吴院学习&科研&留学经验分享

张新镭 2020级智能制造工程

2024 Fall 北卡罗莱纳州立大学直博

吴贤铭智能工程学院
SHIEN-MING WU SCHOOL OF INTELLIGENT ENGINEERING

目录

- 个人升学情况
- 留学申请总结
- 吴院学习&科研心得
- Q&A

个人升学情况

- 申请结果总结
  - Mechanical Engineering / Robotics Engineering

University of California, Berkeley Berkeley , CA #3 in **Best Engineering Schools**	Reject
Georgia Institute of Technology Atlanta , GA #4 in **Best Engineering Schools** (tie)	Reject
University of Illinois Urbana-Champaign (Grainger) Urbana , IL #9 in **Best Engineering Schools** (tie)	Reject
University of Michigan--Ann Arbor Ann Arbor , MI #9 in **Best Engineering Schools** (tie)	Master offer
Johns Hopkins University (Whiting) Baltimore , MD #14 in **Best Engineering Schools** (tie)	Master offer
University of Pennsylvania Philadelphia , PA #16 in **Best Engineering Schools** (tie)	Reject
University of Southern California (Viterbi) Los Angeles , CA #23 in **Best Engineering Schools** (tie)	Ph.D. offer
North Carolina State University Raleigh , NC #27 in **Best Engineering Schools** (tie)	Ph.D. offer
Vanderbilt University Nashville , TN #41 in **Best Engineering Schools** (tie)	Ph.D. offer
Arizona State University (Fulton) Tempe , AZ #45 in **Best Engineering Schools** (tie)	Ph.D. offer
University of Massachusetts--Amherst Amherst , MA #48 in **Best Engineering Schools** (tie)	Ph.D. offer

个人升学情况

- 留学申请开销
  - 8000 RMB – Application Fee
  - 2170*3 RMB – IELTS Test
  - 1000 RMB – 文书润色

留学申请总结

- Master or Ph.D.
  - 授课型 Master
    - GPA，项目经历，语言
  - 研究型 Master
    - 研究经历，GPA，项目经历，语言

Master Offer (少数Partially Funded)
or Reject

  - Ph.D.
    - 研究经历，GPA，项目经历，语言

Ph.D. Offer (Fully Funded)
or Master Offer (少数Partially Funded)
or Reject

  - 申请Ph.D.对申请研究型Master的向下兼容
    - 研究经历（产出）大于GPA和项目经历大于语言

CURRICULUM VITAE

Xinlei Zhang - Applicant to Ph.D. in Mechanical Engineering

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RESEARCH INTERESTS & GOAL

My research interests lie in the **theories** and **applications** in **robotics**, including **state estimation** & **system dynamics**, **nonlinear control**, and **data-driven methods**. My goal is to advance robotics research by integrating artificial intelligence and control theory methods.

EDUCATION

South China University of Technology | **Intelligent Manufacturing** 09/2020 - 06/2024 (Expected)
Shien-Ming Wu School of Intelligent Engineering Guangzhou, China
Overall GPA 3.75/4.00
Related Courses

- Applied Calculus II 96/100, Linear Algebra 97/100, Probability and Statistics 89/100
- Artificial Intelligence Technology and Applications 90/100, Data Structure 91/100
- Sensor Technology and Applications 90/100, Mechatronics 92/100
- System Dynamics 91/100, Classical Control Theory 92/100

PUBLICATION & PATENT

On Ambiguity in 6-DoF Magnetic Pose Estimation | *First Author* 11/2023
Xinlei Zhang, Shuda Dong and Heng Wang
Submitted to **International Journal of Robotics Research**, under the first-round review

A Virtual Ultrasonography Simulator for Skill Training Using Magnetic-Inertial Probe Tracking 03/2023
Heng Wang, Shuangyi Wang, Suqi Liu, Shuda Dong, Xinlei Zhang
CN Patent Pending, No.CN116312122A

RESEARCH EXPERIENCE

The Lab of Magnetic-Controlled Robot, SCUT 09/2021-Present
Research Assistant, advised by Prof. Heng Wang

6-DoF Magnetic-Inertial Pose Estimation | *Team Member* 09/2021-12/2021

- **Contribution:**
  - Debugged the magnetic-inertial sensor and sensor-arduino-Matlab communication.
  - Reviewed the literature regarding the magnetic-inertial pose estimation methods.
  - Learned and completed the probabilistic modeling of magnetic-inertial sensor measuring process.
  - Implemented the constrained extended Kalman filter (CEKF) to fuse a constant velocity model and magnetic-inertial sensor measurements to achieve pose estimation.
  - Defined the ambiguity issue in magnetic-inertial pose estimation system and proposed its identification method, to analyze and interpret the observability in this nonlinear system.
- **Outcome:**
  - Achieved millimeter-degree 6-DoF pose estimation accuracy in experiments.
  - Applied for one **CN patent**.

On Ambiguity in 6-DoF Magnetic Pose Estimation | *Research Leader* 01/2022-Present

- **Contribution:**
  - Utilized the geometry of the special Euclidean group to decouple position and orientation in ambiguity issue.
  - Employed the numerical optimization method to tackle the non-linearity in magnetic field distribution.
  - Systematized the framework to analyze the ambiguity issue in magnetic pose estimation systems, including its definition, categorization, identification algorithms and impact on pose estimation.
  - Proposed the optimal magnetic source design in magnetic pose estimation system to achieve 6-DoF pose estimation without ambiguity.
  - Derived the equation describing the dynamical nature of ambiguity issue.
  - Designed and conducted experiments to verify the framework and the performance of the optimal system.
- **Outcome:**
  - Achieved millimeter-degree-accuracy and unambiguous 6-DoF pose estimation with the prototype.
  - Submitted one manuscript to **International Journal of Robotics Research**, under the first-round review.
  - Earned recognition and funding through the **Chinese National Training Program of Innovation and Entrepreneurship for Undergraduates**, with a total funding amount of $1300.

RELATED COURSE PROJECTS

Tendon-Driven and Flex Sensor Based Gesture Sensing Hand Exoskeleton | *Team Leader* Spring 2023

- **10 motors** are controlled to stretch tendons attached to the hand exoskeleton, achieving independent control of all five fingers. Moreover, **flex sensors** are fixed with fingers to measure their bending extent, providing gesture information, to construct the **closed-loop gesture control** of fingers.
- **Key words:** PID Motor Control, 3D Modeling and Manufacturing of Exoskeleton, Tendon-driven Mechanism, Bending Sensor, Closed-loop Gesture Tracking.

Wireless-Powered Animation System Displayed by Rotating LEDs | *Team Leader* Fall 2022

- **Multiple embedded system modules**, motor-driving, infrared-monitoring, wireless-charging and sounding-effect, were controlled to present the **self-designed animation** based on the principle of persistence of vision.
- **Key words:** Wireless-charging Coil & Circuit Design, Infrared Sensor, Sounding Module, Animation Presented by Rotating LED Stripe.

Omni-Motion, Bluetooth-control and Self-Reloading Automatic Catapult | *Team Leader* Spring 2022

- The **kinematic model** of the 4 omni-wheel motion was analyzed to achieve the **omni-direction control**. Remote operation was achieved using the **Bluetooth** device and **one self-designed android app**. Moreover, a self-reloading mechatronics device was developed by **3D printing, laser cutting and circuit design** technologies.
- **Key words:** Omni-motion UGV Design and Manufacturing, Bluetooth Module & Android App, Self-reloading Mechanism, Lever-Spring-Motor Shooting Mechanism.

Machine Learning & IMU Based Classifier on Ping-Pong Players' Motion | *Team Leader* Fall 2021

- **Neural network** and **decision tree** classifiers were ensembled to distinguish the motion of forehand drive and backhand stroke of a Ping-Pong player based on the inertial data. Moreover, **One-class SVM** and **Local outlier factor** were employed to detect wrong motions during training which may bring damage to the player's wrist.
- **Key words:** Inertial Sensor, Classifier: Neural Network & Decision Tree, Fault Detection: One-class SVM & Local Outlier Factor, Ping-Pong Training Monitoring.

SELECTED AWARDS & HONORS

Mathematical Contest in Modeling 05/2023
Honorable Mention (Second-Class Award), Top 30%

Alibaba Cloud Programming Contest in SCUT 03/2023
Third-Class Award, Top 15%

Undergraduate Internship Scholarship, China Scholarship Council & University of Alberta 08/2022
Only 1 in South China University of Technology and total 9 in China

National Contest on Micro Sensing and Intelligent Technology 10/2021
National First Prize & Excellent Defense, Top 4%

OTHER-RESEARCH-ACTIVITIES

Journalist Volunteer for School Invited Academic Speeches 03/2023-Present
I write 5-minute reading summary news of academic speeches for School Social Media Public Account

Student Memberships of many famous academic research communities 05/2022-Present
Student memberships of IEEE CSS, RAS, and virtual academic seminars hosted by CMU and UoT

SKILLS

Languages: Chinese (Native), English (IELTS: 7.0/9.0)
Programming: MATLAB & Simulink, Python, C, C++, R
Others: SolidWorks, CAD, Embedded System Development, Photo & Video Editing, LaTeX & Markdown

吴院学习&科研心得

- 吴院优势
  - 全英教学
    - 课本
    - Presentation & Poster & Symposium
  - GPA

吴院学习&科研心得

- 吴院优势
  - 课程培养体系(授课型和研究型Master)

General Admissions Information

Applications to the Mechanical Engineering (MechE) Graduate Program are accepted from persons who have completed, or will have completed by the time they arrive, a Bachelor's degree. Most incoming students will have a degree in mechanical engineering or ocean engineering. However, the department's admission criteria are not specific in this regard, and talented students with backgrounds in other branches of engineering or in science may apply.

To qualify for a graduate degree, applicants are expected to have at least an undergraduate-level exposure to most of the core MechE disciplines (solid mechanics, dynamics, fluid mechanics, thermodynamics, heat transfer, materials, control, design and manufacturing), and to be familiar with basic electric circuits and electromagnetic field theory. Admitted students who are deemed deficient in these areas may be asked to make up courses in certain areas before they graduate. The make-up courses may be at the undergraduate-level (in which case they are relatively elementary and usually cannot be applied toward graduate credit), or at the graduate-level (in which case they carry graduate credit).

The processing of applications for graduate study is done entirely by the Department. The MechE Graduate Admissions Officer, together with a faculty committee, reviews all applications, rank-orders them, and admits the number of applicants that the Department expects it can accommodate.

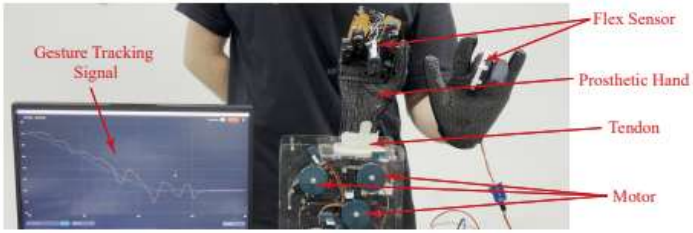
吴院学习&科研心得

- 吴院优势
  - 课程设计
    - 作品集高展示度

Course Projects

Keywords: mechanisms design and manufacturing, sensor technology, embedded system, control system.

Tendon-Driven and Flex Sensor Based Gesture Sensing Hand Exoskeleton: 10 motors are controlled to stretch tendons attached to the hand exoskeleton, achieving independent control of all five fingers. Moreover, flex sensors are fixed with fingers to measure their bending extent, providing gesture information, to construct the closed-loop gesture control of fingers.



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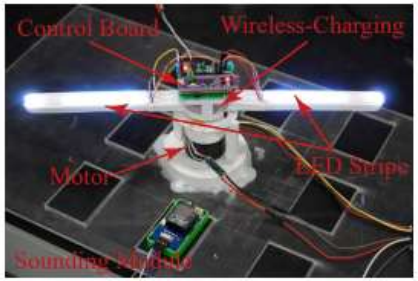

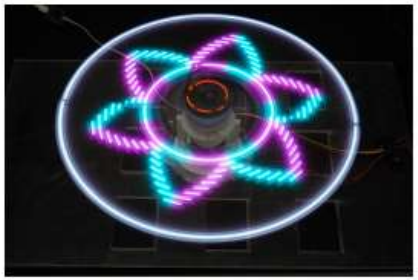

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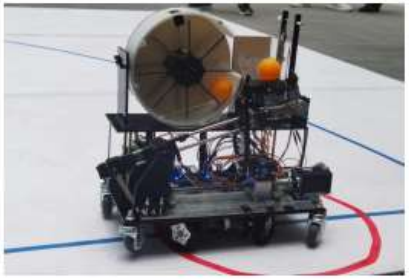

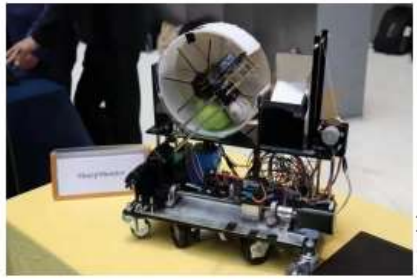

吴院学习&科研心得

- 吴院科研机会
  - 学校项目
    - 大创
    - SRP
    - 攀登计划…
  - 主动进组
- 科研产出与海外强推

吴院学习&科研心得

- 日常学习与科研之间的平衡
  - 课本学习与科研学习
  - 多线程管理（考试，课设，科研）
  - 科研投入时间，长期投入，主导课题
- 留学申请与国内升学（保研，考研）

谢谢大家!

Q&A