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

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
- Final Year Project: Design of variable stiffness actuator

Publications

- 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
- **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

Skills

Programming Languages: Python, C/C++, MATLAB
CAD: Solidworks, AutoCAD
CAE: Ansys, Adams
Framework: Pytorch, ROS, ROS2

Research Experience

Accurate Impedance Rendering for General Complaint Actuator *May 2024 - Present*
Supervisor: Prof. Naira Hovakimyan

- Used $\mathcal{L}_1$ adaptive controller to realize accurate impedance rendering for general compliant actuator.

Collision handling Using Variable Stiffness Actuator *October 2022 - April 2023*
Supervisor: Prof. Yanjiang Huang

- Designed a machined version of the previous VSA to increase output capabilities and made it applicable to robotic arm for further research
- Built a control and data collection platform using ROS2 and test collision handling algorithm on it

Research on Variable Stiffness Actuator | *Principle Researcher* *April 2022 - December 2022*
Supervisor: Prof. Longhan Xie

- Developed a prototype of a VSA for better human robot interaction with SolidWorks, conducting theoretical analysis to validate feasibility and performance metrics.
- Developed prototype and experimental platform with STM32 for feasibility testing. The platform facilitated the measurement of critical metrics such as torque curve, stiffness range and durability.
- Iterated it by using a nonlinear elastic element designed with a normal 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 a novel under actuated Upper-Limb Rehabilitation exoskeleton prototype to solve the joint misalignment problem without significantly increasing the complexity of the structure and the difficulty of control
- Optimized the fixed kinematic parameters based on the range of motion, end-factor stiffness and flexibility. Used Adams to conduct dynamics analyses to determine the maximum torque the motor needs to provide
- Conducted structural and modal analyses using Ansys to iteratively design the linkage with passive degrees of freedom to enhance the end-effector stiffness.
- Designed detection methods for compensatory motion patterns in upper-limb rehabilitation using sensor fusion and machine learning technique to reduce cost and setup complexity while maintain detection accuracy.