

Bowen Zheng

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EDUCATION

University of Illinois Urbana-Champaign (UIUC)

IL, USA

M.S. in Mechanical Engineering

September 2023 – Present

- **GPA: 3.85/4.00**

- Major Courses: Control System Theory & Design; Analysis of Nonlinear Systems; Reinforcement learning; Control of Stochastic Systems; Whole-Body Musculoskeletal Biomechanics; Robust Adaptive Control

South China University of Technology (SCUT)

Guangdong, China

B.S. in Mechanical Engineering

September 2019 – June 2023

- **GPA: 3.85/4.00, major GPA: 3.90/4.00**

- Major Courses: Mechanical Design; Mechanics of Materials; Electrical Engineering and Electrotechnics; Introduction to Robotics

- Final Year Project: Design of variable stiffness actuator

PUBLICATIONS

- **Zheng, Bowen**, Pengpeng Xu, Zhaoqi Guo, and Longhan Xie. Origami-Inspired Variable Stiffness Actuator for Safe Human-Robot Interaction. *Journal of Mechanisms and Robotics*, 16(4):041009, April 2024
- Pengpeng Xu, Dan Xia, **Zheng, Bowen**, Li Huang, and Longhan Xie. A Novel Compensatory Motion Detection Method Using Multiple Signals and Machine Learning. *IEEE Sensors Journal*, 22(17):17162–17172, September 2022

SKILLS

Programming Languages: Python, C/C++

Framework: Pytorch, ROS\ROS2, Gym

Software: Solidworks, AutoCAD, Ansys, Adams, MATLAB\Simulink, Opensim, STM32CubeIDE

RESEARCH EXPERIENCE

Accurate Impedance Rendering for General Compliant Actuator

May 2024 - Present

Supervisor: Prof. Naira Hovakimyan

- Developed a novel impedance control method leveraging \mathcal{L}_1 adaptive control to achieve precise impedance rendering under disturbances and unknown time-varying parameters, applicable to variable stiffness actuator(VSA) and nonlinear serial elastic actuator(SEA)

Collision handling Using Variable Stiffness Actuator

October 2022 - April 2023

Supervisor: Prof. Yanjiang Huang

- Designed a machined version of previously developed VSA to increase output capabilities and made it applicable to robotic arms
- Built a control and data collection framework using ROS2 and tested collision handling algorithms

Research on Variable Stiffness Actuator | Principal Researcher

April 2022 - December 2022

Supervisor: Prof. Longhan Xie

- Developed VSA prototype for safe human robot interaction using SolidWorks, validating its feasibility through theoretical analysis
- Built an experimental platform with STM32 for performance testing, measuring key metrics like torque curve, stiffness range and durability
- Improved the design by using a nonlinear elastic element designed with torsion spring to replace the spring leaf that is prone to fatigue and hard to build accurate theoretical model

Research on the Upper-limb Rehabilitation Exoskeleton | Key Member

April 2021 - December 2022

Supervisor: Prof. Longhan Xie

- Designed an innovative under-actuated upper-Limb Rehabilitation exoskeleton to addresses the joint misalignment issue without significantly increasing the cost and the control complexity
- Optimized the fixed kinematic parameters based on the range of motion, end-factor stiffness and manipulability with fuzzy analytic hierarchy process
- Conducted dynamics analyses using Adams to determine motor torque requirements, and structural analyses using Ansys to iteratively design the linkage stiffness
- Designed detection methods for compensatory motion patterns in upper-limb rehabilitation using sensor fusion and machine learning to reduce cost and setup complexity while maintain detection accuracy