

Spandan Roy

CONTACT INFORMATION Robotics Research Center (RRC),
International Institute of Information Technology,
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RESEARCH INTERESTS Adaptive-robust control, switched systems, artificial delay-based control,
sliding mode control, control applications to Euler-Lagrange systems, robotics.

EDUCATION **Indian Institute of Technology Delhi (IITD)**, New Delhi, India
Ph.D., Control and Automation, Department of Electrical Engineering,
2014–2018

- Course CGPA¹: 9.75/10
- Thesis Topic: *Adaptive-Robust Control of a Class of Uncertain Euler-Lagrange Systems*
- Advisor: Prof. Indra Narayan Kar

Academy of Scientific and Innovative Research (AcSIR), New Delhi, India
M.Tech, Mechatronics, 2011–2013

- Host Institute: CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI), West Bengal, India
- Course CGPA: 9.86/10
- Topic: *Robust Control of Autonomous Mobile Robots*
- Advisor: Prof. Sambhunath Nandy and Dr. Ranjit Ray

West Bengal University of Technology (WBUT), (presently Maulana Abul Kalam Azad University of Technology), West Bengal, India
B.Tech, Electronics and Communication Engineering, 2007–2011

- Host Institute: Techno India, Salt Lake
- Course CGPA: 9.18/10

RESEARCH EXPERIENCE **Assistant Professor** August 2019 to present
Robotics Research Center,
International Institute of Information Technology Hyderabad (IIIT-H)

Postdoctoral Research Fellow October 2018 to September 2019

¹CGPA: Cumulative Grade Point Average

Delft Center for Systems and Control,
Faculty of Mechanical, maritime and Materials Engineering,
Technische Universiteit Delft (Delft University of Technology (TU Delft))
Supervisors: Prof. Simone Baldi and Dr. Milinko Godjevac

Research Scholar July 2014 to September 2018
Control and Automation, Electrical Engineering Department
Indian Institute of Technology Delhi
Supervisor: Prof. Indra Narayan Kar

Scientist Trainee August 2013 to July 2014
Robotics and Automation,
CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI)
Supervisors: Prof. Sambhunath Nandy and Dr. Ranjit Ray

BOOK/MONOGRAPH

1. **S. Roy** and I. N. Kar, “Adaptive-Robust Control with Limited Knowledge on Systems Dynamics: An Artificial Input Delay Approach and Beyond,” *Springer*, 2020.

BOOK CHAPTER

1. **S. Roy**, S. Basu Roy and I. N. Kar, “Adaptive-Robust Control of Autonomous Underwater Vehicle with Unknown System Dynamics,” *In The Book: ‘Autonomous Underwater Vehicles - Design and Practice’*, *IET*, To Appear.

REFEREED JOURNAL PUBLICATIONS

1. V. Shankaranarayanan and **S. Roy**, “Introducing Switched Adaptive Control for Quadrotors for Vertical Operations,” *Optimal Control Applications and Methods*, 2020.
2. J. Ye, **S. Roy**, M. Godjevac and S. Baldi, “A Switching Control Perspective on the Offshore Construction Scenario of Heavy-Lift Vessels,” *IEEE Transactions on Control Systems Technology*, 2020.
3. T. Tao, **S. Roy** and S. Baldi, “The Issue of Transients in Leakage-based Model Reference Adaptive Control of Switched Linear Systems,” *Nonlinear Analysis: Hybrid Systems*, vol. 36, 2020.
4. **S. Roy**, J. Lee and S. Baldi, “A New Adaptive-robust Design for Time Delay Control under State-dependent Stability Condition,” *IEEE Transactions on Control Systems Technology*, 2020.
5. **S. Roy** and S. Baldi, “Towards Structure-Independent Stabilization for Uncertain Underactuated Euler-Lagrange Systems,” *Automatica*, vol. 113, 2020.

6. **S. Roy**, S. Baldi and L. M. Fridman, “On Adaptive Sliding Mode Control without A Priori Bounded Uncertainty,” *Automatica*, vol. 111, 2020.
7. S. Fari, X. Wang, **S. Roy** and S. Baldi, “Addressing Unmodelled Path-Following Dynamics via Adaptive Vector Field: a UAV Test Case,” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 56, no. 2, pp. 1613–1622, 2020.
8. **S. Roy**, S. Basu Roy, J. Lee and S. Baldi, “Overcoming the Underestimation and Overestimation Problems in Adaptive Sliding Mode Control,” *IEEE/ASME Transactions on Mechatronics*, vol. 24, no. 5, pp. 2031–2039, 2019.
9. M. M. Rayguru, **S. Roy** and I. N. Kar, “Time Scale Redesign Based Saturated Controller Synthesis for a Class of MIMO Nonlinear Systems,” *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, DOI: 10.1109/TSMC.2019.2945841, 2019.
10. **S. Roy** and S. Baldi, “On Reduced-complexity Robust Adaptive Control of Switched Euler-Lagrange Systems,” *Nonlinear Analysis: Hybrid Systems*, vol. 34, pp. 226–237, 2019.
11. N. K. Sharma, **S. Roy** and S. Janardhanan, “New Design Methodology for Adaptive Switching Gain Based Discrete-time Sliding Mode Control,” *International Journal of Control*, DOI: 10.1080/00207179.2019.1632489, 2019.
12. **S. Roy**, A. Patel and I. N. Kar, “Analysis and Design of a Wide-Area Damping Controller for Inter-Area Oscillation With Artificially Induced Time Delay,” *IEEE Transactions on Smart Grid*, vol. 10, no. 4, pp. 3654–3663, 2019.
13. **S. Roy** and S. Baldi, “A Simultaneous Adaptation Law for a Class of Nonlinearly-Parametrized Switched Systems,” *IEEE Control Systems Letters*, vol. 3, no. 3, pp. 487–492, 2019.
14. **S. Roy**, J. Lee and S. Baldi, “A new continuous-time stability perspective of time-delay control: introducing a state-dependent upper bound structure,” *IEEE Control Systems Letters*, vol. 3, no. 2, pp. 475–480, 2019.
15. **S. Roy**, I. N. Kar, J. Lee, N. Tsagarakis and D. G. Caldwell, “Adaptive-robust control of a class of EL systems with parametric variations using artificially delayed input and position feedback,” *IEEE Transactions on Control Systems Technology*, vol. 27, no. 2, pp. 603–615, 2019.

16. N. K. Sharma, **S. Roy**, S. Janardhanan and I. N. Kar, "Adaptive Discrete-time Higher Order Sliding Mode," *IEEE Transactions on Circuits and Systems II: Express Briefs*, vol. 66, no. 4, pp. 612–616, 2019.
17. J. Mukherjee, **S. Roy**, I. N. Kar and S. Mukherjee, "A Double-Layered Artificial Delay-Based Approach for Maneuvering Control of Planar Snake Robots," *ASME Journal of Dynamic Systems, Measurement, and Control*, vol. 141, no. 4, 2019.
18. **S. Roy**, S. Basu Roy and I. N. Kar, "Adaptive-robust control of euler-lagrange systems with linearly parametrizable uncertainty bound," *IEEE Transactions on Control Systems Technology*, vol. 26, no. 5, pp. 1842–1850, 2018.
19. **S. Roy** and I. N. Kar, "Adaptive sliding mode control of a class of nonlinear systems with artificial delay," *Journal of The Franklin Institute*, vol. 354, no. 18, pp. 8156–8179, 2017.
20. **S. Roy**, I. N. Kar, and J. Lee, "Toward position-only time-delayed control for uncertain euler–lagrange systems: experiments on wheeled mobile robots," *IEEE Robotics and Automation Letters*, vol. 2, no. 4, pp. 1925–1932, 2017.
 *the contents of this paper were also selected by *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'17)* Program Committee for presentation at the Conference, under the scheme of 'RAL with IROS option'.
21. **S. Roy**, I. N. Kar, J. Lee, and M. Jin, "Adaptive-robust time-delay control for a class of uncertain euler-lagrange systems," *IEEE Transactions on Industrial Electronics*, vol. 64, no. 9, pp. 7109–7119, 2017.
22. **S. Roy**, S. Nandy, I. N. Kar, R. Ray, and S. N. Shome, "Robust control of nonholonomic wheeled mobile robot with past information: theory and experiment," *Proceedings of the Institution of Mechanical Engineers, Part I: Journal of Systems and Control Engineering*, vol. 231, no. 3, pp. 178–188, 2017.
23. **S. Roy**, and I. N. Kar, "Adaptive robust tracking control of a class of nonlinear systems with input delay," *Nonlinear Dynamics*, vol. 85, no. 2, pp. 1127–1139, 2016.
24. M. Sarkar, S. Nandy, S. R. K. Vadali, **S. Roy**, and S. N. Shome, "Modelling and simulation of a robust energy efficient AUV controller," *Mathematics and Computers in Simulation*, vol. 121, pp. 34–47, 2016.

25. **S. Roy**, S. Nandy, R. Ray, S. R. K. Vadali, and S. N. Shome, “Robust diving and composite path tracking control of an autonomous underwater vehicle,” *International Journal of Offshore and Polar Engineering*, vol. 25, no. 4, pp. 305–313, 2015.
26. **S. Roy**, S. Nandy, R. Ray, and S. N. Shome, “Robust path tracking control of nonholonomic wheeled mobile robot: Experimental validation,” *International Journal of Control, Automation and Systems*, vol. 13, no. 4, pp. 897–905, 2015.
27. **S. Roy**, S. N. Shome, S. Nandy, R. Ray, and V. Kumar, “Trajectory following control of AUV: a robust approach,” *Journal of The Institution of Engineers (India): Series C*, vol. 94, no. 3, pp. 253–265, 2013.

REFEREED
CONFERENCE
PUBLICATIONS

1. X. Wang, **S. Roy**, S. Fari and S. Baldi, “The Problem of Reliable Design of Vector-Field Path Following in the Presence of Uncertain Course Dynamics,” *IFAC World Congress, Berlin, Germany, 2020*.
2. T. Tao, **S. Roy**, S. Yuan and S. Baldi, “Robust Adaptation in Dynamically Switching Load Frequency Control,” *IFAC World Congress, Berlin, Germany, 2020*.
3. **S. Roy** and S. Baldi, “The Role of Uncertainty in Adaptive Control of Switched Euler-Lagrange Systems,” *The 2019 IEEE Conference on Decision and Control (CDC 2019), December 11th-13th, Nice, France, 2019*.
4. J. Ye, **S. Roy**, M. Godjevac and S. Baldi, “Observer-based robust control for dynamic positioning of large-scale heavy lift vessels,” *The 15th IFAC Symposium on Large Scale Complex Systems: Theory and Applications (IFAC LSS 2019)*, Delft, The Netherlands, pp. 138-143, 2019.
5. **S. Roy**, S. Basu Roy and I. N. Kar, “A new design methodology of adaptive sliding mode control for a class of nonlinear systems with state dependent uncertainty bound,” *15th International Workshop on Variable Structure Systems (VSS)*, Graz, Austria, pp. 414-419, 2018.
6. **S. Roy**, and I. N. Kar, “Robust control of uncertain Euler-Lagrange systems with time-varying input delay,” *Advances in Robotics*, New Delhi, India, DOI: 10.1145/3132446.3134880, 2017.
7. **S. Roy**, and I. N. Kar, “Adaptive-robust control of uncertain euler-lagrange systems with past data: a time-delayed approach,” *IEEE International Conference on Robotics and Automation (ICRA)*, Stockholm, Sweden, pp. 5715–5720, 2016.

8. **S. Roy**, and I. N. Kar, “Robust time-delayed control of a class of uncertain nonlinear systems,” *4th IFAC Conference on Advances in Control and Optimization of Dynamical Systems (ACODS)*, Tiruchirappalli, India, pp. 736–741, 2016.
9. **S. Roy**, S. Nandy, R. Ray, and S. N. Shome, “Time delay sliding mode control of nonholonomic wheeled mobile robot: experimental validation,” *IEEE International Conference on Robotics and Automation (ICRA)*, Hong Kong, China, pp. 2886–2892, 2014.
10. **S. Roy**, S. Nandy, S. N. Shome, and R. Ray, “Robust position control of an autonomous underwater vehicle: a comparative study,” *IEEE International Conference on Automation Science and Engineering (CASE)*, Madison, WI, USA, pp. 1002–1007, 2013.

AWARDS

Student Awards — Council of Scientific and Industrial Research (CSIR), India

- High value scholarship from CSIR, India for pursuing M.Tech under the Postgraduate Research Programme in Engineering (PGRPE) at CSIR-CMERI, as Quick Hire Scientist Trainee (QHS-T) from August, 2011 - May, 2013.
- One year extended tenure of QHS-T at CSIR-CMERI based on the performance evaluation from June, 2013 - July 2014, after successful completion of M.Tech with Distinction.

PROFESSIONAL SERVICE

Peer reviewer of the following Journals

- Automatica, since 2019
- IEEE Transactions on Industrial Electronics, since 2015
- Nonlinear Dynamics, since 2015
- IEEE/ASME Transactions on Mechatronics, since 2015
- International Journal of Advanced Robotics Systems, since 2016
- Journal of Systems and Control Engineering, since 2016
- IEEE Transactions on Industrial Applications, since 2017
- IEEE Transactions on Systems, Man, and Cybernetics: Systems, since 2017
- Journal of Robotics, since 2017
- Mechanical Systems and Signal Processing, since 2017
- IET Control Theory and Applications, since 2018
- IEEE Access, since 2018
- IEEE Transactions on Circuits and Systems II: Express Briefs, since 2018

- Optimal Control Methods and Applications, since 2018
- Sensors, since 2018
- Journal of The Franklin Institute, since 2018
- Advances in Mechanical Engineering, since 2018

Peer reviewer of the following Conferences

- American Control Conference (ACC), 2015
- IEEE International Conference on Robotics and Automation (ICRA), 2016
- IEEE International Conference on Automation Science and Engineering (CASE), 2017
- IFAC Conference on Advances in Control and Optimization of Dynamical Systems (ACODS), 2018
- IEEE International Conference on Control, Decision and Information Technologies (CoDIT), 2018
- IEEE International Conference on Robotics and Automation (ICRA), 2019.

Member, Technical Committee

- International Conference on Autonomic and Autonomous Systems (ICAS), since 2018.

PROFESSIONAL
RECOGNITIONS

- Outstanding Reviewer- *Mechanical Systems and Signal Processing (Elsevier)*: March 2018.