Sizhe Sui

Email : ssz990220@sjtu.edu.cn
Mobile : +86-17321120072

EDUCATION

Shanghai Jiao Tong University — Shanghai, China
Masters in Mechanical Engineering, Institute of Robotics; Supervised by Prof. Ye Ding — Sep 2021 - Mar 2024 (expected)
Background: Scientific Computation, Numerical Analysis, Optimization Method, Discrete Signal Processing, Mechanical System Dynamics

University of California, Berkeley — Berkeley, California
Exchange Student in Mechanical Engineering; GPA: 4.0/4.0 — Jan 2020 - May 2020
Courses: Engineering Analysis using the Finite Element Method, Heat Transfer, Electronics for the Internet of Things, Mechanical Vibrations

University of Toronto — Remote
Visiting Scholar at Vector Institute, Supervised by Prof. Animesh Garg — May 2020 - Oct 2020
Conducted research on Multi-Agent Deep Reinforcement Learning

Shanghai Jiao Tong University — Shanghai, China
Hsue-Shen Tsien Honor Program of Mechanical Engineering (Top 5%); GPA: 3.76/4.3 — Sep 2017 - June 2021

University of Texas, Austin — Austin, Texas
Visiting Scholar at ASE/ME, Supervised by Prof. Luis Sentis — June 2023 - till now
Conducted research on Ray-Tracing based collision detection

SKILLS SUMMARY

- **Languages**: Python, CUDA, Optix, Julia, Matlab , C++

- **Tools**: ROS, Pybullet, OpenAI Gym, RLLib, Solidworks, Stable-Baseline, Linux, OpenWRT, Photoshop, MAYA

RESEARCH PROJECTS

Smart Manufacturing Center Calibration — Shanghai, China
First author and major contributor, supervised by Prof. Ye Ding, [T-ASE, 2023], [GitHub] — Jan 2022 - Aug 2023

- **Theoretical Contributions**: Proposed a calibration method that runs 4.5x faster and saves 3.5x computational footprint than previous state-of-the-art algorithm to calibrated hand-eye, robot-robot, tool-flange coordinates simultaneously (**AXB** = **YCZ** problem in short) based on Geometric Algebra (GA) and Geometric Calculus (GC).

- **Experiments**: Building a digital twin for a dual robot system using ROS and Moveit to generate collision-free paths, with the hardware driver for both an ABB industrial robot and a JAKA collaborative robot build from plane ground. 1000+ measurements have been carried out automatically with the designed system.

Large-Scale Work-piece Metrology System Design — Shanghai, China
Bachelor's Thesis, First author and group leader, supervised by Prof. Ye Ding — Jan 2021 - Jun 2021

- **Metrology System Design**: Designed and implemented a metrology system that is capable of planning and executing measurements 33% faster than the original method, processing results, and generating reports for a workpiece that is 2m in range. The system integrates a structure light camera, an industrial robot, and two PCs via Ethernet.

- **Serial Robot Calibration**: Designed and implemented a kinematics parameters self-calibrate algorithm with the product of exponential (POE) formula that enables the system to carry out measurement at an accuracy of 0.3 mm

- **Awards**: Presented to a group of elite industrial specialists on how the system works and won the Second Prize in the final presentation (Top 4/100+).

Learning Dexterity with Reinforcement Learning — University of Toronto, Remote
Research Intern, Supervised by Prof. Animesh Garg — May 2020 - Oct 2020

- **Algorithms Reproduction**: Extensive exposure to multi-agent reinforcement learning algorithms and reproduced classic deep reinforcement learning algorithms such as PPO, DDPG, and DQN with PyTorch.

- **Simulation Environment**: Built a tri-finger robot with Solidworks and Pybullet from scratch and wrapped the environment with OpenAI Gym API.

- **Learning Dexterous Manipulation**: Fine-tuned the reward function and trained a three-finger robot in simulation to manipulate a long rod to a specified position as a mimic to in-hand object manipulation with PPO and RLlib toolbox.

SIDE PROJECTS AND SELF-PACING COURSES

- **Collision Free Trajectory Planning**: Implemented a GMM-based RRT path planning algorithm for narrow pipes internal cavity measurement with robot manipulators.

- **Thin-wall blade measurement**: Measure a thin-wall blade characterization using a point cloud camera and a "fast and robust" ICP method Github

- **Self-paced GPU programming courses**: Took online self-path courses and earn certification from NVIDIA on GPU programming. Further extended knowledge in this field such as Stream and Shared Memory Allocation by taking other open courses from UPenn and OLCF.

- **Laboratory Network Construction**: Designed and constructed a network in the laboratory that connects all devices including five robots, three cameras, and several workstations. The network allows users to transfer and back up files at 1000Mbps seamlessly between PCs and devices.

COURSE PROJECTS

Reinforcement Learning with Humanoid Robot Shanghai, China
Group Leader for Course Project *Sep 2020 - Jan 2021*

- Dived deeply into the structure of OpenAI Gym's 'env' data structure and tuned the reward function. The modified environment converges 40% faster than its stock version.
- Trained and fine-tuned a humanoid robot agent in a modified Pybullet gym environment with PPO and SAC. The robot managed to keep balance and walk after a few hours of training on GPU.

Self-adaptive Underactuated Gripper Design Shanghai, China
Group Leader for Course Project *Sep 2019 - Dec 2020*

- Design and build mechanical gripper weights only 500g with under-actuate and shape-adaptive design, capable of conforming to the surface of various objects and exerting a certain amount of pressure to ensure stable grasping.
- Propose an innovative shape adaptive and self-protective method by introducing ratchets into the mechanism.
- Won the Best Team prize in the school's Designing and Manufacturing Competition (Top 3 of 80+ teams).

Auto-shooting Basketball Robot Design Shanghai, China
Group Leader for Course Project *March 2019 - June 2019*

- Led a team of 5 members to design and build a basketball robot with over 80% shooting accuracy and won the first prize (Top 3%) in the school's Designing and Manufacturing Competition after presenting to over 50 professors and 500 students
- Managed to determine the robot's direction by building a system that connects the UART link with the embedded device to transfer locomotion message to an STM32

LEADERSHIP AND ACTIVATIES

Robotics Shanghai, China
Teaching Assistant *Feb 2022 - Jun 2022*

- **Course Co-organizer**: Assist the professor in organizing and managing the process of submitting assignments, grading, and troubleshooting for the students in the class, and ensure the normal operation of the course during the COVID pandemic.
- **Teaching Assistant**: Hand-crafted ten widely praised assignments by abstracting and simplifying real engineering scenarios into interesting while challenging course projects and assignments. The content covers theoretical proof and simulation construction, enhancing students' understanding of the knowledge and igniting their enthusiasm to dive deeper.

Nanyang News Agency Shanghai, China
Head of the photography group *Sep 2019 - Sep 2020*

- **Leader of a content creation team**: Manage a team of 30 members to assist school news reports by providing and publishing high-quality images on the official WeChat blog of SJTU and the official website of SJTU.
- **Photography Lecturer**: Conducting weekly training courses to improve recruit's skill of photographing.

PUBLICATIONS & PATENTS

[1] **S. Sui** and Y. Ding, Solving the **AXB = YCZ** Problem for a Dual-Robot System with Geometric Calculus[J]. *IEEE Transactions on Automation Science and Engineering*, 2023

[2] Y. Ding, **S. Sui** and X. Zhu, A geometric calculus based simultaneous dual-manipulator calibration algorithm, *CN Patent*, CN202211325673.5, Oct 27, 2022 (Processing)

HONORS AND CERTIFICATIONS

- Graduated from Hsue-Shen Tsien Honored Program of Mechanical Engineering, Top 5%
- Second Prize of Excellent Graduation Design, Top4/100+
- Certification: Fundamentals of Accelerated Computing with CUDA C/C++, (NVIDIA, Dec, 2022)
- Certification: Accelerating CUDA C++ Applications with Concurrent Streams, (NVIDIA, Dec 2022)
- Certification: Huawei Certified ICT Associate–Artificial Intelligence, (HuaWei, Dec, 2018)