

Prateek Priyaranjan Pradhan

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PhD | Aerospace Engineering | IIT Kanpur

Summary

Robotics and Optimization engineer working at the intersection of optimal control, trajectory optimization, robotics, and AI/ML, with applications in autonomous and robotic systems. Experience developing control and optimization algorithms for multi-agent UAV/USV systems and ML-based trajectory optimization for industrial robotic manipulators, including real-robot validation. PhD background in optimal control and optimization, with hands-on experience spanning simulation, system integration, and physical systems.

Technical Skills

Robotics ROS, Gazebo, UAVs, multi-agent systems, UR5/6-DOF & Kuka manipulator control
System & Optimization Optimal control, Trajectory optimization, CVX, CVXPY, Kalman filtering, State estimation, Sensor fusion, Hardware-in-the-loop validation
AI / ML Deep-learning, Learning-based control, Computer vision / image processing
Programming Python, MATLAB Tools: OpenCV, Git, Simulink, $\LaTeX$

Work Experience

- Feb 2026 – present **Postdoctoral Researcher – Inspection Technologies, GE Aerospace, Bangalore, India**
- Designing real-time algorithms for closed-loop industrial imaging and metrology systems, translating control- and estimation-theory principles into deployed production pipelines; contributed to measurable gains in process cycle time and throughput.
 - Contributed to an internal invention disclosure covering a novel control/algorithmic approach for automated inspection (pending further IP proceedings).
 - Collaborated across cross-functional research and business teams to scope, plan and execute technology programmes against defined milestones and cost targets.
- Jul 2025 – **Research Intern – Inspection Technologies, GE Aerospace, Bangalore, India**
- Jan 2026
- Developed signal-processing and data-fusion algorithms for automated inspection systems, improving detection accuracy on real manufacturing data.
 - Integrated algorithm solutions with hardware and instrumentation pipelines, bridging software with system-level validation.
- Sep 2020 – **PhD Research Scholar – Optimal & Distributed Control, IIT Kanpur – Intelligent Guidance & Control Lab, Kanpur, Advisor: Prof. Mangal Kothari, Prof. Ketan Rajawat**
- Jul 2025
- Designed optimal and distributed control laws for multi-agent UAV/USV systems performing circumnavigation and coordinated trajectory tracking; .
 - Developed scalable stochastic and Frank-Wolfe optimisation algorithms for real-time control problems under large constraint sets, intractable by classical solvers (e.g. CVX).
 - Designed communication architectures for distributed control and coordination across large-scale multi-agent teams.
- Aug 2024 **Industry Research Collaboration – Robotic Trajectory Optimisation, Universal Robotics (UR), Odense, Denmark**
- Designed a learning-based trajectory optimisation controller for the UR5 robotic arm using B-spline parameterisation and a fully-connected neural network (FCNN).
 - Validated the control approach on both simulation and real-robot data (RTDE) across a 1–5 kg payload range, bridging optimal control with deployable manipulator control.
- Jul 2019 – **Project Assistant – Autonomous Vehicle Lab, Indian Institute of Science (IISc), Bangalore,**
- Aug 2020 **Advisor: Prof. Ashwini Ratnoo**
- Designed real-time 3D trajectory planning and Kalman filter-based state estimation for multiple quadcopters; hands-on system integration and experimental flight validation.
- May 2018 – **Research Intern – Centre for Mechatronics, Hochschule Bochum, Germany, Advisor: Prof. Markus**
- Jul 2018 **Lemmen**
- Performed system identification and designed classical controllers (PID, LQR) for an under-actuated inverted pendulum; hands-on instrumentation, hardware setup and experimental validation.

Key Projects

- Jan–Jul 2025 **Scalable Stochastic Optimisation under Large Constraint Sets**, *SPiN Lab, IIT Kanpur*
Novel hinge-proximal and Frank-Wolfe stochastic gradient methods for constrained control/optimisation problems intractable by classical solvers (e.g. CVX)
- 2018–2019 **Visual Servo Control of Multi-Link Robot Arm**, *B.Tech Final Year Project, NIT Rourkela*
Designed a vision-based feedback controller for a multi-link manipulator; real-time image-processing pipeline closing the control loop via end-effector camera.
- 2016–2019 **Powertrain System Designer**, *Team Roadrunner – FSAE, NIT Rourkela*
Designed the powertrain system for a Formula SAE race car; hands-on mechanical system design, hardware integration and performance optimisation under strict engineering constraints.

Education

- 2020–2025 **PhD, Aerospace Engineering**, *Indian Institute of Technology, Kanpur*, CGPA: 9.80/10
Thesis: Optimal Control, Trajectory Planning and Communication Architecture for Multi-Agent Autonomous Systems *Advisor*: Prof. Mangal Kothari
- 2015–2019 **B.Tech, Electrical Engineering**, *National Institute of Technology, Rourkela*, CGPA: 8.50/10

Selected Publications & IP

Intellectual Property

- **Invention Disclosure**, GE Aerospace (2026) – AI-based algorithm for industrial CT inspection (internal filing, pending further IP proceedings).

Journal Article

- **P.P. Pradhan**, A. Sen, M. Kothari, “Distributed Optimal Controller for Circumnavigation of Multiple UAVs about a Moving Target,” *IEEE Transactions on Aerospace and Electronic Systems*, 2025.
- V. Rajoria, **P.P. Pradhan**, K. Rajawat, “Hinge-Proximal Stochastic Gradient Methods for Convex Optimisation with Functional Constraints,” *IEEE Transactions on Signal Processing*, 2026.
- **P.P. Pradhan**, K. Rajawat, M. Kothari, “Communication-Constrained Energy-Optimal Trajectory Generation for Quadrotor UAVs in Urban Environments,” *IEEE Transactions on Aerospace and Electronic Systems*, 2026.
- M. Samshad, **P.P. Pradhan**, K. Rajawat, M. Kothari, “A Cross Protocol for Large-Scale Multi-UAV Communication,” *Journal of Aerospace Information Systems* (under review).
- V. Rajoria, **P.P. Pradhan**, K. Rajawat, “Stochastic Frank-Wolfe with Smooth Functional Constraints,” *IEEE Transactions on Signal Processing* (under review).

Conference Papers

- **P.P. Pradhan**, A. Sen, M. Kothari, K. Rajawat, “Distributed Optimisation under a Weight-Unbalanced Digraph,” *ICARA 2023*, NYU Abu Dhabi. **[Best Presentation Award]**
- **P.P. Pradhan**, V. Rajoria, K. Rajawat, “Scalable Ensemble-Based Energy-Efficient Unmanned Surface Vehicle Trajectory Optimisation,” *AAMAS 2026*
- **P.P. Pradhan**, A. Sen, M. Kothari, “Decentralized Optimisation for Circumnavigation Around a Stationary Target,” *AIAA SciTech 2024*.
- **P.P. Pradhan**, H. Sandhu, K. Rajawat, M. Kothari, “Optimal Trajectory Generation and Tracking for UAV with Non-convex Obstacles and Constrained Energy,” *AIAA SciTech 2024*.
- U.K. Sahu, **P.P. Pradhan**, A. Mishra, B. Subudhi, “Vision-Based Tip Position Control of a Single-Link Robot Manipulator,” *SUSCOM 2019*.

Awards & Recognition

- **Prime-Minister’s Research Fellowship (PMRF)**, 2021–2025, Fellowship based on impact of doctoral research
- **Best Presentation Award**, ICARA 2023, NYU Abu Dhabi
- **Academic Excellence Award** (Perfect SGPA), IIT Kanpur, 2020–21
- **Selected Participant**, Elite International Summer School 2024, SDU Denmark (25 from 40 countries)