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Welcome to the Systems & Control Research Group

Systems & Control research group is a new generation field of research that integrates the control theoretical techniques with the systems engineering view point at the Department of Applied Physics, University of Calcutta. The current areas of interest including system identification perspectives, self-tuning, adaptive and predictive control, fuzzy control, and the design and implementation of feedback control systems for regulating different robotic systems including manipulator, mobile and aerial robots. The application of modern optimization and machine learning techniques in various system design is also a prime area of our investigation. More recently, the scope of the group's interests has extended to systems and computational biology. This website aims to be an up-to-date source of information for the systems & control group's progress within these concentrations.

Research areas of Systems & Control Group:

- Adaptive control strategies for robotic systems
- Fractional order modeling and control of robotic systems
- Stable hybrid adaptive fuzzy control strategies for various applications
- Modern optimization techniques based system identifications and parameter estimations
- Vision based mobile robot navigation
- Visual cryptographic schemes for online data transmissions
- Machine learning techniques for bio-medical signal and medical image processing
- Computational framework for gene expression data analysis and disease detection

People

Core Faculty Members

- Kaushik Das Sharma
- Nirmal Murmu

Associate Faculty Members

- Rajarshi Gupta, Department of Applied Physics, University of Calcutta, India
- Sanatan Chattyopadhyay, Department of Electronic Science, University of Calcutta, India
- Pritha Bhattachariya, Department of Environmental Science, University of Calcutta, India

Academic Collaborators

- Amitava Chatterjee, Jadavpur University, India
- Anjan Rakshit, Jadavpur University, India
- Madhubanti Maitra, Jadavpur University, India
- Jayanta K. Chandra, Purulia Govt. Engineering College

- Patrick Siarry, University of Paris, Est-Cretil, France
- Koushik Maharatna, University of Southampton, UK
- Octavian Adrian Postolache, ISCTE-Instituto Universitário de Lisboa, Portugal

Doctoral Research Scholars

- Suryasarathi Das
  Research Area: Cyber Resilient Image Transmission Technique Employing Improved Visual Secret Sharing Schemes

- Subhajit Kar
  Research Area: Intelligent human disease detection and classification techniques from gene level and cell level data sets

- Roshni Maity
  Research Area: L1 adaptive control strategy for SISO and MIMO systems

- Debasish Biswas
  Research Area: Fractional order system design employing non sinusoidal orthogonal functions

- Pubali Chatterjee
  Research Area: Machine learning framework for medical image processing

- Debopoma Kar Roy
  Research Area: Study of harmonic power flow in a multi-bus power system

- Monalisa Sinha Roy
  Research Area: Motion artifact removal strategies for bio-medical signals

- Samiul Islam
  Research Area: Computational intelligence based models for bio-medical signal compression

- Bed Prakash Das
  Research Area: Machine learning based occupancy modelling for smart home applications

- Anirban Dey
  Research Area: Multimodal medical data integration

Postgraduate Research Students

- Anirban Bhatta (2017-19)
- Ankita Muhuri (2017-19)
- Amiya Kumar Roy (2016-18)

- Anupam Paul (2016-18)
- Suranja Das (2015-17)
- Sunil Bhuja (2014-16)
- Premananda Manna (2014-16)
- Mandira Das (2013-15)
- Prantik (2013-15)
- Anirban Kundu (2012-14)
- Pramit Biswas (2012-14)
- Roshni Maiti (2012-14)

Publications

Some Notable Publications

- M. Singha Roy, R. Gupta, J. K. Chandra, K. Das Sharma, and A. Talukdar, "Improving Photoplethysmographic Measurements under Motion Artifacts using Artificial Neural Network for Personal Healthcare," IEEE Transactions on Instrumentation & Measurement, Accepted for publication, 2018.
- D. Biswas, K. Das Sharma, and G. Sarkar, "Stable Adaptive NSOF Domain FOPID Controller for a Class of Non-Linear Systems," IET Control Theory & Applications, available in Online First, 2018.
- S. S. Das, K. Das Sharma, J. N. Bera and J. K. Chandra, "Quantum signal processing-based visual cryptography with unexpanded shares", Journal of Electronic Imaging, SPIE, vol. 24(5), pp-053026-1-053026-18, Sept/Oct 2015.
- S. Kar, K. Das Sharma, and M. Maitra, "Gene Selection from Microarray Gene Expression Data for Classification of Cancer Subgroups Employing PSO and Adaptive K-Nearest Neighborhood Technique" Expert Systems With Applications, (Elsevier Pub.), vol-42, pp-612-627, January 2015.
- Roy and K. Das Sharma "GA and Lyapunov Theory Based Hybrid Adaptive Fuzzy Controller for Nonlinear Systems," International Journal of Electronics (Taylor & Francis Pub.), vol. 120(2), pp-312-325, 2015.
- K. Das Sharma, A. Chatterjee and A. Rakshit, "Harmony search algorithm and Lyapunov theory based hybrid adaptive fuzzy controller for temperature control of air heater system with transport-delay", Applied Soft Computing, (Elsevier Pub.), vol-25, pp-40-50, December 2014.
- T. Chakroborti, K. Das Sharma, and A. Chatterjee "A novel local extrema based gravitational search algorithm and its application in face recognition using one training image per class," Engineering Applications of Artificial Intelligence (Elsevier Pub.), vol-34, pp-13-22, September, 2014.
- K. Das Sharma, A. Chatterjee and A. Rakshit "Harmony search-based hybrid stable adaptive fuzzy tracking controllers for vision-based mobile robot navigation," Machine Vision and Applications (Springer Pub.), voi-25, issue-2, pp.405-419, February 2014.
- K. Das Sharma "Stable Fuzzy Controller Design Employing Group Improvisation Based Harmony Search Algorithm," International Journal of Control, Automation and Systems (Springer Pub.), vol. 11, no. 5, pp.1046-1052, 2013.
- K. Das Sharma, A. Chatterjee and A. Rakshit "A Random Spatial lbest PSO Based Hybrid Strategy for Designing Adaptive Fuzzy Controllers for a Class of Nonlinear Systems" IEEE Transactions on Instrumentation & Measurement, vol-61, no.-6, pp-1605-1612, June, 2012.
- K. Das Sharma, A. Chatterjee and A. Rakshit "A PSO-Lyapunov Hybrid Stable Adaptive Fuzzy Tracking Control Approach for Vision Based Robot Navigation" IEEE Transactions on Instrumentation & Measurement, vol-61, no.-7, pp-1908-1914, July, 2012.
- K. Das Sharma, A. Chatterjee and A. Rakshit "Design of a Hybrid Stable Adaptive Fuzzy Controller Employing Lyapunov Theory and Harmony Search Algorithm," IEEE Transactions on Control System Technology, vol-18, no.-6, pp-1440-1447, November, 2010.
- K. Das Sharma, A. Chatterjee and A. Rakshit "A Hybrid Approach for Design of Stable Adaptive Fuzzy Controllers Employing Lyapunov Theory and Particle Swarm Optimization" IEEE Transactions on Fuzzy Systems, vol-17, no.-2, pp-329-342, April, 2009.

- K. Das Sharma, A. Chatterjee, Patrick Siarry and A. Rakshit "CMA – H∞ Hybrid Design of Robust Stable Adaptive Fuzzy Controllers for Non-Linear Systems," in Proc. of 1 st International Conference on Frontiers in Optimization: Theory and Applications (FOTA-2016), November 2016, Kolkata, India.

- S. Kar, K. Das Sharma and M. Maitra, "A Particle Swarm Optimization Based Gene Identification Technique for Classification of Cancer Subgroups", in Proc. of 2016 2nd International Conference on Control, Instrumentation, Energy and Communication (CIEC16), January 2016, Kolkata, India.
- S. Kar, K. Das Sharma and M. Maitra, "A Comparative Study On Gene Ranking And Classification Methods Using Microarray Gene Expression Profiles", in Proc. of Michael Faraday IET International Summit (MFIIS-2015), September 2015, Kolkata, India.
- S. Kar, K. Das Sharma and M. Maitra, "Diagnostic Prediction of Multi-class Cancer using SVM and Nearest Neighbor Classifier", in Proc. of International Conference on Control, Instrumentation, Energy and Communication (CIEC14), pp.711-715, January 2014, Kolkata, India.
- S. S. Das, K. Das Sharma and J. N. Bera, "A Simple Visual Secret Sharing Scheme Employing Particle Swarm Optimization", in Proc. of International Conference on Control, Instrumentation, Energy and Communication (CIEC14), pp.721-724, January 2014, Kolkata, India.
- K. Das Sharma, Patrick Siarry, A. Chatterjee and A. Rakshit "Nonlinear Parameter Variation of HS Algorithm for Designing Stable Adaptive Fuzzy Controllers," in Proc. of The 11th Biennial International Conference on Artificial Evolution (EA-2013), pp.148-160, October 2013, Bordeaux, France.
- Roy and K. Das Sharma "Gravitational Search Algorithm and Lyapunov Theory based Stable Adaptive Fuzzy Logic Controller," Proc. of 1st International Conference on Computational Intelligence: Modelling, Techniques and Applications (CIMTA- 2013), vol.10, pp.581 –586, Procedia Technology, 2013.
- K. Das Sharma, A. Chatterjee and F. Matsuno "A Lyapunov theory and stochastic optimization based stable adaptive fuzzy control methodology," Proc. of SICE International Conf. on Instrumentation, Control & Information Technology 2008, Japan, pp-1839-1844, August 20-22, 2008.