

VISHNU VIJAY

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EDUCATION

Purdue University – West Lafayette, IN

Doctor of Philosophy in Aeronautics and Astronautics

Dec 2028

Concentrations: Autonomy and Control, Aerospace Systems | Advisor: Professor Inseok Hwang

GPA: 4.00/4.00

Master of Science in Aeronautics and Astronautics

Dec 2025

Concentrations: Autonomy and Control, Machine Learning | Advisor: Professor Inseok Hwang

GPA: 4.00/4.00

Bachelor of Science in Aeronautical and Astronautical Engineering

May 2023

Concentration: Autonomy and Control | Minors: Computer Science, Mathematics, History

GPA: 3.88/4.00

Honors College | Graduated with College of Engineering Distinction

RESEARCH EXPERIENCE

Graduate Researcher (Flight Dynamics & Control/ Hybrid Systems Lab)

May 2023 – Present

Topic: *Landing Tethered Kite System using Optimal Control*

Jun 2026 – Present

- Design optimal control framework to enable safe landings of a tethered kite system used for wind energy harvesting.
- Apply learning-based Koopman theory to accelerate computation of control actions for real-time implementation.
- Validate control framework at various model fidelity levels before deploying onto real tethered kite system.

Topic: *Data-Driven Reachability Analysis under Unknown Disturbances*

May 2023 – Present

- Investigate real-time data-driven reachability analysis to complex nonlinear cyber-physical systems (e.g., drones, boats).
- Apply new data-driven reachability algorithms to real systems for safety verification under unknown disturbances.
- Leverage machine learning and Koopman theory to simplify model identification for systems under changed dynamics.

Topic: *Byzantine-Resilient Distributed ADMM (Optimization Algorithm)*

Oct 2024 – Dec 2025

- Construct an innovative distributed optimization algorithm with the ADMM framework resilient to Byzantine cyberattacks.
- Provide mathematical guarantees for the novel Byzantine-resilient ADMM architecture to facilitate real-world application.
- Create software plug-ins for emulation of Byzantine attack on drone swarm in high-fidelity ROS-Gazebo simulator.

Topic: *Multi-Robot Integrity Monitor against Cyberattacks and Faults*

Feb 2024 – Jan 2025

- Designed an advanced distributed algorithm to reconstruct localization error from cyberattacks for multi-robot systems.
- Analyzed integrity monitoring algorithm's convergence behaviors under various attacks using ROS-Gazebo simulator.
- Validated the algorithm on heterogeneous system using lab's custom mixed-reality testbed for cybersecurity analysis.

Undergraduate Researcher (Flight Dynamics & Control/ Hybrid Systems Lab)

Jun 2022 – May 2023

- Explored applications of using ROS and Gazebo for SiTL simulation of model-free reinforcement learning algorithm.
- Implemented model-free optimal control algorithm (LQR) with custom SiTL UAS simulator to collect and visualize data.
- Developed foundational research experience through literature reviews, designing numerical simulations, and data analysis.

LEADERSHIP EXPERIENCE

Graduate Teaching Assistant (AAE 568: Applied Optimal Control)

Jan 2026 – May 2026

- Devise new homework assignments for AAE 568 course, ensuring alignment with course objective and realistic applications.
- Lead biweekly lab sessions for AAE 364L course, guiding 18 students through complex control systems experiments.
- Evaluate student work by grading assignments and providing constructive feedback to enhance understanding (both courses).

Graduate Teaching Assistant (AAE 568: Optimal Control; AAE 364L: Controls Lab)

Jan 2025 – May 2025

- Devise new homework assignments for AAE 568 course, ensuring alignment with course objective and realistic applications.
- Lead biweekly lab sessions for AAE 364L course, guiding 18 students through complex control systems experiments.
- Evaluate student work by grading assignments and providing constructive feedback to enhance understanding (both courses).

Research Mentorship

August 2024 – Present

- Guide an undergraduate student in refining research questions and understanding cybersecurity challenges for drone swarms.
- Teach the student about the use of high-fidelity simulation architectures (e.g., ROS, Gazebo) for algorithm verification.
- Enhance student understanding of robotics and control concepts by simplifying complex topics and fostering critical thinking.

Graduate Teaching Assistant (ENGR 161/162: Honors Intro to Physics and Engineering)

August 2023 – May 2024

- Instructed 250+ first-year engineers about fundamental design concepts through collaborative problem-solving sessions.
- Provided input on lecture material and in-class activities during course instructional time with professors.
- Maintained and troubleshooted course project equipment, including Raspberry Pi-based robotics equipment.

TECHNICAL SKILLS

Programming: Python; MATLAB/ Simulink; C/C++; Java | Simulation: Gazebo Simulator; Robot Operating System

ASSOCIATIONS

American Institute of Aeronautics and Astronautics

October 2020 – Present

Institute of Electrical and Electronics Engineers

November 2024 – Present

PUBLICATIONS

Journal Papers

1. **Vijay, V.**, Pant, K.A., Cho, M., Guo, Y., and Hwang, I., “Dynamically Weighted ADMM for Byzantine Resilience,” *IEEE Control Systems Letters*, Vol. 9, 2025, pp. 2591 – 2596.
2. **Vijay, V.**, Pant, K.A., Cho, M., Guo, Y., Goppert, J.M., and Hwang, I., “Range-Based Multi-Robot Integrity Monitoring For Cyberattacks and Faults: An Anchor-Free Approach,” *IEEE Robotics and Automation Letters*, Vol. 10, No. 3, 2025, pp. 2630 – 2637.
3. Pant, K.A., **Vijay, V.**, Cho, M., and Hwang, I., “On Enhancing Structural Resilience of Multirobot Coverage Control with Bearing Rigidity,” *IEEE Transactions on Control of Network Systems*, Vol. 13, No. 2, 2026, pp. 648 – 660.
4. Park, H., **Vijay, V.**, and Hwang, I., “Data-driven Reachability Analysis for Nonlinear Systems,” *IEEE Control Systems Letters*, Vol. 8, 2024, pp. 2661 – 2666.

Conference Papers

1. Cho, M., Hwang, S., Wu, G., **Vijay, V.**, Byeon, S., and Hwang, I., “C-Rate Constrained Path Planning for Battery Pack Health Management in Long-Term eVTOL Operations,” *AIAA SCITECH 2026 Forum*, 2026.
2. Guo, Y., Pant, K.A., Hwang, S., Vijay, V., Goppert, J.M., and Hwang, I., “RESiLIENT: A Neural-Symbolic Resilient Threat-Response Framework for Large-Scale Hierarchical Swarms,” *Proceedings of 1st GENZERO Workshop*, 2024, pp. 3 – 11.
3. Choi, J., Cho, M., Park, H., **Vijay, V.**, and Hwang, I., “On The Controllability Preservation of Koopman Bilinear Surrogate Model,” *IEEE 63rd Conference on Decision and Control (CDC)*, 2024, pp. 3457 – 3462.

PRESENTATIONS

1. **Vijay, V.**, Pant, K.A., Cho, M., Guo, Y., “Multi-Robot Integrity Monitoring Against Cyberattacks and Faults Using Inter-Robot Range Measurements,” *Midwest Workshop on Control and Game Theory*, Apr. 2025, Urbana, IN, USA.
2. **Vijay, V.**, Pant, K.A., Cho, M., Guo, Y., “Multi-Robot Integrity Monitor For Cyberattacks and Faults,” *ERAU-NASA-NSF Aerospace Cybersecurity Workshop*, Apr. 2025, Prescott, AZ, USA.
3. **Vijay, V.**, Pant, K.A., Cho, M., Guo, Y., Goppert, J.M., and Hwang, I., “Range-Based Multi-Robot Integrity Monitoring For Cyberattacks and Faults: An Anchor-Free Approach,” *2025 CERIAS Cybersecurity Symposium*, Apr. 2025, West Lafayette, IN, USA.