Ziyan Zhao

Ph.D. Candidate in
Mechatronic Engineering

A803-3 Lee Shau Kee Science and Technology Building,
Tsinghua University, Haidian District, Beijing, China.
zhaoziyanTHU@gmail.com
https://zhaozy21.github.io
+86 188 1121 1889

Education

Department of Mechanical Engineering — **Tsinghua University**
Ph.D. in Mechatronic Engineering — **Aug. 2021 - Jun. 2026 (Expected)**

- **Ph.D. Supervisor**: Prof. Chuxiong Hu.
- **Fields of Interest**: Sensorless control; Motor drive; Robotics; Embedded development; Deep Reinforcement learning.

Department of Computer Science and Technology — **Tsinghua University**
Minor in Computer Science; GPA: 3.92/4.0. — **Aug. 2018 - Aug. 2021**

- **Main Courses**: C++ Programming; Data structures; Operating systems; Software Engineering; Computer Hardware Technology; Computer Networks;Fundamental Database; Computer Graphics;Introduction to Artificial Intelligence.

Department of Mechanical Engineering — **Tsinghua University**
Bachelor of Engineering, Mechanical Engineering. — **Aug. 2017 - Aug. 2021**

- **GPA**: 3.80/4.0; ranking 6 of 133.
- **Main Courses**: Mechanical Drawing; Design and Manufacturing; System Dynamics and Control; Robotics; Testing and Instrumentation; Mechatronic System Design; Product Engineering Design; Numerical Control Technology.

Honors and Awards

- **National Scholarship for Postgraduates (Top 2%)** — **Oct. 2023**
- **Best Paper Award** of *2023 IEEE Conference on Industrial Electronics and Applications* — **Aug. 2023**
- **First prize** of Tsinghua University Agent Competition (**2nd Place** of 100+ competitors) — **Mar. 2022**
- **Special Award** of Meituan Cup 23rd Electronic Design Competition (**1st Place**) — **Dec. 2021**
- **1st Place** of the 11th TI-Cup Tsinghua Digital System Innovation Design Competition — **Oct. 2021**
- **Tsinghua Future Scholar Scholarship** — **Aug. 2021**
- **Beijing Outstanding Undergraduate Award (Top 5%)** — **Jul. 2021**
- **Tsinghua Excellent Undergraduate Award (Top 10%)** — **Jun. 2021**
- **Excellent Graduation Thesis of Tsinghua University** — **Jun. 2021**
- **First prize** of Tsinghua University Hardware Design Competition (**Top 3 projects**) — **Sep. 2019**

Researches

Precision Mechatronics and Control Lab — **Tsinghua University**
Supervisor: Prof. Chuxiong Hu — **Beijing, China**

- **Research on Ideal Sensorless Control of IPMSM** — **Aug. 2022 - Jun. 2023**
  - Proposed the concept of "**ideal sensorless control (ISC)**", which aims to be applicable across the entire speed range, robust to motor parameter variations, and high in electrical efficiency.
  - Proposed a novel fundamental PWM excitation-based rotor position estimation algorithm that satisfies ISC and realized it using FPGA.
  - Experimental results demonstrate that the ISC offers superior advantages and can be more extensively applied in the field of servo control.
  - The proposed ISC method has the potential for integration with existing industrial systems.
- **Back EMF-based Sensorless Control in the Whole Speed Range** — **Aug. 2021 - Jun. 2022**
  - Sensorless control technology can reduce costs, simplify the system, and prolong the service life.

- Traditionally, the poor performance in the low-to-zero speed region limits the application range.
- Proposed a novel back EMF-based mover position estimator to achieve consistent good accuracy in the whole speed range including high speeds, low speeds, temporary standstill, and speed reversals.
- Built the entire sensorless drive and control system to verify the proposed algorithm.

INTERNSHIPS

3D Vision Hardware Group — **Mech-Mind Robotics**
Supervisor: Ting Wang — **Beijing, China**

- **Precision motion control of stepper motors for laser mirrors** — **Jun. 2021 - Sep. 2021**
  - Contributed to replacing traditional costly galvanometer motors with more more compact and economical stepper motors.
  - Deployed Iterative Learning Control (ILC) algorithms to achieve satisfactory scanning precision.
  - Conducted experiments on STM32 platforms to prove the efficacy of the proposed method.

ADDTIONAL EXPERIENCE & PROJECTS

- **SnakeGo — The 26th Tsinghua University Agent Competition (THUAC)** — **Mar. 2022**
  - Written thousands of lines AI code to enable the intelligent agent win a game named SnakeGo.
- **Resource Defense Battle — Meituan Cup 23rd Electronic Design Competition** — **Dec. 2021**
  - Crafted a smart car based on STM32 to compete for virtual resources on the game map.
- **Ceramic Additive-Subtractive Composite Manufacturing Equipment** — **Oct. 2021**
  - Designed a new ceramic manufacturing process, summarized as Extrusion-Curing-Milling.
  - Developed the Alpha prototype of the ceramic manufacturing equipment.
- **Performance Robot: Steel Tongue Drum Play** — **Dec. 2019**
  - Let the robotic arm play steel tongue drum using motion capture technology.

SKILLS

- **Languages**: Python; C++; C#; Java; Verilog HDL.
- **Modeling**: MATLAB; Simulink; AutoCAD; Solidworks; Unity3D.
- **Embedded development**: Linux; ROS; ARM; FPGA; PCB design & assembly.
- **AI**: Common deep learning frameworks.

PUBLICATIONS

[1] **Z. Zhao**, C. Hu, S. Wu, Y. Wang, Z. Wang and Y. Zhu, "A Novel Fundamental PWM Excitation-Based Rotor Position Estimation Method for Precision Sensorless Control of IPMSMs," 2023 IEEE 18th Conference on Industrial Electronics and Applications (ICIEA), Ningbo, China, 2023, pp. 28-33, doi: 10.1109/ICIEA58696.2023.10241791. **(Best Paper Award)**

[2] **Z. Zhao**, C. Hu, Z. Wang, S. Wu, Z. Liu and Y. Zhu, "Back EMF-Based Dynamic Position Estimation in the Whole Speed Range for Precision Sensorless Control of PMLSM," IEEE Transactions on Industrial Informatics, vol. 19, no. 5, pp. 6525-6536, May 2023, doi: 10.1109/TII.2022.3205941. **(IF=12.3)**

[3] S. Wu, C. Hu, **Z. Zhao** and Y. Zhu, "High-Accuracy Sensorless Control of Permanent Magnet Linear Synchronous Motors for Variable Speed Trajectories," IEEE Transactions on Industrial Electronics, vol. 71, no. 5, pp. 4396-4406, May 2024, doi: 10.1109/TIE.2023.3288145.

[4] S. Wu, C. Hu, **Z. Zhao**, R. Zhou and Y. Zhu, "A Novel Flux Estimator Using $\alpha - \beta$ Orthogonality Drift Elimination for High Performance Full-Speed-Range Sensorless Control," 2022 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM), Sapporo, Japan, 2022, pp. 1315-1320, doi: 10.1109/AIM52237.2022.9863297.

[5] Y. Wang, C. Hu, Z. Wang, S. Lin, **Z. Zhao**, W. Zhao, K. Hu, Z. Huang, Y. Zhu, Z. Lu, "Optimization-based non-equidistant toolpath planning for robotic additive manufacturing with non-underfill orientation," Robotics and Computer-Integrated Manufacturing, 2023, doi:10.1016/j.rcim.2023.102599.