Abhishek Cauligi

Assistant Professor – Johns Hopkins University

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Education

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

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. Investigating the intersection and connections between optimal control and reinforcement learning.
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 – Robotics Technologist, Robotic Surface Mobility Group. March 2022 – April 2025.

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

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

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

SpaceX – Guidance, Navigation, & Controls Intern, GNC Mission Design Group. 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.

Advising & Mentoring

Current PhD. Students

Sriram Kodey — Fall 2025 onwards.
PhD topic: Foundation models for semantically safe optimal control.

Patrick Schwartz (NSF GRFP recipient) — Fall 2025 onwards.
PhD topic: Hypernetworks for fast satellite attitude control.

Current Masters Students

Brian Chen (Robotics) — Summer 2025 onwards.

Hoon Jeong (Data Science) — Fall 2025 onwards.

Rahul Nunna (Robotics) — Fall 2025 onwards.

Current Undergraduate Students

Sam Lihn (MechE) — Fall 2025 onwards.

Jeongwon Moon (EE) — Spring 2026 onwards.

Erin Ventrudo (MechE) — Summer 2025 onwards.

Casey Shi (MechE) — Summer 2025 onwards.

Catelin Smith (Computer Engineering) — Fall 2025 onwards.

Past Masters Students

Rahul Kalpana Anwardeen (Robotics) — Fall 2025.

External Student 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

Academic Service

Professional Activities

Associate Editor, IEEE Robotics and Automation Letters — September 2025 onwards.

Organized Workshops and Tutorials

Co-Organizer, Space Robotics Workshop, IEEE Int. Conf. on Robotics & Automation, Vienna, Austria, June 2026.

International Program Committee Member, IEEE Int. Conf. on Space Robotics (iSpaRo), Sendai, Japan, December 2025.

Co-Organizer, Space Robotics Workshop, Robotics: Science and Symposium, Los Angeles, California, June 2025.

PhD. Committees

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

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

External Reviewer for Conferences, Journals, and Grant Panels

Aerospace Engineering

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

AIAA Journal of Aerospace Information Systems (JAIS)

Robotics

Conference on Robot Learning (CoRL)

Distributed Autonomous Robotic Systems (DARS)

IEEE Conference on Decision & Control (CDC)

International Journal of Robotics Research (IJRR)

IEEE International Conference on Intelligent Robots and Systems (IROS)

IEEE Transactions on Robotics (T-RO)

IEEE Robotics and Automation Letters (RA-L)

IEEE Robotics & Automation Magazine (RAM)

International Symposium on Robotics Research (ISRR)

Teaching

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

Press Coverage

1. Jill Wu, AI advances robot navigation on the International Space Station. Stanford News. December 3, 2025.
2. Jennifer Kite-Powell, This Gecko-Inspired Robotic Gripper Could Help Clean Up Space Junk. Forbes. May 20, 2021.
3. Allison Gasparini, Stanford 'gecko gripper' tested on the International Space Station. Stanford News. May 20, 2021.
4. Gianine Figliozzi, Sticking Around: Astrobee tests gecko-inspired adhesives in space. NASA Ames newsletter. May 18, 2021.
5. Ingrid Fadelli, A gecko-adhesive gripper for the Astrobee free-flying robot. Tech Xplore. Oct. 20, 2020.

Academic Publications & Presentations

Contribution key: Grad Student, Postdoc in Prof. Cauligi's group. * denotes equal contribution.

Under Review

[U1] F. Lozano-Cuadra, B. Soret, M. S. Net, A. **Cauligi**, and F. Rossi, "Decentralized graph attention-based multi-agent reinforcement learning for communications in autonomous lunar rover swarms," *IEEE Journal on Selected Areas in Communication*, 2026.

Journal Articles

[J1] J. Briden, C. Choi, K. S. Yun, R. Linares, and A. **Cauligi**, "Constraint-informed learning for warm starting trajectory optimization," *AIAA Journal of Guidance, Control, and Dynamics*, vol. 48, no. 10, 2025. arXiv 2312.14336.

[J2] J. Briden, T. Gurga, B. Johnson, A. **Cauligi**, and R. Linares, "Transformer-based tight constraint prediction for efficient powered descent guidance," *AIAA Journal of Guidance, Control, and Dynamics*, vol. 48, no. 5, 2025.

[J3] A. **Cauligi***, K. Albee*, J.-P. de la Croix, and R. Brockers, "CRESCENT: Collision-free highly-constrained trajectory optimization for driving on the moon," *IEEE Transactions on Field Robotics*, 2025.

[J4] K. Echigo, A. **Cauligi**, S. Bandyopadhyay, D. Scharf, G. Lantoine, B. Açıkmeşe, and I. Nesnas, "Principled stochastic trajectory planning for asteroid reconnaissance," *AIAA Journal of Guidance, Control, and Dynamics*, 2025.

[J5] 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," *IEEE Transactions on Field Robotics*, 2024. arXiv 2405.01673.

[J6] A. **Cauligi**, P. Culbertson, E. Schmerling, M. Schwager, B. Stellato, and M. Pavone, "CoCo: Online mixed-integer control via supervised learning," *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 1447–1454, 2022. arXiv 2107.08143.

[J7] T. G. Chen*, A. **Cauligi***, S. A. Suresh, M. Pavone, and M. R. Cutkosky, "Testing gecko-inspired adhesives with Astrobee aboard the ISS," *IEEE Robotics and Automation Magazine*, vol. 29, no. 3, pp. 24–33, 2022, **Winner of IEEE RAM Best Paper Award for 2023**.

Conference Papers

[C1] T.-I. Szatmari and A. **Cauligi**, "Federated multi-agent mapping for planetary exploration," in *IEEE Int. Conf. on Artificial Intelligence*, 2026. arXiv 2404.02289.

[C2] 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. arXiv 2505.05588.

[C3] 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. arXiv 2501.00930.

[C4] J. Briden, B. Johnson, R. Linares, and A. **Cauligi**, "Diffusion policies for generative modeling of spacecraft trajectories," in *AIAA Scitech Forum*, 2025. arXiv 2501.00915.

[C5] 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. arXiv 2412.06816.

[C6] 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. arXiv 2510.20436.

[C7] 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. arXiv 2311.05135, **Winner of 2024 AIAA GNC Graduate Student Paper Competition**.

[C8] 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.

[C9] 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. arXiv 2404.16269.

[C10] 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. arXiv 2301.04630.

[C11] 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.

[C12] 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. arXiv 2009.09151.

[C13] 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. arXiv 2004.03736.

[C14] 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. arXiv 1905.07654.

[C15] 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. arXiv 1903.00155.

Invited Talks & Posters

[I1] *Bridging optimal control and machine learning for spaceflight*, With Mission Design, Guidance, & Navigation Group, Applied Physics Lab., Nov. 2025.

[I2] *Driving on the Moon: Autonomy for unstructured environments*, With Robotics & Autonomy Group, Applied Physics Lab., Aug. 2025.

[I3] *Space autonomy in the big data era*, At Mitsubishi Electric Research Lab., Aug. 2025.

[I4] *Enabling long-range autonomy for future spacecraft missions*, At USC-MHI Cyber-Physical Systems Seminar., Oct. 2022.

[I5] *Gecko-inspired perching gripper for the Astrobee free-flying robot*, At NASA Space Technology Mission Directorate (STMD) Program Review., May 2021.

[I6] *Coco: Learning strategies for online mixed-integer control*, At Bay Area Machine Learning Symposium., Oct. 2020.

[I7] *Safe learning for spacecraft trajectory optimization and control*, At Robotic Technology for In-Space Assembly Workshop (ICRA), Montreal, Canada., May 2019.

[I8] *Trajectory optimization for free-flying robots: Sequential convex programming-based approach*, At NASA Tech Day on the Hill, Washington, D.C., Dec. 2019.

[I9] *GuSTO: Guaranteed sequential trajectory optimization via sequential convex programming*, At NASA Space Technology Mission Directorate (STMD) Autonomy Workshop, Pittsburgh, PA., Oct. 2018.