

Ruijia Zhang

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EDUCATION BACKGROUND

Wuhan University (WHU)	Wuhan, China
B.Eng. Mechanical Engineering , GPA 3.87/4.0 (rank 3/103)	Expected 06/2024
Core courses: Robotics (92), Robot Sensing, Vision and Control (90), Mechanical Principle (98), Mechanical Design, Automatic Control Principle, Microcomputer Principle (95), Fluid Mechanics (93)	
University of Cambridge	Online
Cambridge Program Online (Soft Robotics, Artificial Intelligence, Astronomy, Big Data)	10/2022

HONORS & AWARDS

Merit Student, WHU	2020-2021 & 2021-2022
National Scholarship (0.2%)	2020-2021 & 2021-2022
Professional A-level Scholarship for Outstanding Students, WHU	2020-2021 & 2021-2022
Engineering Practice Curriculum Guidance, WHU Engineering Innovation Center	2021 & 2022
The First Prize, the 16 th China Intelligent Manufacturing Challenge	09/2022
National Second Prize, the 5 th National College Intelligent Robot Creative Competition	07/2022
The First Prize, the 10 th National College Mechanical Innovation Design Competition	05/2022
“Top 10 students”, School of Power and Mechanical Engineering, WHU (10/1200)	04/2022
“Advanced Individual in Scientific and Technological Innovation”, WHU	03/2022
National Gold Award, the 7 th Chinese Engineering and Innovation Competition	11/2021
The Second Prize, the 36 th Chinese Physics Olympiad	09/2019

PUBLICATIONS & PATENTS

Yuanyuan He, Weihong Pan, **Ruijia Zhang** & Miao Li. (2023). Towards understanding of human cervical spine with EMG signal. Submitted to *2024 IEEE International Conference on Robotics and Automation*.

Ruijia Zhang, Min Li, Gai Wu, Lijie Li, Kang Liang & Wei Shen. (2023). Modulating electronic properties of β -Ga₂O₃ by strain engineering. *Results in Physics* (52), [Doi: 10.1016/j.rinp.2023.106916](https://doi.org/10.1016/j.rinp.2023.106916)

Min Li, Shijing Wu, Yunyun Sun, Wenke Zhou & **Ruijia Zhang**. (2023). Design and research of bi-joint bionic robotic fish based on composite linkage. Submitted to *China Mechanical Engineering*.

Min Li, Xiaoqiao Chen, Fenglian Song, Wenke Zhou & **Ruijia Zhang**. (2022). Design and research of intermittent transmission mechanism based on curved groove. *Journal of Wuhan University: Engineering Science Edition* (055-006), [Doi: 10.14188/j.1671-8844.2022-06-013](https://doi.org/10.14188/j.1671-8844.2022-06-013) [\[video\]](#)

Ruijia Zhang, Min Li, Wenke Zhou, Zibin Nian, Ning Luo & Xiaoya He. (2023). Tail fin propelled autonomous swimming bionic robotic fish based on composite connecting rod mechanism. CN 114537629 A, filed 02/28/2022, issued 02/09/2023. [\[EPO\]](#)

Ruijia Zhang, Min Li, Xusheng Cheng & Kailang She. (2022). Heat energy driving vehicle supported by vertical plate. CN 215513213 U, filed 06/07/2021, issued 01/14/2022. [\[EPO\]](#)

RESEARCH & COURSE PROJECTS

Soft Robot Hands 07/2023-Present

Student Researcher, supervised by Prof. Miao Li, Advanced Robotics and Intelligent Control Laboratory, WHU

- Develop a tendon-driven soft robot hand with soft microstructure fingers that could achieve controllable stiffness deformation and effective object grasping.
- Design the finger microstructure and configuration of palm and wrist to produce a prototype robot hand.
- Establish control of the serial bus servo connector by STM32 and implement the grasping function (or posture and shape detection) by adding flexible tactile sensors on fingertips and palms.
- Design a mathematical model for the finger, identify the parameters through FEM simulations and experiments, and achieve the deformation of flexible fingers by adjusting and optimizing the parameters.

Modulating Electronic Properties of β -Ga₂O₃ by Strain Engineering 06/2022-07/2023

Student Researcher, supervised by Prof. Wei Shen, The Institute of Technological Sciences, WHU

- Investigated the effect of strain on the structure and electronic properties of β -Ga₂O₃ semiconductor using GGA+U (Generalized Gradient Approximation + Hubbard U) method based on density functional theory.
- Implemented simulation calculations for bandgap and effective mass tunability using VASP (Vienna Ab-

initio Simulation Package) and PWmat (A Material simulation packages at atomic scale based on first principles) in Python.

- Discovered an indirect-direct bandgap transition and electron mobility anisotropy in β -Ga₂O₃ semiconductor under strain, suggesting potential applications of strain engineering in modulating its electronic properties.

Bionic Robot Fish

09/2021-06/2022

Team Leader, supervised by Prof. Deng Li and Dr. Min Li, Intelligent Manufacturing Lab, WHU

- Led a team to design a bionic robot fish with functions including straightening, turning, sinking and floating, and autonomous underwater cruising.
- Proposed a double-joint bionic robotic fish model based on the caudal fin propulsion theory to simulate the wave motion of trevally fish and designed a composite linkage to achieve straight swimming and steering.
- Developed a wing-rocking mechanism and elevation device to control the steering and pitching of the fish.
- Implemented automatic obstacle avoidance and posture adjustment functions using Raspberry Pi with gyroscope and ultrasonic sensor, and realized three modes of movement: straight swimming, steering and pitching through wireless communication.
- Modeled the robot fish by SolidWorks and tested the feasibility of the mechanism by simulation on Adams.
- Manufactured a prototype and adjusted it through underwater experiments.
- Conducted computational fluid dynamics simulation (CFD) of the robot fish using Ansys Fluent to study the relationship between swimming speed and mechanism design/driving parameters. Compared with experimental results to confirm the feasibility of predicting the change trend of swimming speed by 2D simulation.

Heat-Powered Vehicle

09/2020-09/2021

Team Leader, supervised by Prof. Deng Li and Dr. Min Li, Intelligent Manufacturing Lab, WHU

- Designed a heat-powered vehicle using Stirling engine as the power source and accomplished closed-loop obstacle avoidance trajectory with a pure mechanical structure.
- Created an innovative body structure supported by a vertical plate using SolidWorks to reduce size, costs, the assembly complexity with 50% superior trajectory accuracy by the fine-tuning mechanism.
- Calculated the cam profile to fit the target trajectory using an iterative method based on MATLAB, and optimized algorithms to improve the convergence accuracy by 40%.
- Manufactured the vehicle by laser cutting, 3D printing, and CNC machining and improved cam machining accuracy by 50% by optimizing machining methods.

Other robotic-related projects

- Utilized three regression models (empirical model, BP neural network model, and PSO-BP neural network model) to predict cross-sectional profile characteristics based on Abrasive Waterjet Milling (AWJ) experiments; used multi-objective optimization algorithms (NSGA-II, MO-Jaya, and ADM-MO-Jaya) for AWJ processing parameters to balance surface roughness and processing efficiency.
- Implemented trajectory planning for serial chain manipulators (including 6R, KUKA KR5, and SCARA robots); applied an improved Rapidly-exploring Random Tree (RRT) algorithm with MATLAB to solve obstacle avoidance motion planning problems for the KUKA robot.
- Improved a two-way loop procedure of the smart wardrobe based on PLC program control and optimized mechanisms such as the groove wheels based on Adams dynamical simulation and SolidWorks Topology.

TEACHING EXPERIENCE

Industrial Training Course, WHU

06/2022-07/2022

Mechanical Vehicle Training Camp, WHU

09/2021-02/2022

- Prepared instruction materials for undergraduates and assisted them in understanding theoretical concepts.
- Illustrated the operation of CNC milling machines, and vehicle design, manufacturing and tuning.

SKILLS

CAD/CAE: SolidWorks, Ansys (FEM and CFD), AutoCAD, Adams, Fusion 360, Mastercam

Calculation & Simulation: ROS, RoboAnalyzer, MATLAB, VASP (DFT), Materials Studio (DFT)

Program language: Python, C/C++

Others: CNC machining, Origin, SPSS, Design-Expert, VESTA