Abhishek Cauligi

Assistant Professor – Johns Hopkins University

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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 (Stanford), Fall 2025.

Academic Service

PhD. Committees

Carmine Buonagura, Politecnico di Milano (advised by Prof. Francesco Topputo) 2025

Julia Briden, MIT Aero/Astro (advised by Prof. Richard Linares) 2024

Mentoring

Kevin Fontana, ETH Zurich 2025

Federico Lozano, University of Malaga 2025

Kazuya Echigo, University of Washington 2023–2025

Tiberiu-Ioan Szatmari, Technical University of Denmark 2023–2024

Julia Briden, MIT 2022–2024

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: Astrobee tests gecko-inspired adhesives in space. NASA Ames newsletter. May 18, 2021.
4. Ingrid Fadelli, A gecko-adhesive gripper for the Astrobee free-flying robot. Tech Xplore. Oct. 20, 2020.

Academic Publications & Presentations

Under Review

[U0] 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.

[U1] **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).

[U0] 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).

[J0] 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).

[J3] 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).

[J4] **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.

[J5] T. G. Chen*, **A. Cauligi***, S. A. Suresh, M. Pavone, and M. R. Cutkosky. "Testing Gecko-Inspired Adhesives with Astrobee 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.

[C4] T.-I. Szatmari and **A. Cauligi**. "Federated Multi-Agent Mapping for Planetary Exploration". In: *IEEE/RSJ Int. Conf. on Intelligent Robots & Systems*. 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. Daftry, 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 & 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.