Ruijia Zhang

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EDUCATION

Wuhan University (WHU)   **Wuhan, China**
B.Eng. Mechanical Design Manufacturing and Automation, **GPA** 3.87/4.0 (rank 3/103)   Expected 06/2024
Core courses: Robotics, Sensors, Visual Measurement and Control of Robots, Machinery Principle, Mechanical Design, Principles of Microcomputers, Fluid Mechanics
University of Cambridge   **Online**
Cambridge Program Online (Soft Robotics, Artificial Intelligence, Astronomy, Big Data)   10/2022

HONORS & AWARDS

National Scholarship (Top 1%)	2020-2021 & 2021-2022
Merit Student, WHU	2020-2021 & 2021-2022 & 2022-2023
Professional A-level Scholarship for Outstanding Students, WHU	2020-2021 & 2021-2022 & 2022-2023
First Prize, Liu Daoyu Creative Learning Award, WHU	2022-2023
First Prize, 1st Inno Innovation Achievement Award, WHU (5th in the entire school)	05/2023
First Prize, 16th China Intelligent Manufacturing Challenge	09/2022
National Second Prize, 5th National College Intelligent Robot Creative Competition	07/2022
First Prize, 10th 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, 7th Chinese Engineering and Innovation Competition (1.43%)	11/2021
Second Prize, 36th 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-Ga_2O_3 by Strain Engineering. *Results in Physics* (52), Doi: 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 [video]](Doi: 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] [video]

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] [video]

RESEARCH & COURSE PROJECTS

Soft Robot Hands   07/2023-Present
Student Researcher, supervisor: Prof. Miao Li, Advanced Robotics and Intelligent Control Laboratory, WHU

➢ Developed a tendon-driven soft robotic hand that has microstructure fingers with controllable stiffness deformation and effective object grasping functionality.
➢ Incorporated synergy patterns into the mechatronic hand system in order to replicate coordinated human hand motions observed during the grasp approach phase.
➢ Used STM32 to establish serial bus servo connector control and added flexible tactile sensors on fingertips and palms to implement the grasping function.
➢ Established the finger kinematic model through finite element simulation of SOFA software, and integrated vison control to investigate the reinforcement learning of in-hand manipulation.

Modulating Electronic Properties of β-Ga_2O_3 by Strain Engineering   06/2022-07/2023
Student Researcher, supervisor: Prof. Wei Shen, The Institute of Technological Sciences, WHU

- Examined the effect of strain on the structure and electronic properties of β-Ga$_2$O$_3$ semiconductor using GGA+U (Generalized Gradient Approximation + Hubbard U) method based on density functional theory.
- Implemented simulation calculations in Python for bandgap and effective mass tunability using VASP (Vienna Ab-initio Simulation Package) and PWmat (a material simulation package at atomic scale based on first principles).
- Discovered an indirect-direct bandgap transition and electron mobility anisotropy in β-Ga$_2$O$_3$ semiconductor under strain, suggesting potential applications of strain engineering in modulating its electronic properties.

Bionic Robot Fish   09/2021-06/2022

Team Leader, supervisor: Prof. Deng Li and Dr. Min Li, Intelligent Manufacturing Lab, WHU
- 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 fish steering and pitching.
- 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 via wireless communication.
- Modeled the robot fish by SolidWorks and tested mechanism feasibility by simulation on Adams.
- Manufactured a prototype fish capable of swimming in a straight line at an average speed of 5 cm/s using 3D printing and Computer Numerical Control (CNC) machining technologies.
- Refined the design and optimized performance by analyzing the influence of mechanism design/driving parameters on swim speed by comparing Computational Fluid Dynamics (CFD) simulation results with experimental data.

Heat-Powered Vehicle   09/2020-09/2021

Team Leader, supervisor: Prof. Xiaosun Wang and Dr. Min Li, Intelligent Manufacturing Lab, WHU
- Designed a heat-powered vehicle using a 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, and the assembly complexity with 50% superior trajectory accuracy through the fine-tuning mechanism.
- Calculated cam profile to fit target trajectory using an iterative method based on MATLAB, and optimized algorithms leading to a 40% improvement in convergence accuracy.
- Manufactured the vehicle using laser cutting, 3D printing, and CNC machining and improved cam machining accuracy by 50% by optimizing machining methods.

Other robotics-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); solved obstacle avoidance motion planning problems for the KUKA robot by applying an improved Rapidly-exploring Random Tree (RRT) algorithm with MATLAB.
- 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 comprehending theoretical concepts.
- Illustrated CNC milling machine operation, and vehicle design, manufacturing and tuning.

SKILLS
Programming languages: Python, C/C++
CAD/CAE: SolidWorks, AutoCAD, Fusion 360
Calculations & Simulations: Ansys, Adams, ROS, MATLAB, SOFA, VASP (DFT)
Others: Mastercam (CNC machining), Origin, SPSS, Design-Expert, Materials Studio (DFT), VESTA (DFT)