Name Chen-Ning Tai (戴承寧)

Birthdate 12 June 1999 in Darmstadt, Germany

Hometown Tainan City, Taiwan

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Research Interests

Computational Mechanics: Coupling of Multiphysics Problems, Phase-Field Method, GPU-CUDA (Compute Unified Device Architecture) High-Performance Computing

Robotics: Dynamic Simulation, Digital Twins, ROS, Computer Vision

Degrees

Jul. 2022 – Jul. 2023

National Taiwan University (NTU), Taiwan, M.Sc. Degree in *Institute of Applied Mechanics (IAM)*

Thesis: "Influence of Transport Properties of Highly Concentrated Electrolytes on Li-Dendrite Growth". *Published in Journal of Energy Storage (SCI, Q1)*
Advisors: Prof. Chih-Hung Chen, IAM, NTU & Prof. Kuo-Ching Chen, IAM, NTU.

- Developed a numerical multi-physics phase-field model implemented in the C language using the CUDA platform for high-performance computing.
- Systematically discussed the influence of concentration-dependent transport properties on Li-plating stability and dendrite patterns, with a
- Derived an analytical solution of Li-ion concentration distribution for concentration-dependent diffusivity.

Coursework: Applied Mathematics, Dynamics, Linear Algebra & Its Applications, Introduction to CUDA Parallel Programming (Audited)

Sep. 2017 – Jun. 2021

National Taiwan University, Taiwan, B.Sc. Degree in *Department of Mechanical Engineering (ME)*

Coursework: Automatic Control, Digital Control System, System Dynamics, Applied Electronics, CAE Drawing, Introduction to Machine Learning and Deep Learning, Data Structure

Research Experience

Mar. 2024 – Present

Research Assistant, Development of Biosafety Level 3 (BSL-3) Modular/Automated System

Biomedical Translation Research Center (BioTReC), Academia Sinica, Taiwan

- Integrating the Action Chunking Transformer (ACT) within the Robot Operating System (ROS) framework to enable the robotic arms to perform complex tasks.
- Planned the automated experimental procedures & emergency handling protocols of the BSL-3 modular/automated system.
- Developed a fully automated microscope system, enabling auto-focus and xy-localization, incorporating MQTT communication functionality. And developed robust automated cell counting through active learning model based on CNN.

Jun. 2021 – Jun. 2022

Research Assistant, Robotics Lab

Department of Mechanical Engineering, National Taiwan University, Taiwan

- Assembled and calibrated a humanoid five-finger robotic hand and proposed co-simulation of the robotic hand using MATLAB, Simulink, and Adams.
- Assisted in developing a humanoid dual-arm and five-finger-hand system, implementing cooperative control of robotic arms with redundant kinematic degrees of freedom.

Publications

Journal Paper

- C.-J. Ko, **C.-N. Tai**, C.-H. Chen, and K.-C. Chen, "Influence of concentration-dependent diffusivity on lithium plating: Polarization, stability, and dendrite formation in phase-field simulations," *Journal of Energy Storage*, vol. 97, p. 112615, 2024, doi: https://doi.org/10.1016/j.est.2024.112615.

Honors

Dean's Award
Excellent Master Thesis of the College of Engineering, National Taiwan University

Excellence Award
2020 AIoT Technology Development and Platform Application Competition.
Work: Tangible Light, https://projecthub.arduino.cc/chenningtai/ab44e666-34d6-4b34-b7df-a9847f84bb7c.

Selected Projects

Propeller-driven Autonomous Car
ME Capstone project @ ME, NTU *Feb. 2020- Jun. 2020*

- Collaborated with a team of five to develop a propeller-driven car with autonomous line-tracing, obstacle avoidance, and overtaking capabilities.
- Applied DFM (Design for Manufacturing) and kept the budget under $100 to design the car chassis, propeller-driven system, brake system, and steering system using CAD (Computer-Aided Design), 3D printing, and laser cutting.

Verilator-Aided Circuit Tester
Special Project @ EE, NTU, Advisor: Prof. Jiun-Lang Huang *Sep. 2019- Jun. 2020*
GitHub: https://github.com/ChenningTai/Verilator-Aided-Circuit-Tester

- Developed a C++-based circuit-testing tool capable of real-time simulation of circuit behavior described by hardware description language (HDL).
- Utilized the open-source project 'Verilator' to efficiently simulate HDL logic with C++.

Medical System Automation
Special Project @ ME, NTU, Advisor: Prof. Hao-Ming Hsiao *Feb. 2019- Jun. 2019*
GitHub: https://github.com/ChenningTai/Roi-Tracer

- Developed an eye-tracking system using a standard webcam, implementing pupil localization with morphological operations, a border-following algorithm, and a low-pass filter for robust tracking.
- Engineered cardiovascular stents, focusing on improving their structural integrity and performance. Employed FEA (Finite Element Analysis) in ABAQUS to evaluate the stress-strain behavior of the stents under severe deformation conditions.

Logic Simulation
Computer Programming Course Project @ EE, NTU *Dec. 2018- Jan. 2019*

- Collaborated with a team of three to develop a logic simulator in Python Language.
- Utilized Python's integer arithmetic overflow-free feature to implement parallel computing, enhancing simulation efficiency by over 100 times compared to the traditional approach, and won 1st place in final efficiency evaluation.

Languages

English: *Fluent (GEPT High-Intermediate)*
German: *Intermediate (GOETHE-ZERTIFIKAT B1)*
Chinese: *Mother language*

Computer Skills

Languages: C/C++, C#, Python, CUDA, ROS, Arduino, MATLAB

Libraries & Tools: PyTorch, TensorFlow, Scikit-Learn, Matplotlib, OpenCV, AForge, Simulink, Git, LaTeX

Mechanical Design: 2D/3D CAD, Solidworks, Inventor, Adams, Abaqus