Falak Mandali

Email: falak8112.mandali@gmail.com **LinkedIn:** https://www.linkedin.com/in/fmandali/
Cell Phone: +17653894460 **Portfolio:** https://fmandali82.github.io/portfolioApp/

Hands-on experience in robotics and aerospace has shaped my passion for system modeling, optimization, and control design. I bring a strong foundation in bridging theoretical methods with hardware implementation, and I am eager to expand my skills in both high- and low-level control system design, while supporting cross-team integration and system development.

EDUCATION:

PURDUE UNIVERSITY, West Lafayette, Indiana
MS in Mechanical Engineering ***Dec 2026***
BS in Aeronautical and Astronautical Engineering ***Dec 2024***

RESEARCH EXPERIENCE:

PURDUE UNIVERSITY, West Lafayette, Indiana
TERRAIN ROBOTICS ADVANCED CONTROL AND EXPERIMENTATION (TRACE) LAB
Graduate Research Assistant ***Jan 2025 – present***

- Implemented an invariant extended Kalman filter (InEKF) on a bipedal humanoid robot for state estimation to facilitate robot control on a moving surface.
- Spearheaded perception module design for ball tracking using cameras and robot localization using motion capture technology, to provide observation with an accuracy of 2 cm for RL-driven locomotion control of a bipedal humanoid robot.

FLIGHT DYNAMICS & CONTROLS LABORATORY
Undergraduate Research Assistant ***Jan 2024 – May 2024***

- Created a Gaussian mixture model (GMM) of a vehicle using the Expectation-Maximization (EM) algorithm to optimize its path while considering vehicle and physical constraints.
- Showed that a weighted EM algorithm is better at path optimization by underweighting undesired paths

JAIN RESEARCH LABORATORY
Undergraduate Research Assistant ***Sept 2022 – Dec 2022***
Summer Undergraduate Research Assistant ***May 2022 – Aug 2022***

- Demonstrated effectiveness of the control co-design process in simultaneous optimization of geometric design of a phase-changing thermal energy storage (TES) device and its controller embedded in a thermal management system (TMS).
- Validated robustness of the proposed TES design with 52% higher phase-changing material by volume, in its ability to mitigate a transient heat load for longer without needing to be recharged.
- ITherm 2023 Best Poster Award in the System Level Thermal Management Track by IEEE.

WORK EXPERIENCE:

MAGLEV AERO Inc., Boston, Massachusetts
Aeromechanical Engineering Intern ***Jan 2023 – Aug 2023***

- Contributed to formulation of flight dynamics and simulation of an eVTOL in MATLAB.
- Optimized 13 design parameters of the propulsion system to reduce power consumption and weight.
- Established a connection between MATLAB and AWS to reduce optimization computation time to 2 hrs.
- Conducted scalability analysis of propulsion system to understand its performance with increasing size from a test hub of 600 mm diameter to the proposed full-scale hub of 2000 mm diameter.
- Supported workspace and test stand setup, performing electrical wiring and manufacturing tasks.

PUBLICATIONS:

F. Mandali, M. Shanks and N. Jain, "Control Co-Design of a Thermal Management System with Integrated Latent Thermal Energy Storage and a Logic-based Controller," 2023 22nd IEEE ITherm, Orlando, FL, USA, 2023, pp. 1-10, doi: 10.1109/ITherm55368.2023.10177617.

RELEVANT COURSEWORK:

AAE 451: AIRCRAFT DESIGN-BUILD-FLY ***Aug 2024 – Dec 2024***

- Collaborated with a team of 7 to design a single propeller radio-controlled aircraft.
- Performed initial sizing and weight estimation of design concept.
- Analyzed the stability and aerodynamics performance to design the wing and tail using XFLR5.
- Designed the control surfaces and the corresponding servos required to move the control surfaces.

AAE 590 ECL: ESTIMATION & CONTROLS LABORATORY ***Aug 2024 – Dec 2024***

- Designed classical control laws (PID) for rover guidance systems such as speed and heading.
- Applied numerical optimization (A*) algorithms for real-time path planning and obstacle avoidance.
- Implemented consensus formation control on a system of 3 autonomous cars to form a triangle.
- Controlled the lighter-than-air blimp using LQR to track a moving target pointing.

ECET 279: EMBEDDED DIGITAL SYSTEMS ***Aug 2024 – Dec 2024***

- Learnt embedded system architecture with applications of advanced programmable counter/timer arrays, analog interfaces, serial communication, and interrupt handling.
- Practised on custom I/O board with applications of DC motor, servo motor, stepper motor, and LED display using AT mega2560 microcontroller.

AAE 568: OPTIMAL CONTROL & ESTIMATION ***Jan 2024 – May 2024***

- Learnt optimal estimation and control methods such as dynamic programming, Kalman filter, etc.
- Collaborated with a team of 3 to simulate real-time trajectory optimization for a UAV
- Designed a non-linear predictive controller (NMPC) to optimize input to UAV guidance systems, and an extended Kalman filter (EKF) to predict the next state using simulated satellite data.

TEACHING EXPERIENCE:

SCHOOL OF MECHANICAL ENGINEERING, Purdue University

Graduate Teaching Assistant ***Jan 2025 – present***

- Directed lab sessions focused on implementing classical control theory and analyzing stability of servos, wind tunnels, and wheeled robots using Simulink. (ME 37500)
- Coached students on theoretical concepts of particle kinematics and kinetics. (ME 27400)
- Facilitated course instruction by organizing help sessions, grading assignments, and validating course material.

SCHOOL OF AERONAUTICS & ASTRONAUTICS, Purdue University

Undergraduate Teaching Assistant ***Jan 2024 – May 2024***

Grader ***Aug 2024 – Dec 2024***

- Assisted students in understanding concepts of classical control theory in AAE 364.
- Organized help sessions, verified/created HW solutions, graded HWs/exams, and proctored exams.

BECHTEL INNOVATION & DESIGN CENTER, Purdue University

Peer Mentor ***Jan 2022 – Dec 2023***

- Guided students in creating computer-aided design (CAD) and manufacturing (CAM) for their project.
- Train students on CNC and manual machines for manufacturing metal components.

COMMUNITY ENGAGEMENT:

OFFICE OF FUTURE ENGINEERS, Purdue University

Undergraduate Peer Counsellor ***May 2024 – Dec 2024***

- Connecting with prospective students and families by providing comprehensive information on Purdue University's engineering program and sharing perspectives as a current undergraduate student.
- Host and present daily engineering information sessions to 140+ prospective families.

SCHOOL OF AERONAUTICS & ASTRONAUTICS, Purdue University

Undergraduate Ambassador ***Aug 2022 – Dec 2024***

- Introducing the AAE curriculum and industry to first-year engineering students to assist with identifying their career interests.

ENGINEERING PROJECTS IN COMMUNITY SERVICE, Purdue University

Undergraduate Project Manager and Archivist ***Aug 2020 – May 2021***

- Managed 3 design projects by organizing weekly meetings, coordinating resources, consulting with advisors, performing documentation, and ensuring strong communication with community partners.

AWARDS:

- **ITherm 2023 Best Poster Award** in the System Level Thermal Management Track by IEEE.
- **Dorian DeMaio Scholarship** by School of Aeronautics & Astronautics at Purdue University.
- **Warren G Koerner Scholarship** by School of Aeronautics & Astronautics at Purdue University.
- **AAE Undergrad General Scholarship** by School of Aeronautics & Astronautics at Purdue University.
- **Outstanding Second-Year Student** by School of Aeronautics and Astronautics at Purdue University.
- **Outstanding First-Year Student & Community Engagement** by EPICS at Purdue University.
- **Dean's List & Semester Honors** by Purdue University every semester.

SKILLS:

Python	C / C++	Arduino	MATLAB	Simulink	ROS2	LaTex
MoCap	Ubuntu OS	AWS EC2	Docker	GitHub	Slack	CAD & CAM