Yunan Wang

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RESEARCH STATEMENT

My research interest focuses on **robotic motion planning based on optimal control and optimization**. I have seven peer-reviewed publications as the first author, including two **full papers** in *IEEE TAC*. I used to (1) develop **special theoretical frameworks** based on system structure analysis and develop **optimal algorithms** with high efficiency and numerical stability; (2) formulate a real-world problem into optimization and solve it by **sequential convex programming**.

My proudest theoretical contribution is deriving the first time-optimal snap-limited trajectory with box constraints and discovering chattering phenomena in the problem, which challenges a prevalent conception on the time-optimality of S-shaped trajectories. Some of my works achieve applications in the industry, such as optimization-based feedrate scheduling.

EDUCATION

Tsinghua University   Beijing, China
- Ph.D. Student in Mechanical Engineering (Supervisor: Prof. Chuxiong Hu)   Aug. 2022 – Present
- **Research Interests**: Optimal Control, Motion Planning, Optimization

Tsinghua University   Beijing, China
- First Bachelor's Degree in Mechanical Engineering (GPA: 3.87/4.00, **Rank: 1/103**)   Aug. 2018 – Jul. 2022
- Second Bachelor's Degree in Mathematics (GPA: 3.84/4.00)

AWARDS

Top Grade Scholarship (**The highest honor for students in Tsinghua University, TOP 0.3%**)   Dec. 2021
NSFC Grant on Doctoral Student Basic Research Project (**TOP 0.6%**)   Jan. 2025
National Scholarship for Doctoral Students (TOP 3%) and Undergraduate Students (TOP 2%)   2024, 2021 & 2019
Gold Award (**Sole**) in Chinese "Hengxing Cup" Graduation Design Competition (**Rank: 1/1002**)   Jun. 2022
First Prize (National 2nd Place) in Chinese Mathematics Competition (Non-Math Major Category)   Mar. 2021
First Prize (**Sole**), **Future Scholar Fellowship** of Tsinghua University (TOP 1%)   Jun. 2022
Best Conference Paper Finalist in *IEEE ICARM*   Jul. 2022
Outstanding Graduation Design of Beijing and Tsinghua University (TOP 1%)   Jun. 2022
Outstanding Graduate of Beijing and Tsinghua University (TOP 3%)   Jun. 2022

SLECTED PUBLICATIONS

[1] **Y. Wang**, C. Hu, Z. Li, et al. "Time-optimal control for high-order chain-of-integrators systems with full state constraints and arbitrary terminal states." *IEEE Trans. on Automatic Control*, 70(3): 1499-1514, 2025. (**Full paper**)

[2] **Y. Wang**, C. Hu, Z. Li, et al. "Chattering phenomena in time-optimal control for high-order chain-of-integrator systems with full state constraints." *IEEE Trans. on Automatic Control*, 70(8): 5365-5380, 2025. (**Full paper**)

[3] **Y. Wang**, C. Hu, Y. Lin, et al. "A novel state-centric necessary condition for time-optimal control of controllable linear systems based on augmented switching laws.", 2025. (Conditionally accepted as a **full paper** in *IEEE TAC*)

[4] **Y. Wang**, C. Hu, Z. Wang, et al. "Optimization-based non-equidistant toolpath planning for robotic additive manufacturing with non-underfill orientation." *Robotics and Computer-Integrated Manufacturing*, 84: 102599, 2025.

[5] **Y. Wang**, C. Hu, Z. Li, et al. "On the consistency of path smoothing and trajectory planning in CNC machining: a surface-centric evaluation." *Robotics and Computer-Integrated Manufacturing*, 92: 102873, 2025.

[6] **Y. Wang**, C. Hu, J. Yu, et al. "Jerk-limited oscillation-free feedrate scheduling under non-stationary boundary conditions." in *IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, Hangzhou, China, 2025.

[7] **Y. Wang**, J. Wang, Y. Li, et al. "Learning latent object-centric representations for visual-based robot manipulation." in *IEEE International Conference on Advanced Robotics and Mechatronics*, Guilin, China, 2022.

[8] **Y. Wang**, C. Hu, Z. Wang, et al. "Slice extension for high-quality hybrid additive-subtractive manufacturing." in *49th Annual Conference of the IEEE Industrial Electronics Society*, Singapore, 2023.

[9] Z. Li, C. Hu, **Y. Wang**, et al. "Safe reinforcement learning with dual robustness." *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 46(12): 10876-10890, 2024. (Contribution: some theoretical derivations)