Dr. Joyjit Mukherjee

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Dr. JOYJIT MUKHERJEE, Ph.D.

Roboticist & Control System Engineer

About Me: I am currently working as a Postdoctoral Researcher under Prof. Christian Schlette at SDU Robotics, The Maersk Mc-Kinney Moller Institute, University of South Denmark. Previously, I worked as a Research Associate in a JATC-DRDO sponsored project at IIT Delhi under Prof. Shubhendu Bhasin. I have completed my Ph.D under the supervision of Prof. Indra Narayan Kar (EE) and Prof. Sudipto Mukherjee (ME) at the Control and Automation Group, Department of Electrical Engineering, IIT Delhi in September 2019 and was awarded the degree in November 2019. My field of research is "Dynamics and Control of Robotics Systems" on which I am working since July, 2012. I did my B. Tech in Electrical Engineering from NIT Durgapur. Thereafter, I pursued M. Tech at IIEST, Shibpur in Mechatronics & Robotics and did my thesis work at CSIR-CMERI, Durgapur.

My research interests include Robotics, Aerospace systems & Space Robotics, Digital Twins, Human-Robot Interaction, Adaptive-Robust control, Optimal control, Differential Flatness, Quantum Control, AI and ML.

I aim to further increase my technical know-how and hone my skills such that it contributes to the symbiotic growth of the organization and mine.

Education

2013 - 2019, IIT Delhi
Ph.D in Electrical Engineering (Robot Dynamics & Control Systems)
Coursework CGPA: 9.25

2011 - 2013, IIEST Shibpur, Howrah
M.Tech in Robotics & Mechatronics
Percentage: 80.95 %

2006 - 2010, NIT Durgapur
B.Tech in Electrical Engineering
CGPA: 7.83

Projects

October 2020 - Till Date, *Postdoctoral Researcher,* SDU Robotics, The Maersk Mc-Kinney Moller Institute, University of South Denmark.

- Digital-Twins for Robotic Applications

January 2020 - October 2020, *Research Associate,* JATC-DRDO Sponsored Project.

- Design and Control of Soft-Exosuit for assisting a human in Upper-Limb motion
- Execute Human-Robot Interaction (HRI) through Brain-Computer Imaging (BCI)

May 2019 - August 2019, *Project,* Faros Technologies Pvt. Ltd.

- Labview program to acquire and propagate data for a Driving Simulator
- Image Processing based solution for firing and detecting virtual gunshots for a Gun Simulator

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August 2013 - September 2019, *Research Scholar,* Dept. of Electrical Engg., IIT Delhi

Maneuvering of Serpentine Robots: An Adaptive Robust Control Approach
- Adaptive-Robust Control Techniques for trajectory tracking of Planar Snake Robot with Uncertainties
- Mathematical modeling of In-Pipe Snake robot motion
- Differential Flatness based control approach for snake robot

August 2011 - July 2013, *M.Tech Project,* Dept. of Robotics & Automation, CSIR-CMERI Durgapur

Control of Nonholonomic Mobile Robot System Based on Simultaneous Quadratic Stabilization
- Formulated reduced order dynamics of a Wheeled mobile robot
- Applied Simultaneous Quadratic Stabilization to achieve precise point-to-point motion of the robot

August 2009 - July 2010, *B.Tech Project,* Dept. of Electrical Engg., NIT Durgapur

Power System State Estimation
- Formulated an algorithm for estimating the power system states from the erroneous sensor data

Publications

Book
- J. Mukherjee, I.N. Kar and S. Mukherjee, "*Adaptive Robust Control of Planar Snake Robots*", [In Press] Studies in Systems, Decision and Control, Springer, 2021.

Journal
- **J. Mukherjee**, S. Mukherjee and I.N. Kar, "*Sliding mode control of planar snake robot with uncertainty using virtual holonomic constraints*", IEEE Robotics and Automation Letters, vol. 2, no. 2, pp.1077-1084, doi.org/10.1109/LRA.2017.2657892, 2017.
- **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 Transaction on Dynamic Sys. Measurement and Control, vol. 141, pp. 1-10, doi.org/10.1115/1.4042033, 2018.
- A. Banerjee, **J. Mukherjee** and M. Nabi, "*Time-Energy Efficient Guidance Strategy for a Realistic 3D Interceptor: An Adaptive Robust Time-Delayed Control Approach with Input Saturation*", Aerospace Science and Technology, 104, vol. 104, pp. 1-15, doi.org/10.1016/j.ast.2020.106015, 2020.
- A. Banerjee, **J. Mukherjee**, M. Nabi and I.N. Kar, "*An Artificial Delay based Robust Guidance Strategy for an Interceptor with Input Saturation*", ISA Transactions, vol. 109, pp. 34-48, doi.org/10.1016/j.isatra.2020.09.013, 2021.
- R. Sarkar, **J. Mukherjee**, D. Patil and I.N. Kar, "*Artificial Delay Based Robust Tracking of Re-entry Trajectory for Reusable Launch Vehicle*", Advances in Space Research, vol. 67, no. 1, pp. 557-570, doi.org/10.1016/j.asr.2020.10.006, 2021.
- R. Kumar, **J. Mukherjee** and S. Mukherjee, "*A Sliding-Mode Control Algorithm to Enhance In-Hand Motion Capabilities*", ASME Journal of Mechanisms and Robotics, vol. 13, pp. 1-13, , 2021.

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- **J. Mukherjee**, S. Roy, I.N. Kar and S. Mukherjee, *"Maneuvering Control of Planar Snake Robot: An Adaptive Robust Approach with Artificial Time Delay"*, International Journal on Robust Nonlinear Control, pp. 1-18, doi.org/10.1002/rnc.5430, 2021.

Conference
- **J. Mukherjee**, S. Nandy, S. N. Shome, G. Chakraborty and C. S. Kumar, *"Simultaneous Quadratic Stabilization of a Nonholonomic Mobile Robot"*, In Proceedings of IEEE iMac4s, pp. 1-6, 2013, Kerala, India.
- **J. Mukherjee**, I.N. Kar and S. Mukherjee, *"Kinematic control of wheeled mobile robot: An error based differentially flat system approach"*, IEEE INDICON, pp. 1-6, December, 2015, doi.org/10.1109/INDICON.2015.7443561, New Delhi, India.
- **J. Mukherjee**, I.N. Kar and S. Mukherjee, *"Adaptive sliding mode control for head-angle and velocity tracking of planar snake robot"*, IEEE Asian Control Conference (ASCC), pp. 537-542, December, 2017, doi.org/10.1109/ASCC.2017.8287227, Gold Coast, Australia.
- R. Sarkar, **J. Mukherjee**, D. Patel and I. N. Kar, *"Artificial Time Delay based Adaptive Robust Fault Tolerant Control for RLV During Re-entry Phase"*, IEEE Mediterranean Conference on Control and Automation (MED), pp. 56-61, September 2020, doi.org/10.1109/MED48518.2020.9182892, Saint-Raphaël, France.
- R. Kumar, **J. Mukherjee** and S. Mukherjee, *"A Sliding-Mode Control Algorithm to Enhance In-Hand Motion Capabilities"*, ASME International Design Engineering Technical Conferences (IDETC), pp. 1 - 12, November 2020, doi.org/10.1115/DETC2020-22251.

Achievements

2015, Best Paper Award
IEEE Indicon, New Delhi

2013-2018, Ph.D. Scholarship (T.A.)
Ministry of HRD, Govt. of India

2010, GATE Scholarship
Ministry of HRD, Govt. of India

Important Position

Peer Reviewer
- Robotics and Automation Letters
- International Journal of Adaptive Control and Signal Processing
- ASME Journal of Autonomous Vehicles and Systems
- IEEE Transactions on Circuits and Systems
- IEEE Transaction on System, Man and Cybernetics
- Control System Letters & Conference on Decision and Control
- IEEE Indian International Conference (INDICON)
- International Conference on Control, Decision and Information Tech.
- International Symposium on Intelligent Systems Tech. and Applications

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Student Coordinator and Organiser

- Indian Control Conference, IIT Delhi (2019)
- Advances in Robotics, IIT Delhi (2017)
- International Workshop on Autonomous Vehicles & Mobile Robotics, IIT Delhi (2014)
- Seminar Series, Dept. of Electrical Engg., NIT Durgapur (2009)
- Aarohan 2008, Annual Techno-Management Fest, NIT Durgapur (2008)

Software Skills

- Matlab
- Simulink
- Ansys
- Solidworks
- Comsol
- Labview
- Verosim
- C++

References

Prof. Sudipto Mukherjee
Ford Chair Professor,
Dept. of Mechanical Engineering,
Indian Institute of Technology Delhi, New Delhi, INDIA.
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