Kevin Tracy

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Education

Carnegie Mellon University — **Pittsburgh, PA**
Ph.D. Robotics, GPA 4.14/4 — *2020-Present*
Advisor: Zac Manchester

Stanford University — **Stanford, CA**
M.S. Mechanical Engineering, GPA 4.05/4 — *2018-2020*
Advisor: Zac Manchester

Rice University — **Houston, TX**
B.S. Mechanical Engineering, GPA 3.91/4 — *2014-2018*

Research Experience

Carnegie Mellon University — **Pittsburgh, PA**
Researcher, Robotic Exploration Laboratory — *Sep 2020–Present*
- Developing optimization-based motion planning and control algorithms.

Stanford University — **Stanford, CA**
Researcher, Robotic Exploration Laboratory — *Jan 2018–Aug 2020*
- Trajectory optimization for low-thrust orbital manuevers and flexible-body attitude control.

Professional Experience

Space Exploration Technologies (SpaceX) — **Hawthorne, CA**
Associate Engineer: Guidance, Navigation, and Control — *May 2021–Aug 2021*
- Implemented a novel closed-form solar array occlusion prediction algorithm
- Wrote a primal-dual interior point solver for quadratic programs in C++
- Developed reaction wheel allocation algorithms using convex optimization

Astranis Space Technologies — **San Francisco, CA**
Guidance, Navigation, and Control Intern — *Jan 2020–Mar 2020*
- Built high-fidelity orbital simulation environment from scratch in Julia
- Implemented fuel-optimal low-thrust trajectory methods for orbit-raising
- Designed orbital relocation algorithm for moving between GEO slots
- Developed novel attitude control algorithms using convex optimization

Lockheed Martin Space Systems — **Sunnyvale, CA**
Guidance, Navigation, and Control Intern — *July 2019–Sep 2019*
- Worked in GNC group for DOD Secret hypersonic and counter-hypersonic efforts
- Designed hardware-in-the-loop test setup for Multiple Object Kill Vehicle (MOKV)
- Contributed to 6-DOF hypersonic missile simulation tools
- Published a paper internally on attitude parameterization conventions at LM Space

Maxar Technologies (Formerly Space Systems/Loral) — **Palo Alto, CA**
Spacecraft Systems Intern — *May 2016–Sep 2018*
- Completed three internships in the spacecraft systems engineering organization
- Created subsystem models for attitude control, solar array, and electric power subsystem sizing in MATLAB for Monte Carlo optimization of spacecraft architecture
- Redesigned equipment list system for bus subsystems and provided relevant training for engineers

Teaching Experience

Carnegie Mellon University — **Pittsburgh, PA**
Teaching Assistant, 16745: Optimal Control and Reinforcement Learning — *Spring 2022, 2023*
Teaching Assistant, 16715: Advanced Robot Dynamics and Simulation — *Fall 2021*

Stanford University — **Stanford, CA**
Teaching Assistant, AA273: State Estimation and Filtering for Robotic Perception — *Spring 2020*
Teaching Assistant, ENGR205: Introduction to Control Design Techniques — *Fall 2019*

Rice University — **Houston, TX**
Teaching Assistant, ENGI120: Introduction to Engineering Design — *Fall 2016, 2017*
Teaching Assistant, STAT305: Statistics for Biosciences — *Fall 2015*

Awards

Best Paper (Avionics and Electronics for Space Applications)
IEEE Aerospace Conference — *2022*
"Ultra-Fine Pointing for Nanosatellite Telescopes With Actuated Booms"

Best Student Paper Finalist
IEEE Robotics and Automation Society — *2021*
"Planning with Attitude"

Publications

Journal Papers

1. B. E. Jackson, K. Tracy, and Z. Manchester, "Planning With Attitude," en, *IEEE Robotics and Automation Letters*, 2021.
2. E. S. Douglas, K. Tracy, and Z. Manchester, "Practical Limits on Nanosatellite Telescope Pointing: The Impact of Disturbances and Photon Noise," en, *Frontiers in Astronomy and Space Sciences*, vol. 8, Aug. 2021.

Preprints

3. K. Tracy, *A Square-Root Kalman Filter Using Only QR Decompositions*, Aug. 2022. arXiv: 2208.06452 [cs, eess].
4. K. Tracy, T. A. Howell, and Z. Manchester, *DiffPills: Differentiable Collision Detection for Capsules and Padded Polygons*, Jul. 2022. arXiv: 2207.00202 [cs].

Conference Papers

5. K. Tracy, T. A. Howell, and Z. Manchester, "Differentiable Collision Detection for a Set of Convex Primitives," in *2023 IEEE International Conference on Robotics and Automation (ICRA)*, London, England, May 31, 2023.
6. K. Tracy, G. Falcone, and Z. Manchester, "Robust Entry Guidance with Atmospheric Adaptation," in *AIAA SciTech Forum and Exposition*, National Harbor, Maryland, Jan. 2023.
7. B. E. Jackson, J. H. Lee, K. Tracy, and Z. Manchester, "Data-Efficient Model Learning for Control with Jacobian-Regularized Dynamic-Mode Decomposition," in *6th Annual Conference on Robot Learning*, Dec. 2022.
8. T. A. Howell, K. Tracy, K. Le Cleac'h, and Z. Manchester, "CALIPSO: A Differentiable Solver for Trajectory Optimization with Conic and Complementarity Constraints," in *The International Symposium on Robotics Research*, Geneva, Switzerland, Sep. 2022. arXiv: 2205.09255 [cs, eess].
9. M. Holliday, K. Tracy, Z. Manchester, and A. Nguyen, "The V-R3x Mission: Towards Autonomous Networking and Navigation for CubeSat Swarms," in *4S Symposium*, Vilamoura, Portugal, May 2022.
10. K. Tracy and Z. Manchester, "CPEG: A Convex Predictor-corrector Entry Guidance Algorithm," in *IEEE Aerospace Conference*, Big Sky, MT, USA, Mar. 2022.
11. K. Tracy, Z. Manchester, and E. Douglas, "Ultra-Fine Pointing for Nanosatellite Telescopes With Actuated Booms," in *IEEE Aerospace Conference*, Big Sky, MT, USA, Mar. 2022.
12. B. E. Jackson, T. Punnoose, D. Neamati, K. Tracy, R. Jitosho, and Z. Manchester, "ALTRO-C: A Fast Solver for Conic Model-Predictive Control," in *2021 IEEE International Conference on Robotics and Automation (ICRA)*, Xi'an, China, May 31, 2021.
13. K. Tracy and Z. Manchester, "Low-Thrust Trajectory Optimization Using the Kustaanheimo-Stiefel Transformation," in *AAS/AIAA Space Flight Mechanics Meeting*, Charlotte, NC, Jan. 31, 2021.
14. K. Tracy and Z. Manchester, "Model-Predictive Attitude Control for Flexible Spacecraft During Thruster Firings," in *AAS/AIAA Astrodynamics Specialist Conference*, Lake Tahoe, CA, Aug. 9, 2020.