

Zhengyu Tao

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EDUCATION

University of Illinois at Urbana–Champaign

Aug. 2024 - Dec. 2025 (expected)

Master of Mechanical Science and Engineering

GPA: 3.77/4.0

Main Courses: Control System Theory & Design, Artificial Intelligence, Data Science in Manufacturing Quality Control, Computer Control of Mechanical Systems, Introduction to robotics, Robust Adaptive Control, Num Control of Mfg Processes, Robot Dynamics and Control, 3D Laser Printing

Guizhou University, China

Sept. 2020-July 2024

Bachelor of Mechanical Design & Manufacturing and Automation

GPA: 89/100 Rank: top 1%

Main Courses: C Programming, Fundamentals of Mechanic Engineering Control, Thermal Engineering, Hydromechanics, Electrotechnology, Mechanical Design, Fundamentals of Mechanical Manufacturing Technology, Engineering Mathematics

RESEARCH EXPERIENCE

Smart Safety Co-pilot for Drone Inspection

May. 2025 - August. 2025 (Expected)

IDEA Lab, University of Illinois at Urbana-Champaign

Supervisor: Prof. Mohamad Alipour

- Developed an optimization-based visual-inertial odometry (VIO) and visual SLAM pipeline for UAV localization in GPS-denied environments, enabling real-time pose estimation and 3D reconstruction.
- Designed a human-in-the-loop navigation system with AR-based visual cues, real-time synthetic view generation, and sensor fusion via IMU-camera calibration.
- Integrated DJI SDKs and ROS for geofencing, path deviation alerts, and semi-autonomous control.
- Developed a model-free RL agent for autonomous inspection and integrated it with the assistive co-pilot framework.

Collaborative Robotic Printing

Dec. 2024 - Present

Supervisor: Prof. Mickey Clemon

- Designed and assembled a 6-axis robotic printing system; modeled and simulated robotic motion using SolidWorks and PyBullet.
- Developed a dependency graph-based scheduler and 3D-aware local search algorithm, reducing extrusionless motion by over 60%.
- Integrated an energy-aware inverse kinematics (IK) solver to select joint configurations minimizing actuator energy per motion segment.
- Generated energy-optimal toolpaths through joint-level power modeling and algorithmic optimization; validated with simulations and experiments.
- Preparing a first-author journal paper on energy-optimized path planning for multi-robot 3D printing.

Automotive Power Battery Thermal Management

Jan. 2024 - June 2024

Supervisor: Prof. Qingguo Peng

- Reviewed key challenges and advancements in power battery thermal management, guiding the development of optimized cooling strategies.
- Built physical and numerical models for various thermal management schemes using SolidWorks and Fluent, enabling comparative analysis of different cooling solutions.
- Optimized air, liquid, and hybrid cooling strategies, integrating phase change materials, and validated performance via CFD simulations in Fluent. Results demonstrated a temperature difference $<5^{\circ}\text{C}$ and maximum battery temperature $<50^{\circ}\text{C}$ under high-temperature, high-discharge conditions.

UAV Fault Diagnosis

June 2023-Jan. 2024

Supervisor: Prof. Shaobo Li

- Researched data-driven UAV fault diagnosis methods, leveraging signal processing, machine learning, and deep learning approaches to enhance fault detection accuracy.
- Applied CNN, RNN, and GAN for feature extraction and classification, improving diagnostic performance in UAV fault analysis.
- Developed a few-shot learning framework to mitigate data scarcity challenges, enabling reliable fault diagnosis with limited labeled samples.
- Validated the proposed method through real-world case studies and experimental simulations, demonstrating its effectiveness in industrial UAV applications.

PROJECT EXPERIENCE

Robotic Manipulation and Force-Control under Trajectory Constraints

March. 2025-May. 2025

- Designed and implemented a control system for a 3-DOF robotic arm to execute multi-stage tasks including peg insertion, obstacle avoidance, trajectory tracking, and force-controlled pressing.
- Developed piecewise linear trajectory planning using C, and employed PD control with feedforward compensation to improve tracking accuracy and dynamic responsiveness.
- Adapted the end-effector coordinate frame in real time and applied gain weakening during zig-zag path navigation to enhance motion stability and compliance in constrained environments.
- Integrated real-time force feedback control to apply a precise pressing force (500–1000g) on fragile objects (e.g., eggs), ensuring interaction safety and force consistency.

Ultrasonic Welding Quality Analysis with Machine Learning

Oct. 2024 - Dec. 2024

5-person team, team leader

- Led a team of 5 to analyze ultrasonic welding quality using machine learning and statistical modeling techniques, managing task allocation and providing technical guidance.
- Developed algorithms to segment main weld regions and extract key features, incorporating control charts for non-destructive ultrasonic welding quality evaluation.
- Implemented and optimized machine learning models (KNN, SVM, Random Forest) for ultrasonic welding quality classification, applying feature selection and performance evaluation through cross-validation.

Machine Vision for Precision Inspection and Measurement

Nov. 2021 - Dec. 2021

Independent Project

- Researched machine vision techniques for precision workpiece inspection, enhancing detection accuracy and positioning efficiency.
- Developed a dimension measurement pipeline utilizing gray transform, Gaussian filtering, Canny edge detection, and morphological algorithms.
- Explored deep learning-based approaches, including convolutional neural networks (CNNs), to enhance detection accuracy and mitigate background interference.

INTERNSHIP EXPERIENCE

Dongfeng Motor Corporation Technical Center, China

June 2023 - Aug. 2023

Position:Assistant Mechanical Engineer

- Familiarized and assisted with the production and manufacturing processes of various automotive components, including material selection, process parameter setting, and product quality control.
- Used CAD software (such as SolidWorks, AutoCAD, etc.) to create 3D models and engineering drawings, ensuring the design met manufacturing standards and requirements.
- Gained hands-on experience with the operation of various production equipment and manufacturing techniques, such as stamping, welding, and assembly, with the capability to solve on-site problems.

Xuzhou Construction Machinery Group Co. LTD, Xuzhou, China

July 2022 - Aug. 2022

Position: Assistant at Science and Technology Quality Information Department

- Assisted in product quality system certification, intellectual property management
- Helped the leader with product scientific research and technology management

AWARDS & HONORS

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| • Guizhou University Scholarships for Further Study Abroad | 2024 |
| • First Prize of Scholarship for Outstanding Students of Guizhou University | 2021&2022 |
| • Outstanding Student Leader of Guizhou University | 2021 |
| • Merit Student of Guizhou University | 2021&2023 |

SKILLS

- Programming Languages: Python, Matlab, C, C ++, Java, G code, C#
- Software: AutoCAD, SolidWorks, UG, CATIA, MATLAB/Simulink, Fluent, Ansys, COMSOL, Origin, Arduino, COLMA,OpenCV, Android Studio
- Tools & Frameworks: Linux, ROS1 & ROS2, Git, PyTorch, TensorFlow, Pybullet, DJI SDKs, Gazebo, LaTeX, SLAM
- Manufacturing & Control Skills:3D Printing, CNC Machining, PID Tuning, Control System Design, Path Planning, Photogrammetry, Human-Robot Interaction