Zhong Zhang

Personal info

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Personal Statement

I am a Ph.D. candidate in the School of Aerospace Engineering at Tsinghua University, deeply interested in the confluence of Astrodynamics and artificial intelligence. My primary research revolves around trajectory optimization, optimal control of spacecraft, and the scheduling of autonomous space systems. It's the intersection of these domains—leveraging heuristic algorithms and machine learning techniques—that I find especially intriguing, evident in its applications to challenges such as space debris removal and asteroid exploration.

Up to now, I have published many papers in top journals such as Journal of Guidance, Control, and Dynamics and IEEE Transactions on Aerospace and Electronic Systems. And I led a team to win the 11th edition of the Global Trajectory Optimization Competition (GTOC 11) in 2021.

Among the notable projects I've undertaken are:

- Optimal strategies for large-scale space mission design via heuristic algorithms.
- Data-driven methods for improved spacecraft trajectory optimization.
- Robust and fast neural policy for spacecraft guidance.

Education

Tsinghua University, Ph.D. Candidate
Supervisor: Prof. Junfeng Li
Co-Supervisor: Prof. Hexi Baoyin August 2019 - Present
Lab of Astrodynamics, Major in Aerospace Engineering

- Honors:
  National Scholarship for Graduate Student, China(2022);
  Research Exploration Scholarship, Tsinghua(2022);
  Future scholar scholarship, Tsinghua(2019)

Tsinghua University, Undergraduate Student August 2015 - July 2019
Bachelor of Engineering, Major in Aerospace Engineering

- Honors:
  Outstanding Graduate, Tsinghua(2019);
  National Scholarship for Undergraduate Student, China(2017);
  National Encouragement Scholarship, China(2016, 2018);
  Academic Excellence Scholarship, Tsinghua(2017, 2018)

Publications

- **Zhong Zhang**, Nan Zhang, Fanghua Jiang, Hexi Baoyin, and Junfeng Li. 2023. "Global Trajectory Optimization of Multi-Spacecraft Successive Rendezvous Using Multi-Tree Search". Journal of Guidance, Control, and Dynamics. (Accepted)
- **Zhong, Zhang**, Nan Zhang, Yifei Jiao, Hexi Baoyin, and Junfeng Li. 2021. "Multi-Tree Search for Multi-Satellite Responsiveness Scheduling Considering Orbital Maneuvering." IEEE Transactions on Aerospace and Electronic Systems. https://doi.org/10.1109/TAES.2021.3129723.
- **Zhong, Zhang**, Nan Zhang, Xiang Guo, Di Wu, Xuan Xie, Jinyuan Li, and Jia Yang. n.d. 2022. "GTOC 11: Results from Tsinghua University and Shanghai Institute of Satellite Engineering." Acta Astronautica. https://doi.org/10.1016/j.actaastro.2022.06.028.
- **Zhong, Zhang**, Zhibo E, Lixia Huang, Junfeng Li. "Semi-analytical algorithm for computing satellite-area target visibility." Journal of Tsinghua University(Science and Technology). https://doi.org/10.16511/j.cnki.qhdxxb.2021.26.020
- **Zhong Zhang**, Nan Zhang, Xiang Guo, Di Wu, n.d. 2023. "Sustainable Asteroid Mining: on the design of GTOC12 problem and summary of the results". Astrodynamics. (Submitted)
- **Zhong Zhang**, Xiang Guo, Di Wu, Hexi Baoyin, and Junfeng Li. 2023. "Global fuel optimum in multi-flyby trajectory optimization with a prescribed sequence". Journal of Guidance, Control, and Dynamics. (Preparing to Submit)
- Zhang Nan, **Zhong Zhang**, and Hexi Baoyin. 2021. "Timeline Club: An Optimization Algorithm for Solving Multiple Debris Removal Missions of the Time-Dependent Traveling Salesman Problem Model." Astrodynamics. https://doi.org/10.1007/s42064-021-0107-z.
- Zhang Nan, Shiyu Chen, **Zhong Zhang**, and Hexi Baoyin. 2022. "A Two-Stage Dynamic-Assignment Optimization Method for Multispacecraft Debris Removal." Journal of Guidance, Control, and Dynamics. https://doi.org/10.2514/1.G006602.
- Yang Jia, **Zhong Zhang**, and Fanghua Jia. 2022. "Low-Energy Transfer Design of Heliocentric Formation Using Lunar Swingby on the Example of LISA." Aerospace. https://doi.org/10.3390/aerospace10010018.
- Zhang Nan, **Zhong Zhang**, and Hexi Baoyin. 2023. "Multi-Trajectory Combination for Multiple Ground Target Observation by Maneuvering On-Orbit Satellites." IEEE Transactions on Aerospace and Electronic Systems. (Accepted)

Research Experience

12th Global Trajectory Optimisation Competition 2023 (June. - July.)
(Organizer)

- Responsible for designing the problem
- Winner: **NASA's Jet Propulsion Laboratory.**

11th Global Trajectory Optimisation Competition 2021 (Oct. - Nov.)
(First Place, team leader)

- Led the team to obtain a final score of 8,443 points.
(Video demo at https://www.bilibili.com/video/BV1yS4y197pP)

- Proposed greedy-like algorithm for global asteroid assignment, achieving 95% efficiency and better than the second team by 5%.
- Other competitors, such as ESA's Advanced Concepts Team, University of Texas at Austin, etc.

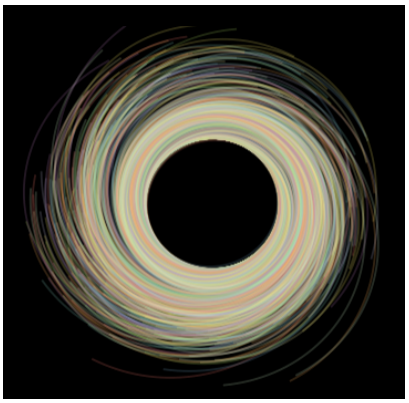

Figure 1: All the asteroid low-thrust trajectories of our winning solution, credited by ESA's Advanced Concepts Team

Deep reinforcement learning on air combat strategy 2021 (Jun. - Aug.)
(Internship)

- Achieved 100% of dodging medium-range air-to-air missiles in DCS (an online air combat game on the Steam platform); over 90% win rate in 1 vs. 1 aerial gun combat.

Figure 2: DCS Scene

Ornithopter and tilt-rotor aircraft design 2018 Jun. - 2021 Aug.
(Project, team member)

- Controller design, both achieve stable flying

Figure 3: Tiltrotor aircraft