

# Abhishek Cauligi

Assistant Professor – Johns Hopkins University

Email: [cauligi@jhu.edu](mailto:cauligi@jhu.edu)  
Website: [acauligi.github.io](https://github.com/acauligi)  
Office: Hackerman 117

## Education

Ph.D. Aeronautics & Astronautics, Stanford University, 2021.

Advisor: Marco Pavone

NASA Space Technology Research Fellow

M.S. Aeronautics & Astronautics, Stanford University, 2018.

B.S. Aerospace Engineering, University of Michigan – Ann Arbor, 2016.

## Research Interests

My research interests span the problems of planning and control for complex robotic systems. I am particularly interested in leveraging recent advances in nonlinear optimization, machine learning, and control theory towards:

1. Enabling safe and robust decision making for robotic systems under uncertainty.
2. Combining learning-based methods with classical model-based control techniques.
3. Advancing the state-of-the-art in spacecraft robotic system development.

## Professional Experience

**Johns Hopkins University** – Assistant Professor, Dept. of Mechanical Engineering, July 2025 – *present*.

**NASA Jet Propulsion Lab** – Robotic Surface Mobility Group. Robotics Technologist, March 2022 – April 2025.

**Mitsubishi Electric Research Labs** – Control & Autonomy Group. Research Intern, June – Sep. 2021.

**NASA Jet Propulsion Lab** – Robotic Aerial Mobility Group. NSTRF Visiting Technologist, June – Sep. 2019.

**NASA Ames Research Center** – Intelligent Robotics Group. NSTRF Visiting Technologist, Summers 2017 & 2018.

**SpaceX** – GNC Mission Design Group. Guidance, Navigation, & Controls Intern, May – Aug. 2016.

**Planetary Resources**. Attitude Dynamics & Controls Intern, Jan. – July 2015.

## Honors and Awards

IEEE Robotics and Automation Magazine Best Paper Award, 2023.

NASA Space Technology Research Fellowship, 2016 – 2020.

NSF Graduate Research Fellowship Honorable Mention, 2016.

Univ. of Michigan College of Engineering's Scholarship of Honor (largest offered merit scholarship), 2012 – 2016.

The Boeing Company Endowed Scholarship, 2013 – 2014.

Univ. of Michigan William J. Branstrom Freshman Prize (top 5% of class), 2012 – 2013.

## Teaching

Instructor, EN.530.626: Trajectory Design for Space Systems, Fall 2025.

## Academic Service

### *PhD. Committees*

Carmine Buonagura, Politecnico di Milano (advised by Prof. Francesco Topputo)	2025
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Julia Briden, MIT Aero/Astro (advised by Prof. Richard Linares)	2024
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### *Mentoring*

Kevin Fontana, ETH Zurich	2025
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Federico Lozano, University of Malaga	2025
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Kazuya Echigo, University of Washington	2023–2025
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Tiberiu-Ioan Szatmari, Technical University of Denmark	2023–2024
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Julia Briden, MIT	2022–2024
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### *Reviewing*

AIAA Journal of Guidance, Control, & Dynamics (JGCD)

Conference on Robot Learning (CoRL)

IEEE Conference on Decision & Control (CDC)

International Journal of Robotics Research (IJRR)

IEEE International Conference on Intelligent Robots and Systems (IROS)

International Symposium on Robotics Research (ISRR)

IEEE Transactions on Robotics (T-RO)

IEEE Robotics and Automation Letters (RA-L)

IEEE Robotics & Automation Magazine (RAM)

Distributed Autonomous Robotic Systems (DARS)

## Press Coverage

1. Jennifer Kite-Powell, This Gecko-Inspired Robotic Gripper Could Help Clean Up Space Junk. *Forbes*. May 20, 2021.
2. Allison Gasparini, Stanford ‘gecko gripper’ tested on the International Space Station. *Stanford News*. May 20, 2021.
3. Gianine Figliozzi, Sticking Around: Astrobbee tests gecko-inspired adhesives in space. *NASA Ames newsletter*. May 18, 2021.
4. Ingrid Fadelli, A gecko-adhesive gripper for the Astrobbee free-flying robot. *Tech Xplore*. Oct. 20, 2020.

## Academic Publications & Presentations

### Under Review

- [U1] S. Banerjee, **A. Cauligi**, and M. Pavone. “Deep Learning Warm Starts for Trajectory Optimization on the International Space Station”. In: *IEEE Int. Conf. on Space Robotics*. 2025.
- [U2] **A. Cauligi\***, K. Albee\*, J.-P. de la Croix, and R. Brockers. “CRESCENT: Collision-Free Highly-Constrained Trajectory Optimization for Driving on the Moon”. In: *IEEE Transactions on Field Robotics* (2025).
- [U3] F. Lozano-Cuadra, B. Soret, M. S. Net, **A. Cauligi**, and F. Rossi. “Learning Decentralized Routing Policies via Graph Attention-based Multi-Agent Reinforcement Learning in Lunar Delay-Tolerant Networks”. In: *IEEE Int. Conf. on Space Robotics*. 2025.

### Journal Articles

- [J1] J. Briden, C. Choi, K. S. Yun, R. Linares, and **A. Cauligi**. “Constraint-Informed Learning for Warm Starting Trajectory Optimization”. In: *AIAA Journal of Guidance, Control, and Dynamics* (2025).
- [J2] J. Briden, T. Gurga, B. Johnson, **A. Cauligi**, and R. Linares. “Transformer-based Tight Constraint Prediction for Efficient Powered Descent Guidance”. In: *AIAA Journal of Guidance, Control, and Dynamics* 48.5 (2025).
- [J3] K. Echigo, **A. Cauligi**, S. Bandyopadhyay, D. Scharf, G. Lantoine, B. Açıkmeşe, and I. Nesnas. “Principled Stochastic Trajectory Planning for Asteroid Reconnaissance”. In: *AIAA Journal of Guidance, Control, and Dynamics* (2025).
- [J4] D. Atha, M. R. Swan, **A. Cauligi**, A. Bettens, E. Goh, D. Kogan, L. Matthies, and M. Ono. “ShadowNav: Autonomous Global Localization for Lunar Navigation in Darkness”. In: *IEEE Transactions on Field Robotics* (2024).
- [J5] **A. Cauligi**, P. Culbertson, E. Schmerling, M. Schwager, B. Stellato, and M. Pavone. “CoCo: Online Mixed-Integer Control via Supervised Learning”. In: *IEEE Robotics and Automation Letters* 7.2 (2022), pp. 1447–1454.
- [J6] T. G. Chen\*, **A. Cauligi\***, S. A. Suresh, M. Pavone, and M. R. Cutkosky. “Testing Gecko-Inspired Adhesives with Astrobbee Aboard the ISS”. In: *IEEE Robotics and Automation Magazine* 29.3 (2022), pp. 24–33. Winner of IEEE RAM Best Paper Award for 2023.

## Conference Papers

- [C1] J. Briden, T. Gurga, B. Johnson, **A. Cauligi**, and R. Linares. "Tight Constraint Prediction of Six-Degree-of-Freedom Transformer-based Powered Descent Guidance". In: *AIAA Scitech Forum*. 2025.
- [C2] J. Briden, B. Johnson, R. Linares, and **A. Cauligi**. "Diffusion Policies for Generative Modeling of Spacecraft Trajectories". In: *AIAA Scitech Forum*. 2025.
- [C3] K. Echigo, **A. Cauligi**, S. Bandyopadhyay, D. Scharf, G. Lantoine, B. Açıkmeşe, and I. Nesnas. "Autonomy in the Real-World: Autonomous Trajectory Planning for Asteroid Reconnaissance via Stochastic Optimization". In: *AIAA Scitech Forum*. 2025.
- [C5] J. Briden, T. Gurga, B. Johnson, **A. Cauligi**, and R. Linares. "Improving Computational Efficiency for Powered Descent Guidance via Transformer-based Tight Constraint Prediction". In: *AIAA Scitech Forum*. 2024. **Winner of 2024 AIAA GNC Graduate Student Paper Competition**.
- [C6] J.-P. de la Croix, F. Rossi, R. Brockers, D. Aguilar, K. Albee, E. Boroson, **A. Cauligi**, J. Delaune, et al. "Multi-Agent Autonomy for Space Exploration on the CADRE Lunar Technology Demonstration Mission". In: *IEEE Aerospace Conference*. 2024.
- [C7] K. Echigo, **A. Cauligi**, and B. Açıkmeşe. "Expected Time-Optimal Control: a Particle MPC-based Approach via Sequential Convex Programming". In: *Proc. IEEE Conf. on Decision and Control*. 2024.
- [C8] **A. Cauligi\***, M. R. Swan\*, M. Ono, S. Daftary, J. Elliott, L. Matthies, and D. Atha. "ShadowNav: Crater-Based Localization for Nighttime and Permanently Shadowed Region Lunar Navigation". In: *IEEE Aerospace Conference*. 2023.
- [C9] **A. Cauligi**, A. Chakrabarty, S. Di Cairano, and R. Quirynen. "PRISM: Recurrent Neural Networks and Presolve Methods for Fast Mixed-integer Optimal Control". In: *Learning for Dynamics & Control*. 2022.
- [C10] **A. Cauligi\***, T. Chen\*, S. A. Suresh, M. Dille, R. G. Ruiz, A. M. Vargas, M. Pavone, and M. R. Cutkosky. "Design and Development of a Gecko-Adhesive Gripper for the Astrobee Free-Flying Robot". In: *Int. Symp. on Artificial Intelligence, Robotics and Automation in Space*. 2020.
- [C11] **A. Cauligi\***, P. Culbertson\*, B. Stellato, D. Bertsimas, M. Schwager, and M. Pavone. "Learning Mixed-Integer Convex Optimization Strategies for Robot Planning and Control". In: *Proc. IEEE Conf. on Decision and Control*. 2020.
- [C12] R. Bonalli, A. Bylard, **A. Cauligi**, T. Lew, and M. Pavone. "Trajectory Optimization on Manifolds: A Theoretically-Guaranteed Embedded Sequential Convex Programming Approach". In: *Robotics: Science and Systems*. 2019.
- [C13] R. Bonalli, **A. Cauligi**, A. Bylard, and M. Pavone. "GuSTO: Guaranteed Sequential Trajectory Optimization via Sequential Convex Programming". In: *Proc. IEEE Conf. on Robotics and Automation*. 2019.

## Invited Talks &amp; Posters

- [I1] *Enabling Long-Range Autonomy for Future Spacecraft Missions*. At USC-MHI Cyber-Physical Systems Seminar. Oct. 2022.
- [I2] *Gecko-Inspired Perching Gripper for the Astrobee Free-Flying Robot*. At NASA Space Technology Mission Directorate (STMD) Program Review. May 2021.
- [I3] *CoCo: Learning Strategies for Online Mixed-Integer Control*. At Bay Area Machine Learning Symposium. Oct. 2020.
- [I4] *Safe Learning for Spacecraft Trajectory Optimization and Control*. At Robotic Technology for In-Space Assembly Workshop (ICRA), Montreal, Canada. May 2019.

- [I5] *Trajectory Optimization for Free-Flying Robots: Sequential Convex Programming-Based Approach*. At NASA Tech Day on the Hill, Washington, D.C. Dec. 2019.
- [I6] *GuSTO: Guaranteed Sequential Trajectory Optimization via Sequential Convex Programming*. At NASA Space Technology Mission Directorate (STMD) Autonomy Workshop, Pittsburgh, PA. Oct. 2018.