CHAYAN KUMAR PAUL



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Ph.D. Scholar (PMRF), Control and Automation Group, Department of Electrical Engineering, IIT Delhi.

Under the supervision of Prof. I. N. Kar, my doctoral research focuses on safety and compliance in human–robot interaction (HRI). My work spans fixed-time parameter convergence, adaptive impedance control, and invariance-based control using switched MRAC, along with the development of unknown-input dynamic observers for HRI applications. I have also contributed to collaborative research on adaptive backstepping control and mixed-mode switched systems using contraction theory. Currently, I am pursuing robust MPC-based control strategies to formally guarantee safety in HRI.

Education

2020-2025 **Ph.D. Coursework**, IIT Delhi, CGPA - 9.6/10. (Supervisor- Prof. Indra Narayan Kar)
2015-2019 **B.Tech. in Electrical Engineering**, IIEST Shibpur, CGPA - 8.32/10.

Journals

[1] **C. K. Paul**, I. N. Kar, and S. Janardhanan, "Unknown Input Dynamic Observer for a class of Nonlinear Systems using Contraction Analysis", International Journal of Systems Science, 1–12, 2025. (doi)

[2] **C. K. Paul**, K. Nath, I. N. Kar, D. Efimov, and R. Ushirobira " Robust Fixed-time Model Reference Adaptive Control," submitted to IEEE Transactions in Automatic Control.

[3] **C. K. Paul**, B. S. Dey, and I. N. Kar, "Safety in Admittance Control using Reference Trajectory Shaping", submitted to International Journal of Human-Computer Interaction. (Under Review)

[4] B. S. Dey, **C. K. Paul**, and I. N. Kar, "A Matrix Measure Framework for Incremental Stability of Mixed-Mode Switched Systems", submitted to International Journal of Systems Science. (Under Review)

[5] **C. K. Paul**, K. Nath, and I. N. Kar, " Fixed-time Impedance Control with Parameter Convergence," (Manuscript in preparation).

Conference Proceedings

[1] **C.K. Paul**, B.S. Dey and I.N. Kar, "Safe Human Robot-Interaction using Switched Model Reference Admittance Control", IEEE International Conference on Control, Decision and Information Technologies (CoDiT), Malta, 2024.

[2] **C.K. Paul**, N. Patel, B. S. Dey, and I. N. Kar, "Adaptive Impedance Control : A Contraction Theory Approach",Eighth IFAC International Conference on Advances in Control and Optimization of Dynamical Systems (ACODS), 2024.

[3] N. Patel, **C.K. Paul**, I. N. Kar, and S. Mukherjee, "Finite Time Adaptive Backstepping Control Approach for Quadrotors", Eighth IFAC International Conference on Advances in Control and Optimization of Dynamical Systems (ACODS), 2024.

Project & Internship

August 2018 – June 2019 | **B.Tech. Project, IIEST Shibpur, Howrah, W.B.-711103.**
Final Year Project, Supervisor : Prof. Paramita Chattopadhyay
› Using the Hilbert transform for fault detection in power system equipment with FPGA implementation.

December 2017 | **Research Internship, IIT (BHU), Varanasi, U.P.-221005.**
Supervisor : Prof. Devender Singh
› Implemented to solve the Non-Linear Programming(NLP) and Mixed Integer Non-Linear Programming(MINLP) problems of Optimal Power Flow using General Algebraic Modelling System(GAMS).

May 2017 – July 2017 | **Research Internship, IIEST Shibpur, Howrah, W.B.-711103.**
Supervisor : Prof. Paramita Chattopadhyay

- Comparison among fault analysis of Brushless DC motor using Fourier Transform, Fast Fourier Transform and Wavelet Transform with the conclusion Wavelet Transform giving better results.

Workshops and Trainings

May 2022	Workshop on Healthcare Robotics and Drone Applications, IIT Mandi.
February 2022	Training on Industrial Robot Operation and Programming, conducted by KUKA AKGEC.
May 2018	Industrial Training at Damodar Valley Corporation Andal, W.B.-713321
June 2017	Design of Real-time Clock using MSP430, IIEST Shibpur

Awards

2024	Recommended with commendation by national PMRF review committee.
2022	Received prestigious Prime Minister's Research Fellows (PMRF) award.
2021	Received MHRD Teaching Assistantship for pursuing full-time PhD at IIT Delhi.
2020	Received MHRD Teaching Assistantship for pursuing full-time MS(R) at IIT Delhi.
2019	Selected as Graduate Engineer Trainee in Power Transmission and Distribution (PTD) Department by Larsen and Toubro Limited.

Extracurricular Activities

- Presented our work on Indian Control Conference 2025 at IISc Bengaluru.
- Presented our work on IFAC Joint Symposia on Mechatronics & Robotics, 2025 at Sorbonne University.
- Conferences attended : Learning for Dynamics and Control, 2021 organized by ETH Zurich (Online mode), IHFC Cobotics Workshop Series, IIT Delhi, 2021.
- Conferences attended : 60th Conference on Decision and Control, December, 2021, Austin, Texas (Online mode).
- Conferences attended : 8th International Conference on Advances in Control and Optimization of Dynamical Systems (ACODS), 2024, New Delhi, India.
- Conferences attended : 10th International Conference on Control, Decision and Information Technologies (CoDIT), July, 2024, Valletta, Malta.

Technical Skill

Operating Systems	Windows, Linux.
Programming Languages	Python, MATLAB/Simulink, LaTeX, Optimization tools (YALMIP, CVX), OpenCV, ROS 1.
Software Platforms	Gazebo, PyBullet, NI Multisim, Mathematica.
Hardware Platforms	Quanser Rotary Servo Base Unit (Safe Admittance Control, Fx-time MRAC), Quanser 2 DOF Helicopter (Fx-time Parameter Convergence for EL System).

Teaching assistantship

Dr B R Ambedkar National Institute of Technology Jalandhar (PMRF TAship) March, 2025-July, 2025
Conducted classes on discrete control theory and helped with experiments.

Science for Rural India (PMRF TAship) Sept, 2024-Jan, 2025
Helped class X-XII students with hands-on experiments on AC-DC and Rectifier Circuits.

G.B. Panth (DSEU) (PMRF TAship) March, 2022-July, 2024
Conducted various Labs and classes on basic electrical engineering, basic electronics engineering.

IIT Delhi (Institute TAship) August, 2022-July, 2025
Conducted various Labs and tutorials on basic electrical engineering, control engineering, nonlinear systems and robotics.

References

References will be provided upon request.