Chih-Chin (Zhijin) Liu

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Education

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

- ***Core Courses:*** *Modern Control Theories and Methods (4.0), Mechatronic Intelligent Control Engineering (4.0), Modern Mechatronics System (4.0).*
- ***Research Field:*** *Ultra-precision Control, Carbon material.*
- ***Scholarship:***
  - *Outstanding Postgraduate Award of Tsinghua University, Minor Award, 2022.*
  - *Outstanding Postgraduate Award of Tsinghua University, Grand Prize Candidate (Selecting,* ***Highest Honor for all Students****, 10 Persons in the school every year), 2023.*
  - *Outstanding Taiwan Graduate students Award of Ministry, Grand Prize (Selecting,* ***Highest Honor for Taiwan Students****, 4 Persons in the school every year), 2023.*

Hunan University (U.S.News Global Ranking 168) Changsha, China
Bachelor in Mechanical Engineering, GPA: 3.37/4.0 *2017 - 2021*
College of Mechanical & Vehicle Engineering - State Key Laboratory

- ***Research Experiences:*** *Flexible Sensor, Fault Diagnosis*
- ***Scholarships:***
  - *The Ministry of National Education scholarship: 2018, 2019, 2020.*
  - *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%)****, 2021.*
  Outstanding Graduates of Hunan University, 2021.
  Outstanding Volunteer of Social Practice, National Cooperation Office, 2021.

Research and Projects

Research on Piezoelectric Nano-Precision Control 2022 - 2024, 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 modeling while enhancing the robustness to trajectory variations.
- Two-axis motion platform was built to further optimize the contour control error while attempting further extend related algorithm to **Atomic Force Microscopy (AFM).**

Ultrafast Low-Grade Coal Upgrade 2022 - 2023, THU

- Proposed an ultrafast and environmental-friendly approach for upgrading low-grade coal into conductive nanoporous material and applying it to solar-driven water treatment.
- The approach eliminates complex pre-activation processes, which takes **only 30 s**, while the ultrafast heating rate exceeds **9000 °C/min,** with a maximum temperature over **1500 °C.**
- Under 1 sun, its final product brings a significant increase **(∼8 times)** in water evaporation rate than pure water, while exhibiting over **98.2%** removal rate of contaminants.

Developing a Small Parallel Cable-Driven Robot Based on TCPF Sept. - Dec. 2021, THU

- Led two graduate students through the design and fabrication of Twisted and Coiled Polymel Fiber (TCPF), **a type of artificial muscle made from fish line.**
- A Small Parallel Cable-Driven Robot based on TCPF with an overall dimension of $45 \times 50 \times 90$ mm^3 and a motion space of $20 \times 23 \times 16$ mm^3, has been controlled by Matlab and dSPACE.
- This Robot was driven by current and can perform precise tasks, such as micro assembling. The related paper was nominated as ***Best Paper Finalist in Control*** by *IEEE RCAR 2022.*

Undergraduate Experiences

State Key Laboratory of Advanced Design and Manufacturing for Vehicle 2019 - 2021, HNU

- The combination of CNN and attention mechanism has been used to improve the accuracy of segmentation of pigmented tumor images (Main work: Data Processing and Model Porting).
- Under the casein sodium salt and polydopamine hydrogel system (SC-PDA), the material conductivity has been 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 research and paper writing, 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**, 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."* *Nano Energy, 2023: 108634.*

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

[3] **C. Liu**, C. Hu, et al. *"Model-Free Adaptive Nonlinearity and Hysteresis Compensation Control Strategy with Application to a Nano-Precision Piezoelectric Stage."* *2023 IEEE ICCMA, Oral report.*

[4] **C. Liu**, K. Zhao, et al. *"A Moxibustion Instrument with Automatic Cleaning."* *CN213608199U. 2021.*

[5] **C. Liu**, C. Hu, Z. Wang, et al. *"Accelerated Iteration Algorithm Based Contouring Error Estimation for Piezoelectric Stage Control."* *In preparation, Expected Mar. 2024.*

[6] Z. Zhao, C. Hu, Z. Wang, S. Wu, **Z. Liu**, et al, *"Back EMF-Based Dynamic Position Estimation in the Whole Speed Range for Precision Sensorless Control of PMLSM."* *IEEE TII, 2022: 6525-6536.*

[7] J. Yu, C. Hu, Z. Wang, Y. Wei, **Z. Liu**, et al. *"Printing Three-dimensional Refractory Metal Patterns in Ambient Air: Toward High Temperature Sensors."* *Advanced Science, 2023: 2302479.*

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

Activities

Rural Revitalization Workstation, Detachment Leader Jul. 2022, Xiangxiang, Hunan

- Led 19 members from 10 different universities to conduct social and field research in rural Hunan.
- Produced 18 architectural renderings, 9 creative designs, 3 research works… Related outcomes are already in actual production and Xiangxiang became an important practice base of Tsinghua University.

Have been learning Face-changing for more than two years 2021 -, Xiangtan, Hunan

Practical Skills

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

References

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