

TERENCE SHENGYU TAO

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Homepage | Google Scholar | LinkedIn | Research Gate | GitHub| ORCID

EMPLOYMENT

Chalmers University of Technology

Researcher affiliated with Department of Electrical Engineering

Gothenburg, Sweden

Sept. 2025 - now

EDUCATION

Tsinghua University Advised by Prof. Guangmin Zhou & Xuan Zhang

Ph.D. student in Electrical Engineering GPA: 3.9/4.0

Beijing, China

Sept. 2022 - 2025

University of California, Berkeley Advised by Prof. Scott J. Moura

Ph.D. student in Energy, Controls and Applications Lab (eCAL)

California, U.S.A.

Sept. 2024 - 2025

Fudan University Supervised by Prof. Yaojie Sun

M.S. Electrical and Control Engineering(with honors) GPA: 3.85/4.0 (1/64)

Shanghai, China

Sept. 2019 - Jun. 2022

Shanghai Ocean University Supervised by Prof. Yue Zhou

B.S. Electrical and Control Engineering (with honors) GPA: 3.95/4.0 (1/62)

Shanghai, China

Sept. 2015 - Jun. 2019

RESEARCH INTEREST

Keywords: Batteries | Energy Systems | AI for Science | AI for Sustainability | Controls.

Research in one sentence: AI for sustainable re-manufacturing, reusing, recycling of retired energy storage systems (batteries), for second-life applications and critical material recycling.

Method in one sentence: Data-driven battery modeling, state estimation, diagnosis, and prognosis under limited and heterogeneous data availability.

PAST WORK EXPERIENCE

Microsoft Research Asia Research Intern in Innovation Center

Topic: Physics based battery cycling data generation and foundational model

Beijing, China

May 2024 - Nov. 2024

Tencent AI Lab Research Intern in Scientific Large Model Group

Topic: Generative AI for battery modeling, and states estimations

Shenzhen, China

Sept. 2023 - May 2024

PUBLICATION

Batteries:

[J.Bat.15] **Tao, S.** *et al.*, Immediate remaining capacity estimation of heterogeneous second-life lithium-ion batteries via deep generative transfer learning. *Energy Environ. Sci.*, 2025,**18**, 7413-7426

<https://pubs.rsc.org/en/content/articlelanding/2025/ee/d5ee02217g>, **COVER PAPER, CODE**, selected as *HOT Paper 2025*

[J.Bat.14] **Tao, S.#**, Zhao, Z.#, Zhang, M.#, *et al.*, Non-destructive degradation pattern decoupling for early battery trajectory prediction via physics-informed learning. *Energy Environ. Sci.*, 2025,**18**, 1544-1559

<https://doi.org/10.1039/D4EE03839H>, **COVER PAPER, DATASETS, CODE**

[J.Bat.13] **Tao, S.#**, Ma, R.#, Zhao, Z.# *et al.* Generative learning assisted state-of-health estimation for sustainable battery recycling with random retirement conditions. *Nat. Commun.* **15**, 10154 (2024).

<https://doi.org/10.1038/s41467-024-54454-0>, **DATASETS, CODE**

[J.Bat.12] **Tao, S.** *et al.* Rapid and sustainable battery health diagnosis for recycling pretreatment using fast pulse test and random forest machine learning. *J. of Power Sources* **597**, 234156 (2024). <https://doi.org/10.1016/j.jpowsour.2024.234156>

[J.Bat.11] **Tao, S.**, Liu, H., Sun, C. *et al.* Collaborative and privacy-preserving retired battery sorting for profitable direct recycling via federated machine learning. *Nat. Commun.* **14**, 8032 (2023). <https://doi.org/10.1038/s41467-023-43883-y>, selected as *Editor's highlight* paper and the *Focus* paper

[J.Bat.10] Ma, R.#, **Tao, S.#** *et al.* Pathway decisions for reuse and recycling of retired lithium-ion batteries considering economic and environmental functions. *Nat. Commun.* **15**, 7641 (2024). <https://doi.org/10.1038/s41467-024-52030-0>, **COLLECTION, DATASETS+CODE**

[J.Bat.9] **Tao, S.**, Sun, C., Fu, S. *et al.* Battery Cross-Operation-Condition Lifetime Prediction via Interpretable Feature

Engineering Assisted Adaptive Machine Learning. *ACS Energy Lett.* **8**, 3269-3279 (2023).
<https://pubs.acs.org/doi/10.1021/acsenerylett.3c01012>

[J.Bat.8] **Tao, S.** *et al.* PulseBat: A field-accessible dataset for second-life battery diagnostics from realistic histories using multidimensional rapid pulse test. *arXiv*. <https://arxiv.org/abs/2502.16848>

[J.Bat.7] **Tao, S.** *et al.* The proactive maintenance for the irreversible sulfation in lead-based energy storage systems with a novel resonance method. *J. of Energy Storage* **42**, 103093 (2021). <https://doi.org/10.1016/j.est.2021.103093>

[J.Bat.6] Liang, C#, **Tao, S.#** *et al.* Stochastic state of health estimation for lithium-ion batteries with automated feature fusion using quantum convolutional neural network. *J. of Energy Chem.* **106**, 205-219 (2025).
<https://doi.org/10.1016/j.jechem.2025.02.030>

[J.Bat.5] Huang, X#, **Tao, S.#** *et al.* Robust and generalizable lithium-ion battery health estimation using multi-scale field data decomposition and fusion. *J. of Power Sources* **642**, 236939 (2025). <https://doi.org/10.1016/j.jpowsour.2025.236939>

[J.Bat.4] Guo, R Zhang, K., He, S., **Tao, S.** *et al.* Robust Health Monitoring for Lithium-Ion Batteries under Guidance of Proxy Labels: A Deep Multi-Task Learning Approach. *IEEE Transactions on Power Electronics* 1-12 (2025).
<https://doi.org/10.1109/TPEL.2025.3553956>

[J.Bat.3] Fu, S#, **Tao, S.#** *et al.* Data-driven capacity estimation for lithium-ion batteries with feature matching based transfer learning method. *Appl. Energy* **353**, 121991 (2024). <https://doi.org/10.1016/j.apenergy.2023.121991>

[J.Bat.2] Liu, X.#, **Tao, S.#** *et al.* Binary multi-frequency signal for accurate and rapid electrochemical impedance spectroscopy acquisition in lithium-ion batteries. *Appl. Energy* **364**, 123221 (2024).
<https://doi.org/10.1016/j.apenergy.2024.123221>

[J.Bat.1] He, K.#, **Tao, S.#** *et al.* A Novel Quick Screening Method for the Second Usage of Parallel-connected Lithium-ion Cells Based on the Current Distribution. *J. of Electrochem. Soc.* **170**, 030514 (2023).
<https://iopscience.iop.org/article/10.1149/1945-7111/acbf7e>

Energy Systems:

[S.EnerSys.1] Shi, J., Aarsnes, U., **Tao, S.***, Scott Moura *et al.*, Health-Aware Energy Management for Multiple Stack Hydrogen Fuel Cell and Battery Hybrid Systems. *Appl. Energy* **397**, 126257 (2025).
<https://doi.org/10.1016/j.apenergy.2025.126257>

[J.EnerSys.10] Talihati, B.#, **Tao, S.#** *et al.* Energy storage sharing in residential communities with controllable loads for enhanced operational efficiency and profitability. *Appl. Energy* **373**, 123880 (2024).
<https://doi.org/10.1016/j.apenergy.2024.123880>

[J.EnerSys.9] Wang, Y., Wu, Q., Li, Z., **Tao, S.** *et al.* Federated Multi-Agent Deep Reinforcement Learning-Based Competitive Pricing Strategy for Charging Station Operators. *IEEE Transactions on Energy Markets, Policy and Regulation* 1-13 (2025). <https://doi.org/10.1109/TEMPR.2025.3558414>

[J.EnerSys.8] T. Cao, Y. Xu, G. Liu, **Tao, S.** *et al.* Feature-enhanced deep learning method for electric vehicle charging demand probabilistic forecasting of charging station. *Appl. Energy* **371**, 123751 (2024).
<https://doi.org/10.1016/j.apenergy.2024.123751>

[J.EnerSys.7] Xu, J., *other authors*, **Tao, S.**, Sun, H., *et al.* Energy efficiency and carbon savings via a body grid. *Communications Engineering* **4**, 27 (2025). <https://doi.org/10.1038/s44172-025-00366-w>

[J.EnerSys.6] Li, T.#, **Tao, S.#** *et al.* V2G Multi-Objective Dispatching Optimization Strategy Based on User Behavior Model. *Frontiers in Energy Research* **9** (2021). <https://doi.org/10.3389/fenrg.2021.739527>

[J.EnerSys.5] Hu, M.#, **Tao, S.#** *et al.* Non-Intrusive Load Monitoring for Residential Appliances with Ultra-Sparse Sample and Real-Time Computation. *Sensors* **21**, 5366 (2021). <https://www.mdpi.com/1424-8220/21/16/5366>

[J.EnerSys.4] **Tao, S.** *et al.* Behavioral Economics Optimized Renewable Power Grid: A Case Study of Household Energy Storage. *Energies* **14**, 4154 (2021). <https://www.mdpi.com/1996-1073/14/14/4154>

[J.EnerSys.3] Pan, C.#, **Tao, S.#** *et al.* Multi-objective optimization of a battery-supercapacitor hybrid energy storage system based on the concept of cyber-physical system. *Electronics* **10**, 1801 (2021).
<https://www.mdpi.com/2079-9292/10/15/1801>

[J.EnerSys.2] Li, T.#, **Tao, S.#** *et al.* Reliability evaluation of photovoltaic system considering inverter thermal

characteristics. *Electronics* **10**, 1763 (2021). <https://www.mdpi.com/2079-9292/10/15/1763>

[J.EnerSys.1] Xu, Z.#, **Tao, S.#** *et al.* Power Limit Control Strategy for Household Photovoltaic and Energy Storage Inverter. *Electronics* **10**, 1704 (2021). <https://www.mdpi.com/2079-9292/10/14/1704>

AI for Science:

[J.AI4Sci.3] Han, Z.#, **Tao, S.#**, Jia, Y., *et al.*, Data-driven insight into the universal structure-property relationship of catalysts in lithium-sulfur batteries. *J. Am. Chem. Soc.*, **147**, 26, 22851–22863 (2025).

<https://doi.org/10.1021/jacs.5c04960>

[J.AI4Sci.2] Piao, Z., Han, Z., and **Tao, S.#**, *et al.* Deciphering failure paths in lithium metal anodes by electrochemical curve fingerprints. *National Science Review* (2025),

<https://academic.oup.com/nsr/advance-article/doi/10.1093/nsr/nwaf158/8119407>, selected as **Cover Paper**

[J.AI4Sci.1] Han, Z., Gao, R., Wang, T., **Tao, S.** *et al.* Machine-learning-assisted design of a binary descriptor to decipher electronic and structural effects on sulfur reduction kinetics. *Nat. Catal.* **6**, 1073-1086 (2023).

<https://doi.org/10.1038/s41929-023-01041-z>, **COVER PAPER**

Submitted Papers:

Batteries:

[S.Bat.1] Su, L., **Tao, S.**, *et al.*, Generalized data sufficiency of battery degradation trajectory predictability and transferability. 1st revision at *Cell Reports Physical Science*

Controls:

[S.Contr.1] Shi, J., Jiang, S., **Tao, S.***, Scott Moura *et al.*, Robust and Real-time LFP Battery SOC Estimation with Hysteresis Effect using Adaptive Fisher Information Fusion. Under review at *J. of Energy Storage*

AI for Sustainability:

[S.AI4Sus.1] **Tao, S.**, *et al.*, Artificial intelligence for sustainable battery reusing, recycling, and remanufacturing. Submitted to *formally working with the editors, under review at Nat. Rev. Clean Technol.*

AI for Science:

[S.AI4Sci.1] Gao, R., Zhu, Y., **Tao, S.** *et al.*, Programming effective pre-mediators in sulfur electrochemistry with intelligent molecular skeleton design. 1st revision at *Nature*.

Selected Conference Papers:

[C9] **Tao, S.**, *et al.* Empirical Analysis of Energy Drift in Battery Energy Storage Systems on Supporting Grid Frequency Stability, The 51st Annual Conference of the IEEE Industrial Electronics Society (IECON 2025), as **Oral Presentation**.

[C8] Chen, Y.#, **Tao, S.#**, *et al.* Lithium-ion Battery Degradation Curve Prediction Based on Multipartite Gaussian Process Regression, IEEE 7th Conference on Energy Internet and Energy System Integration (EI2), 1-7, 2023.

[C7] Hu, M.#, **Tao, S.#**, *et al.* A Data-Driven Approach for Lithium-ion Battery Lifetime Classification Based on Early Cycles, IEEE 7th Conference on Energy Internet and Energy System Integration (EI2), 2208-2213, 2023.

[C6] **Tao, S.**, Collaborative and privacy-preserving retired battery sorting for profitable direct recycling via federated machine learning, **Best Paper, and Best Oral presentation** at closing ceremony of International Carbon Neutrality Forum for Doctoral Students, Tsinghua University, 2023.

[C5] **Tao, S.**, Generating the voltage response of retired batteries for data augmentation from pulse test using variational autoencoder, **Best Paper, and Best Oral presentation** at New Energy Science and Electrification of Transportation International Conference, Elsevier, eTransportation, 2023.

[C4] Li, T.#, **Tao, S.#**, *et al.* Multi-objective optimal dispatching of electric vehicle cluster considering user demand response, IEEE 4th International Conference on Electronics Technology (ICET), 1003-1008, 2021.

[C3] Zhang, Y.#, **Tao, S.#**, *et al.* Power System Optimization Based on Behavioral Economics: The Case of Household Battery Storage, IEEE 4th International Conference on Electronics Technology (ICET), 383-388, 2021.

[C2] Zhang, Y., Yuan, M., Mao, Z., **Tao, S.** *et al.*, Research on Behavior Incentives of User-side Battery by Behavioral Economics. IEEE 4th International Conference on Energy, Electrical and Power Engineering (CEEPE), 108-114, 2021.

[C1] Li, T.#, **Tao, S.#** *et al.*, Behaviorally Realistic Model for Analyzing the Effect of V2G Participation, IEEE 4th

International Conference on Energy, Electrical and Power Engineering (CEEPE), 1229-1235, 2021.

AWARDS & PROJECTS

PulseRenew: Rapid pulse diagnostics for the reusing and recycling of lithium batteries, *Silver Medal* at the 50th Geneva Inventions Exhibition April. 2025

Youth Talent Support Program (Doctoral Students) by CAST and SAE, Advised by Professor Minggao Ouyang (Tsinghua University) and Professor Jianguo Zhu (Tongji University) (**40,000 Yuan Granted**) Jan. 2025

Large Scale Rapid Internal State Estimation Technology and Applications for Sustainable Utilization of Retired Batteries, *First Prize* at the 3rd China Postgraduate “Carbon Peak and Carbon Neutrality” Innovation and Creativity Competition November. 2024

Tsinghua Presidential Scholarship (**0.01%, finalist, 20,000 Yuan Granted**) Nov. 2024

National Scholarship (Doctoral Students) (**1%, 30,000 Yuan Granted**) Oct. 2024

Tsinghua-Berkeley Future Leader Scholarship (**1%, 50,000 Yuan Granted**) Aug. 2024

TEACHING EXPERIENCES

Teaching Assistant of Berkeley Energy & Resources Collaborative (BERC) at UC Berkeley Sept. 2024 - Now

Teaching Assistant of Optimization Theory and Machine Learning at UC Berkeley Mar. 2024 - Jun. 2024

Teaching Assistant of Introduction to Energy Informatics at Tsinghua University Sept. 2023 - Dec.2023

COMMUNITY SERVICES

Reviewer: Nature Communications; Joule, Energy & Environmental Science, Journal of Energy Chemistry; ACS Energy Letters; Energy Storage Materials, Journal of Power Sources; Advances in Applied Energy; Journal of Industrial Information Integration, Chemical Engineering Journal, EES Batteries, etc. Sept. 2022 - Now

Guest Editor of Special issue: Advanced Control and AI Methods for Future Battery Diagnostics and Prognostics, *Electronics*, Multidisciplinary Digital Publishing Institute April. 2025 - Now

Guest Editor of Special issue: Revolutionizing Battery Materials Discovery - Advanced Characterization and AI-Driven Data Analysis, *Frontiers in Batteries and Electrochemistry*, August. 2025 - Now

Forum Convener for **Early Career Researchers** in the battery diagnostics and prognostics community: AI-enabled battery life cycle management: from R&D and manufacturing, primary life to secondary life Jun. 2025(expected)

Member Chinese Society of Automotive Engineers Jan 2025 - Now

Graduate Student Member IEEE May 2019 - Now

TECHNIQUES

battery modeling, battery testing, life cycle assessment, machine learning, state estimation, reliability engineering

SOFTWARE

Python, Matlab, C, Hardware-in-the-loop, Keil

LANGUAGES

Fluent English, Chinese

REFERENCE

Prof. Dr. Xuan Zhang, Tsinghua University, PhD advisor, xuanzhang@sz.tsinghua.edu.cn

Prof. Dr. Scott Moura, UC Berkeley, PhD advisor, smoura@berkeley.edu

Prof. Dr. Guangmin Zhou, Tsinghua University, PhD co-advisor, guangminzhou@sz.tsinghua.edu.cn

Prof. Dr. Xiaosong Hu, Chongqing University, Academic collaborator, xiaosonghu@ieee.org

Prof. Dr.-Ing. Weihai Li, RWTH Aachen University, Academic collaborator, weihai.li@isea.rwth-aachen.de

Prof. Dr.-Ing. Dirk Uwe Sauer, RWTH Aachen University, Academic collaborator, dirkuwe.sauer@isea.rwth-aachen.de

Prof. Dr. Changfu Zou, Chalmers University of Technology, Academic collaborator, changfu.zou@chalmers.se