
15:40 – 16:00	33	Guidance of Parafoil Using Line of Sight and Optimal Control	Nitin Murali, Dineshkumar M, Arun Kishore W.C, DS. Sheela

Session 23: Fuzzy and Neural Systems

Session Chair: BM Mohan, IIT Kgp

Co chair: Nischal Verma, IIT K

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	112	Adaptive Fuzzy PI Controller Design for Coupled Tank System: An Experimental Validation	Soumya Ranjan Mahapatro, B Subuddhi, S Ghosh
14:20 – 14:40	143	Mathematical Models and Computational Aspects of the Simplest Fuzzy Two-term Controllers	Arun Neelimegham, Murali Mohan Bosukonda
14:40 – 15:00	256	ANN Based Arousal Detection from ECG Data	Chandan Kumar Behera, Tharun Kumar Reddy, Laxmidhar Behera
15:00 – 15:20	218	Solar Radiation Forecasting Using Neural Networks and Wavelet Transform	Ajay Pratap Yadav, Laxmidhar Behera
15:20 – 15:40	57	Estimation of Aerodynamic Derivatives using Neural Network based Method	Rakesh Kumar, A K Ghosh
15:40 – 16:00	67	Ship's Propulsion Neural Controller Main Engine - Pitch Propeller - Shaft Generator	Jan Kruszewski

Session 24: Systems Modelling and Control

Chair: A Swaroop, NIT Kurukshetra

Co Chair: Jayesh Barve, Nirma University

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	20	Estimation of Process Dynamics Using Biased Relay Feedback Approach	Saurabh Pandey, Somanath Majhi
14:20 – 14:40	157	Approximate Snapshot-ensemble Generation for Basis Extraction in Proper Orthogonal Decomposition	Shahkar Ahmad Nahvi, Mohammad Abid Bazaz, Mashuq-un- Nabi, S Janardhanan

14:40 – 15:00	27	System identification and robust control for a two-axis direct drive gimbaled stabilization system	Sudhakar Bendi, Subba Raju N
15:00 – 15:20	18	On a Wind Turbine-Generator System in the Presence of Wind Speed Noise and Fokker-Planck Equations	Ravish H Hirpara, Shambhu N. Sharma
15:20 – 15:40	132	Boiler Model and Simulation for Control Design and Validation	Sunil P Unnikrishnan, Jayesh Barve, P.S.V. Nataraj
15:40 – 16:00	35	Evaluation of Semi-Active Suspension Control Strategies for 8x8 Armoured Vehicle Using Stochastic Road Profile Inputs	Mukund Trikande, Vinit Jagirdar, Sujithkumar Muralidharan

Session 25: Design, Dynamics and Optimization of Active Mechanisms for Dynamical Systems

Chair: Bisakh Bhattacharya, IIT K

CoChair: Rituparna Datta, IIT K

Time	Paper Id.	Paper Title	Author(s)
14:00 – 14:20	122	Analysis of Composite Plate Dynamics Using Spatial Maps of Frequency-Domain Features Described by Gaussian Processes	Sean Anderson, Parham Aram, Bishakh Bhattacharya, Visakan Kadirkamanathan
14:20 – 14:40	138	Advances in Addressing Challenges in Complex Control Systems Design	Arun Chakrapani Rao, Jun Liu
14:40 – 15:00	169	An Experimental Analysis of an Active Elastic Metamaterial	Simon Alexander Pope, Hatim Laalej, Visakan Kadirkamanathan
15:00 – 15:20	221	Development of Autonomous Small EV in Japan Aging Society	Nan Wu, Harutoshi Ogai, Masakuni Oshito, Seiichirou Kamata, Shigeyuki Tateno, Akira Uchida, Masahiko Kai, Makio Iida, Yuji Sano
15:20 – 15:40	243	Damage Characterization in Frame Structures Using Output-only Modal and Feature-based Techniques	Harikrishnan Panikkaveettil, Koushik Roy, Samit Ray Chaudhuri
15:40 – 16:00	231	Design and Experimentation on Passive Vibration Isolation Systems Using PZT-PDMS Composite and a Shape Memory Alloy Wire Integrated Mechanism	Satish B. Satpal, Rituparna Datta, Vaibhav Chaturvedi, Bishakh Bhattacharya

Session 26: Process Dynamics and Control

Session Chair: : Arun K Tangirala, IITM

Co Chair: Nishchal Verma, IITK

Time	Paper Id.	Paper Title	Author(s)
16:15 – 16:35	135	Closed Loop Reaction Curve Method for Identification of TITO Systems	V. Dhanya Ram, Chidambaram Manickam

16:35 – 16:55	125	Eigenvalue Assignment via the Smith Predictor Based IMC & the Matrix Lambert W Function for Control of Time-delayed Process Systems	Prashant Prakash, Nishchal Kumar Verma, Laxmidhar Behera
16:55 – 17:15	30	Output-Feedback Control for Stabilization of SLOSH Using Higher Order Sliding Modes	Jyoti Prakash Mishra, Shailaja Kurode
17:15 – 17:35	53	Model-based Optimisation of Integrated Algae Biorefinery	Soumyajit Sen Gupta, Sharad Bhartiya, Yogendra Shastri
17:35 – 17:55	211	Developing a Soft Sensor for Fineness in a Cement Ball Mill	Peter Kavitha Stanley, GuruPrasath Muralidharan, Arun K. Tangirala
17:55 – 18:15	213	Control Loop Performance Assessment for Two Degree of Freedom Controller: Analysis of Model-Plant Mismatch	Ashish Advani, Sharad Bhartiya, Ravindra D. Gudi

Session 27: Power Systems

Session Chair: Sukumar Mishra, IITD

Co Chair: Santanu Mishra, IITK

Time	Paper Id.	Paper Title	Author(s)
16:15 – 16:35	164	Sliding Mode Control of Surface Mounted Permanent Magnet Synchronous Generator	Kiran Gautam, V. Sankaranarayanan Velupillai
16:35 – 16:55	136	Output Voltage Control and Power Management of a Dual Input Buck-Boost Converter Employing P and O Algorithm	Sundareswaran K, Kiran Kuruvnashetti, Gangadhar Ippili, Sankar Peddapati, P. Srinivarao Nayak, Vigneshkumar V
16:55 – 17:15	36	Optimal PMU Placement Techniques for the Topological Observability of a Partial Network of the Southern Grid of India	Satish Kumar Kotthapally, Sydulu Maheshwarapu
17:15 – 17:35	49	Combined Economic and Emission Dispatch Using a Classical Technique	Suresh K Damodaran, T. K. Sunil Kumar
17:35 – 17:55	134	Transient Stability Improvement of Multi-machine Power System Using Higher Order Sliding Mode Control	Mohammad Irfan, Samidha Kulkarni, Pralhad Kulkarni, Sushama Wagh, Navdeep Singh

Session 28: Vibration control

Session Chair : Bishakh Bhattacharya, IITK

Co Chair: Malay Banarjee, IIT K

Time	Paper Id.	Paper Title	Author(s)
16:15 – 16:35	158	Design and Experimental Evaluation of Higher Order Sliding Mode Control for Vibration Suppression of Shape Memory Alloy Actuated Structure	Sunjai Nakshatharan S, Josephine Selvarani Ruth D, Dhanalakshmi K
16:35 – 16:55	102	Analysis of Vibration in Gearbox Sensor Data Using Lipschitz Exponent (LE) Function: A Wavelet Approach	Venkatakrishnan Perumalsamy, S. Sangeetha, J.S.Gnanasekaran, M.G. Vishnukumar, A.S. Padmanaban
16:55 – 17:15	129	A Novel Active Vibration Control Design Methodology Using Viscoelastic Phenomenology	D. Roy Mahapatra, Vadiraja G.K.
17:15 – 17:35	9	Experimental and LS-DYNA of Sand Particle Erosion on Polymer Composites	Mahesh Haldankar, Santosh Kumar Malipatil
17:35 – 17:55	73	Detection of Cracks in Structures Using Two Crack Transfer Matrix	Nandakumar Palanisamy, Shankar Krishnapillai
17:55 – 18:15	10	Time Response Options for Structural Damage Mitigation Using an Actuator Load	Chimpalthradi Ashokkumar, Ashwin Sridhar, Manmathan Krishnan

Session 29: Control and Formations of UAVs

Session Chair: A K Ghosh, IIT K

Co Chair: Jayesh Barve, Nirma University

Time	Paper Id.	Paper Title	Author(s)
16:15 – 16:35	151	A Composite Guidance Strategy for Optical Flow Based UAV Navigation	Pooja Agrawal, Ashwini Ratnoo, Debasish Ghose
16:35 – 16:55	229	Quadrotor: Design, Control and Vision Based Localization	Anurag Sai Vempati, Vipul Choudhary, Laxmidhar Behera
16:55 – 17:15	196	Maximizing Total Surveillance Time of Monitoring Dual Ground Targets Using UAVs	Arun Vishnu Suresh Babu, Debasish Ghose
17:15 – 17:35	171	Reactive Collision Avoidance of UAVs with Stereovision Camera Sensors using UKF	Amit Tripathi, Ramsingh G. Raja, Radhakant Padhi
17:35 – 17:55	209	Modelling, Simulation and Altitude-Range-Analysis of Quad-copter UAV	Jayesh Barve, Keyurkumar Patel

Session 30: Adaptive Critic Designs for Control

Session Chair: AK Deb, IITKgp

Session Co-Chair: BM Mohan, IITKgp

Time	Paper Id.	Paper Title	Author(s)
16:15 – 16:35	239	Near-Optimal Control of Serial Manipulator with Unknown Dynamic Model	Samrat Dutta, Laxmidhar Behera
16:35 – 16:55	144	Adaptive Optimal Control of Nonlinear Inverted Pendulum System Using Policy Iteration Technique	Lal Bahadur Prasad, Hari Om Gupta, Barjeev Tyagi
16:55 – 17:15	182	Robust Regulation of a Class of Nonlinear Systems Using DR-SNAC	Radhakant Padhi, Shivendra Nath Tiwari, Sandeep K Jada
17:15 – 17:35	215	RLS Estimator State Space Basis for Solution of HJB-Riccati Equation in Approximate Dynamic Programming	Gustavo Andrade Joao Viana da Fonseca Neto Patrcia Helena Moraes Rego Marcio Eduardo Gonsalves
17:35 – 17:55	58	A Reinforcement Learning Algorithm with Evolving Fuzzy Neural Networks	Hitesh Shah, Madan Gopal
17:55 – 18:15	177	Parameter Identification of Flexible Aircraft Using Frequency Domain Output Error Approach	Majeed Mohamed