# Abhishek Cauligi

Robotics Technologist – NASA Jet Propulsion Lab

## 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.
Advisor: Brian Gilchrist

## Research Interests

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

1. Enabling safe planning and decision-making for robotic systems.

2. Infusing data-driven approaches into robot optimal control and reinforcement learning.

3. Advancing the state-of-the-art in spacecraft robotic system development.

## Professional Experience

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

**Mitsubishi Electric Research Labs** – Control & Autonomy Group. Research Intern, June – Sep. 2021.
Mentor: Rien Quirynen, *Boston, MA*

**NASA Jet Propulsion Lab** – Robotic Aerial Mobility Group. NSTRF Visiting Technologist, June – Sep. 2019.
Mentor: Ali Agha, *Pasadena, CA*

**NASA Ames Research Center** – Intelligent Robotics Group. NSTRF Visiting Technologist, Summers 2017 & 2018.
Mentors: Brian Coltin & Trey Smith, *Sunnyvale, CA*

**SpaceX** – GNC Mission Design Group. Guidance, Navigation, & Controls Intern, May – Aug. 2016.
Mentor: John Stedl, *Hawthorne, CA*

**Planetary Resources**. Attitude Dynamics & Controls Intern, Jan. – July 2015.
Mentors: Brian Douglas & Hannah Goldberg, *Redmond, WA*

# 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

Teaching Assistant, AA 274B: Principles of Robot Autonomy II (Stanford), Winter 2021.

Teaching Assistant, AA 274A: Principles of Robot Autonomy I (Stanford), Autumn 2020.

Instructor, AI4ALL/SAILORS Robotics Camp (Stanford), Summer 2018.

# Academic Service

*PhD. Committees*

Julia Briden, MIT Aero/Astro (advised by Prof. Richard Linares) 2022–2024

*Mentoring*

Kazuya Echigo, University of Washington 2023–2024

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

Julia Briden, MIT 2022–2024

*Reviewing*

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)

Distributed Autonomous Robotic Systems (DARS)

# Academic Publications & Presentations

## Under Review

[U1] 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* (2024).

[U2] 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* (2024).

[U3] K. Echigo, **A. Cauligi**, S. Bandyopadhyay, D. Scharf, G. Lantoine, B. Açıkmeşe, and I. Nesnas. "HARP: Hierarchical Asteroid Reconnaissance Planner via Stochastic Optimization". In: *AIAA Journal of Guidance, Control, and Dynamics* (2024).

[U4] T.-I. Szatmari and **A. Cauligi**. "Federated Multi-Agent Mapping for Planetary Exploration". In: *Int. Symp. on Artificial Intelligence, Robotics and Automation in Space*. 2024.

## Journal Articles

[J1] 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).

[J2] **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.

[J3] 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] R. Brockers, **A. Cauligi**, K. Albee, R. Hewitt, J. Delaune, P. Proença, and J.-P. de la Croix. "How to Drive on the Moon with a Miniature Rover: CADRE Surface Mobility". In: *IEEE Aerospace Conference*. 2025.

[C2] 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.

[C3] 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**.

[C4] 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.

[C5] 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.

[C6] **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.

[C7] **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.

[C8]   **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.

[C9]   **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.

[C10]  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.

[C11]  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.

Workshop Papers

[W1]   **A. Cauligi**, P. Culbertson, M. Schwager, B. Stellato, and M. Pavone. "CoCo: Learning Strategies for Online Mixed-Integer Control". In: *Conf. on Neural Information Processing Systems - Learning Meets Combinatorial Algorithms Workshop*. 2022.

[W2]   **A. Cauligi**, A. Bylard, R. Bonalli, and M. Pavone. "A Sequential Convex Programming Approach for Free-Flying Robot Trajectory Generation". In: *Int. Symp. on Artificial Intelligence, Robotics and Automation in Space*. 2018.

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.