

FU ZE

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EDUCATION

Shanghai Jiao Tong University (SJTU)

Shanghai, China

Master of Mechanical Engineering (GPA: 3.84/4.00; Rank: top 3%)

2021.09-2024.06

- Scholarships: National Scholarship for Graduate Students
- Core Modules: Matrix Theory, Computational Methods, Data Mining, Modern Control Theory, Intelligent Control, Advanced Mechanical Dynamics, Advanced Kinematics

Xi'an Jiao Tong University (XJTU)

Xi'an, China

Bachelor of Mechanical Engineering (GPA: 4.06/4.3; Rank: 1/212)

2017.09-2021.07

- Selected in the International Elite Programme
- Scholarships: Baogang Scholarship, HIWIN Outstanding Student Scholarship (top 0.1%)
- Core Modules: Advanced Mathematics, Linear Algebra, Advanced Programming, Electronic and Electrical Technology, Microcomputer Principles and Interface Technology

MAIN PUBLICATIONS & PATENTS

- [1] **Fu, Z.**, Wen, L., Cai, P., Fu, D., et al. (2023). TrafficMCTS: A Closed-Loop Traffic Flow Generation Framework with Group-Based Monte Carlo Tree Search. *Journal: Transportation Research Part C*.
- [2] **Fu, Z.**, Xu, H., Li, Y., & Guo, W. (2022). Design of a Novel Wheel-Legged Robot with Rim Shape Changeable Wheels. *Advances in Mechanism, Machine Science and Engineering in China: Proceedings of IFToMM CCMMS 2022*, 315.
- [3] **Fu, Z.**, & Li, Y. (2023). Swing Leg Motion Strategy for Heavy-load Legged Robot Based on Force Sensing. *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, under review.
- [4] Zhang, Y., **Fu, Z.**, Chen, X., Xu, Jing., et al. (2020). An accessible shower system friendly to old people. CHN Patent No. CN111887753A. China National Intellectual Property Administration.

RESEARCH EXPERIENCE

Multi-agent Cooperative Decision Planning in Large-scale Complex Traffic Flow

2022.12-2023.03

Advisors: Dr. Pinlong Cai.

- Proposed a grouping algorithm based on interaction possibilities between vehicles.
- Proposed a multi-agent joint decision-making algorithm based on Monte Carlo Tree Search (MCTS), enabling vehicles to complete driving intentions such as lane changing, overtaking, and merging.
- Enhanced the efficiency of multi-vehicle joint decision-making by four times while maintaining a decision success rate of over 95% compared to other methods.
- Proposed a dual closed-loop framework, which is capable of handling up to 80 vehicles simultaneously planning on a road network while maintaining an overall simulation acceleration ratio of over 110%.
- Introduced the driver's social value orientation (SVO), allowing for diversity in traffic flow.
- Paper Link: <https://arxiv.org/abs/2308.12797>
- Video Link: <https://youtu.be/Tr0QWCasO54>

Force Sensing Inspection of a Novel Legged Quadruped Lander

2021.11-2022.11

Advisors: Prof. Weizhong Guo | Chinese National Natural Science Foundation Project

- Developed a dynamic simulation environment for the landing and inspection processes.
- Developed control modules including kinematic inverse solutions and trajectory interpolation, implemented the communication system using ROS.
- Established an external force sensing method based on joint currents and Kalman filter.
- Proposed dynamic foot trajectory planning algorithms based on D* and finite state machine, which enabled heavy-load legged robots to pass through complex terrains autonomously and smoothly.
- Proposed a localization algorithm based on ground contact point and point cloud registration.
- Paper Link: <https://arxiv.org/abs/2309.01112>

Design of a Novel Wheel-legged Robot with Rim Shape Changeable Wheels

2021.10-2022.03

Advisors: Prof. Weizhong Guo.

- Established a general kinematic and dynamic model of the transformable wheel structure and optimized the obstacle-crossing trajectory. Conducted the parameters optimization of the robot.
- The experiments show that the prototype installed with the novel wheel can cross obstacles with the height of 1.52 times of its wheel radius with less fluctuation and good terrain adaptability.
- Paper Link: https://link.springer.com/chapter/10.1007/978-981-19-9398-5_17

WORK EXPERIENCE

Ant Group

2023.06-2023.09

Embedded Software and Hardware Development Intern (Digital Technology - AIOT Department)

- 1) Implemented a lightweight Zero-Knowledge Proof (ZKP) algorithm based on zkSNARK protocol, deployed the ZKP algorithm on embedded devices with ARM architecture.
- 2) Developed Solidity smart contracts and deployed them on both Ethereum for on-chain verification, developed a blockchain interaction tool using Web3.js.
- 3) Applied for an CHN patent as the **first** author.

Shanghai Artificial Intelligence Laboratory

2022.12-2023.03

Decision & Planning Algorithm Intern (Intelligent Transport Platform)

- 1) Investigated joint decision-making of multiple intelligent agents under large-scale complex traffic flow.
- 2) Completed an SCI journal paper as the **first** author.

SCIENCE COMPETITIONS

"Huawei Cup" National Mathematical Modeling Competition, National 2nd Prize

2022.10

- Team leader, responsible for modeling and analyzing, coding, and paper writing.

National College Student Mechanical Design Innovation Competition, National 1st Prize

2021.02

- Team leader, take charge of innovative structural design and control system development.

RoboCup China Robot Competition, National 1st Prize

2020.08

- Algorithm group leader, responsible for designing and debugging robot path planning algorithms.

Energy Conservation and Emission Reduction Competition, National 1st Prize

2019.09

- Team members, responsible for building thermal flow simulation models, conducting numerical calculations, and designing product structures.

SKILLS & INTERESTS

- **Language Skills:** English (fluent, IELTS Overall Band 7.5), Chinese(native)
- **Programming Languages:** C/C++, Matlab, Python, JavaScript, C#
- **Operating System:** Robot Operating System (ROS), Linux, and experienced in embedded system development with devices such as Raspberry Pi, STM32, etc.
- **Behavioral decision-making:** Monte Carlo Tree Search, imitation learning, reinforcement learning.
- **Path Planning:** Search-based algorithms (A*, D*), sampling-based algorithms (PRM/RRT), optimization-based algorithms for path planning, and convex optimization principle.
- **Robotics:** Kinematic and dynamic modeling methods for serial and parallel mechanisms.
- **Simulation Software:** Toolkit for RL such as OpenAI-Gym and NVIDIA Isaac, dynamic analysis software such as Adams and its co-simulation with Simulink, 3D modeling software such as SolidWorks and UG, FEA software such as ANSYS.
- **Control Theory:** Modern control theory, fuzzy control, and model predictive control (MPC), with experience in applying industrial controllers.
- **Cryptography:** Hash functions, RSA, ECC, and other asymmetric encryption algorithms, familiarity with zero-knowledge proof algorithms, and experience in blockchain development.
- **Interests:** Fitness, football, table tennis, running, photography.
- **Teaching Activity:** TA for *Design and Manufacturing* (Outstanding Teaching Assistant Award).
- **Leadership:** Team Leader of RoboCup team in XJTU, and Director of Media Studio at Runners' Club.