

Kevin Tracy

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Education

Carnegie Mellon University

Ph.D. Robotics, GPA 4.14/4

Advisor: Zac Manchester,

Thesis: "Differentiable Convex Modeling for Robotic Planning and Control"

Pittsburgh, PA

2020-Present

Stanford University

M.S. Mechanical Engineering, GPA 4.05/4

Advisor: Zac Manchester

Stanford, CA

2018-2020

Rice University

B.S. Mechanical Engineering, GPA 3.91/4

Houston, TX

2014-2018

Professional Experience

[Google] Intrinsic

PhD Resident

- Working with Stefan Schaal (Intrinsic), Yuval Tassa, and Tom Erez (DeepMind)
- Focusing on developing derivative-free trajectory optimization methods for contact systems
- Developed a method for sim2real learning for contact-rich assembly tasks like connector insertion

Mountain View, CA

June 2023–Present

SpaceX

Associate Engineer: Guidance, Navigation, and Control

- 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

Hawthorne, CA

May 2021–Aug 2021

Astranis

Guidance, Navigation, and Control Intern

- 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

San Francisco, CA

Jan 2020–Mar 2020

Lockheed Martin Space Systems

Guidance, Navigation, and Control Intern

- 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)
- Published a paper internally on attitude parameterization conventions at LM Space

Sunnyvale, CA

July 2019–Sep 2019

Maxar Technologies

Spacecraft Systems Intern

- 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

Palo Alto, CA

May 2016–Sep 2018

Teaching Experience

Carnegie Mellon University

Teaching Assistant, 16745: Optimal Control and Reinforcement Learning

Teaching Assistant, 16715: Advanced Robot Dynamics and Simulation

Pittsburgh, PA

Spring 2022, 2023, 2024

Fall 2021

Stanford University

Teaching Assistant, AA273: State Estimation and Filtering for Robotic Perception

Teaching Assistant, ENGR205: Introduction to Control Design Techniques

Stanford, CA

Spring 2020

Fall 2019

Rice University

Teaching Assistant, ENGI120: Introduction to Engineering Design

Teaching Assistant, STAT305: Statistics for Biosciences

Houston, TX

Fall 2016, 2017

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 and Z. Manchester, *On the differentiability of the primal-dual interior-point method*, 2024. arXiv: 2406.11749 [math.OA].
4. K. Tracy, Z. Manchester, A. Jain, K. Go, S. Schaal, T. Erez, and Y. Tassa, *Efficient online learning of contact force models for connector insertion*, 2023. eprint: arXiv:2312.09190.
5. K. Tracy, *A Square-Root Kalman Filter Using Only QR Decompositions*, Aug. 2022. arXiv: 2208.06452 [cs, eess].
6. 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

7. A. L. Bishop, J. Z. Zhang, S. Gurumurthy, K. Tracy, and Z. Manchester, "Relu-qp: A gpu-accelerated quadratic programming solver for model-predictive control," in *2024 IEEE International Conference on Robotics and Automation (ICRA)*, Yokohama, Japan, May 31, 2024.
8. K. Tracy and Z. Manchester, "Convex quasi-dynamic simulation of rigid point clouds with torsional friction," in *2023 IROS Workshop on Leveraging Models for Contact-Rich Manipulation*, Detroit, Michigan, Oct. 1, 2023.
9. 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.
10. K. Tracy, G. Falcone, and Z. Manchester, "Robust Entry Guidance with Atmospheric Adaptation," in *AIAA SciTech Forum and Exposition*, National Harbor, Maryland, Jan. 2023.
11. 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.
12. 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].
13. 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.
14. K. Tracy and Z. Manchester, "CPEG: A Convex Predictor-corrector Entry Guidance Algorithm," in *IEEE Aerospace Conference*, Big Sky, MT, USA, Mar. 2022.
15. 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.
16. B. E. Jackson, T. Punnoose, D. Neamati, K. Tracy, R. Jitosh, 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.
17. 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.
18. 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.