Chih-Chin (Zhijin) Liu

Email: lzj21@mails.tsinghua.edu.cn
Mobile: +86-13787328931
Personal Website: ChihChin-Liu.com

Education

Tsinghua University (Global Ranking 23) Beijing, China
Master in Mechanical Engineering; GPA: 3.73/4.0 *2021 - Expected June, 2024*
Department of Mechanical Engineering - Lab of Precision Equipment & Control

- ***Core Courses:*** *Introduction to Modern Control Theories and Methods, Advanced Numerical Analysis, Mechatronic Intelligent Control Engineering, Modern Mechatronics System.*
- ***Research Field:*** *Piezoelectric Actuator, Ultra-precision Control, Carbon material.*
- ***Scholarship:*** *Outstanding Postgraduate Award of Tsinghua University, Minor Award, 2022.*

Hunan University (Global Ranking 168) Changsha, China
Bachelor in Mechanical Engineering, GPA: 3.33/4.0 *2017 - 2021*
College of Mechanical & Vehicle Engineering - State Key Laboratory of Advanced Design

- ***Research Experiences:*** *Flexible Sensor, Fault Diagnosis, Deep learning*
- ***Scholarships:***
  - *Ministry of Education scholarship: Major Award - 2020, Minor Award - 2018, 2019.*
  - *Outstanding Undergraduate Students Award of Hunan University: Minor Award, 2020.*
  - *Individual outstanding (Research) scholarship of Human University, 2018*
- ***Honors:*** *Outstanding Graduation Design of Hunan University (Top 1%).*
  Outstanding Graduates of Hunan University, 2021.
  Outstanding Volunteer of Social Practice, National Cooperation Office.

Research and Projects

Research on Piezoelectric Nano-Precision Control 2021-2023, THU

- Proposed a novel nonlinearity compensation scheme that exhibits a comparative performance to the iterative learning control (ILC) without abundant time consuming off-line iterations or complex hysteresis model while augmenting the robustness to trajectory variations.
- A two-axis motion platform was built to further optimize the algorithm by taking the contour control error and attempting to further extend it to Atomic Force Microscopy (AFM).

An Ultrafast Low-Grade Coal Upgrade Approach 2021-2022, THU

- Proposed an ultrafast process to upgrade a low-grade coal - lignite into conductive porous material and successfully applied to solar-driven water treatment.
- The process eliminates the complex pre-activation processes in conventional approaches. The whole process takes only 30 s with an ultrafast heating rate exceeding 9000℃/min and a maximum temperature over 1500℃.
- The final product exhibits remarkable properties. Under 1 sun, its application to solar-driven water treatment brings a significant increase (∼8 times) in water evaporation rate than water itself, while exhibiting over 98.2% removal rate of contaminants.

A Small Parallel Cable-Driven Robot Based on TCPF 2021, THU

- Led three graduate students to complete the design and manufacturing of Twisted and Coiled Polymel Fiber (TCPF), a type of artificial muscle made by fish line.
- Combined it with small parallel robots to achieve the task such as handling, assembling and positioning. One paper has been published and the merits could be summarized as follows:
  - Large stroke: the deformation can reach to 35% of the length itself,
  - Large load: the maximum load can reach 50g without affecting the accuracy,
  - High energy density: only weighs 0.5g, but can afford more than 50g.

State Key Laboratory of Advanced Design and Manufactur 2020-2021, HNU

- The combination of CNN and attention mechanism is used to imporve the accuracy of segmentation of pigmented tumor images (The main work is data preprocessing and model porting).
- Under the casein sodium salt and polydopamine hydrogel system (SC-PDA), the material conductivity was improved by doping carbon black (GF≈10), and then has been applied to the human motion signals acquisition and robot remote control (Graduation Design).

Mechanical Fault Diagnosis Laboratory 2019-2020, HNU

- Conducted extensive research on fault diagnosis of rotating machinery, specializing in Wavelet Transform and Empirical Mode Decomposition (EMD).
- Acquired basic training in paper writing and research methodologies, demonstrating proficiency in experimental design and data analysis.

Geek Space Innovation Center, Department of Industrial Training 2018-2020, HNU

- Led a team of five students from diverse backgrounds in mechanical, electronic, and information engineering to successfully apply for and complete a two-year national student innovation project: *"Automatic Ash Cleaning Bird Pecking Moxibustion".*
- Secured a total funding of $5,000 for the project and Published 2 patents.

Publications and Patents

[1] **C. Liu**,, C. Hu, Z. Liu, H Han, Z. Wang, *"Small Parallel Cable-Driven Robot Based on TCPF Design and Control Research"[C]. 2022 IEEE RCAR: 118-123.* ***(Oral report, Best Paper in Control Finalist).***

[2] Z. Zhao, C. Hu, Z. Wang, S. Wu, **Z. Liu**, Y. Zhu, *"Back EMF-Based Dynamic Position Estimation in the Whole Speed Range for Precision Sensorless Control of PMLSM"[J]. IEEE Transactions on Industrial Informatics, 2022.*

[3] **C. Liu**, R. Chen, Y. Wei, Y. Huang, Z. Zhang, Y. Zhao, et al. *"Reconstructing the Nanoscale Porous Structures in Coal-based Membranes by Ultrafast High-Temperature Sintering for Solar-driven Water Treatment"[J]. Available at SSRN 4435592. Nano Energy, Revision Submitted to Journal.*

[4] **C. Liu**, C. Hu, et al. *"Model-free adaptive nonlinearity and hysteresis compensation control strategy with application to a nano-precision piezoelectric stage"[C]. 023 ASME IMECE, Under Review.*

[5] M. Zhang, J. Huang, Q. Li, **Z. Liu**, et al. *"Laser upgraded petroleum/coal tar for smart pavements towards road structural health and traffic monitoring applications"[J]. Nature Sustainability, Under Review.*

[6] J. Yu, C. Hu, Z. Wang, **Z. Liu**, et al. *"Printing Three-dimensional Refractory Metal Patterns in Ambient Air: Toward High Temperature Sensors"[J]. Advanced Science, Under Review.*

[7] C. Yin, J. Wu, J. Zhou, D. Zhang, **Z. Liu**, et al. *"Enhancing the sensitivity of flexible acoustic wave ultraviolet photodetector with graphene-quantum-dots decorated ZnO nanowires"[J]. Sensors and Actuators A: Physical.*

[8] **Z. Liu**, K. Zhao, W. Tian *"A moxibustion instrument with automatic cleaning"[P]. CN213608199U, 2021-07-06.*

Activities

Rural Revitalization Workstation, Detachment Leader July 2022, Xiangxiang, Hunan

- Led 20 members from 9 different universities to conduct field research in rural Hunan for 10 days.
- Produced 18 architectural renderings, 9 creative designs, 3 research works, 2 academic reports…
- Published 10 news and 2 videos, covered by social media 8 times with more than 20,000 reads.

Candidates for the Inheritors of Intangible Cultural Heritage 2021-, Xiangtan, Hunan

- Have been learning Face-changing in Sichuan Opera for more than one year.

Class Leader 2019-2021, Changsha, China

- Elected as the class leader serving 30 students at Hunan University.

Half Marathon Finisher Apr 2023, Beijing, China

Practical Skills

- **Languages** English (C1), Chinese (Native)
- **Coding** Python, C++, LaTeX
- **Software** MATLAB, Simulink, SolidWorks, Altium Designer

Referrers

- Supervisor: **Chuxiong Hu,** Associate Professor, Tsinghua University.
- Undergraduate Supervisor: **Huigao Duan,** Professor, Hunan University.