Yanbing Dai

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Research Interests

My focus is on utilizing mathematical and computational tools to improve machines throughout their lifecycle, from design and production to long-term reliability. The recent advancements in generative AI have strengthened my belief in its potential applications in engineering. I'm excited to be part of this rapidly evolving field.

Education

Xi'an Jiaotong University(XJTU, Top 10 in China) — **Xi'an, China**

M.S. in Power Engineering (GPA: 3.87/4.00, Top 10%) — Sep 2022 - Jun 2025

B.E. in Power Engineering (GPA: 3.50/4.00) — Sep 2017 - Jun 2021

Publications

1. X. Han, **Y. Dai**, X. Guo, K. Braimakis, S. Karellas, J. Yan. A novel dual-stage intercooled and recuperative gas turbine system integrated with transcritical organic Rankine cycle: System modeling, energy and exergy analyses. *Energy (1st Revision, Under Review, 2024).* [preprint]
2. M. Su, X. Han, **Y. Dai**, J. Wang, J. Liu, J. Yan. Investigation on recirculated regenerative solid desiccant-assisted dehumidification system: Impact of system configurations and desiccant materials. *Energy*, 2024, 286: 129629. [Journal article]
3. X. Han, T. Yuan, D. Zhang, **Y. Dai**, J. Wang, J. Liu, J. Yan. Waste heat utilization from boiler exhaust gases for zero liquid discharge of desulphurization wastewater in coal-fired power plants: Thermodynamic and economic analysis. *Journal of Cleaner Production*, 2021, 308: 127328. [Journal Article]
4. X. Han, **Y. Dai**, X. Guo, K. Braimakis, S. Karellas, J. Yan. Thermodynamic analysis of a novel dual-stage intercooled and recuperative gas turbine-transcritical organic Rankine cycle power generation system. *3rd International Conference for Global Chinese Academia on Energy and Built Environment*, Shanghai, China, Jul 29-31, 2023. [Conference Paper]
5. M. Su, X. Han, **Y. Dai**, J. Wang, J. Liu, J. Yan. Investigation on recirculated regenerative solid desiccant-assisted dehumidification system: Impact of system configurations and desiccant materials. *3rd International Conference for Global Chinese Academia on Energy and Built Environment*, Shanghai, China, Jul 29-31, 2023. [Conference Paper]
6. X. Han, **Y. Dai**, T. Yuan, D. Zhang, J. Liu, J. Yan. Thermodynamic and techno-economic analysis of solar-steam hybrid driven flue gas desulfurization wastewater zero liquid discharge system. *12th International Conference on Applied Energy*, Bangkok, Thailand, Dec 1-10, 2020. [Conference Paper]

Research Experience

Generating High-quality HSR Vibration Signals via Diffusion Model

Advisor: **Prof. Jinglong Chen** — May 2023 - Oct 2023

- Explore the use of cross-modal control data, such as voltage or current, to guide the generation of realistic high-speed railway (HSR) bogie vibration signals.
- Propose a Voltage-Guided Conditional Diffusion Model (VGCDM) for generating vibration signals, where solely sampling control voltages efficiently transforms Gaussian Noise into vibration signals.
- Conduct experiments to assess the generated performance using frequency spectrum similarity (FSCS), achieving an FSCS of over 0.7 for steady speeds and 0.6 for variable speeds.

Intelligent Fault Diagnosis via Dynamic Unsupervised Imbalanced Domain Adaptation

Advisor: **Prof. Jinglong Chen** Sep 2022 - Feb 2023

- Explore solutions to adapting diagnostic models in unlabeled and imbalanced scenarios across various operational conditions.
- Propose a Dynamic Unsupervised Imbalanced Domain Adaptation (DUIDA) approach for diagnostic algorithms, incorporating Sample and Margin Regularization.
- Employ dynamic mechanisms to balance distance metrics and discriminator functions for stable training and sustained generalization
- Utilize label-aware regularization and a rebalancing strategy to refine decision-making boundaries, enhancing generalization for less-represented faulty classes.
- Conduct experiments to evaluate classification performance across various speeds or loads, achieving over 95% accuracy in detecting unseen faulty patterns under 3 imbalanced modes.

Cross-domain Diagnosis Augmented by Explicit Weight Strategy based on Meta Data

Advisor: **Prof. Jinglong Chen** Sep 2021 - May 2022

- Explore addressing the challenges of imbalance over-fitting in cross-domain deployment of diagnostic model.
- Propose a Transfer Residual Network with an Explicit Weight Self-assignment Strategy(TRN-EWM).
- Train a MLP by labeled meta data to learn a mapping from loss to sample weights, optimizing model parameters for re-balancing majority normal and minority faulty samples weights.
- Conduct experiments to evaluate classification performance across bearing dataset, achieving an over 15% improvement in classification accuracy under three types of imbalanced ratios (0.1, 0.2, 0.3).

Selected Projects and Competitions

Low-Cost Remote Control Servo Quadruped Robot Nov. 2020 - Jan. 2021

Product Design and Development Course, advised by **Prof. Dun Lv**

- Deploy an eight-servo quadrupedal gait with pitch control.
- Implement a bluetooth-enabled remote control system with a corresponding mobile application.
- Mechanism design (via Solidworks) and fabrication (via 3D print).

Indoor Assistive Robot for Elderly People Aug. 2019 - Nov. 2020

Role: Leader, Mechanism Design, co-advised by **Sr. Eng. Liang Gui**

- National 1^{st} Prize in National College Student Mechanical Design Innovation Competition.
- Design a biomimetic flexible protection mechanism that adapts to fit the human back for protection.
- Design a lifting mechanism(via Solidworks) suitable for the natural curvature of human body and Check mechanical strength(via Ansys).

RoboCon China College Robot Competition Sept. 2018 - Jun. 2019

Role: Mechanism Design, advised by **Prof. Jun Xu**

- National 1^{st} Prize of RoboCon China College Robot Competition.
- Design and fabricate two competition-ready robots (Including wheeled mobility, obstacle navigation, and projectile tasks, achieving all tasks under 1 min).
- Mechanism design(via Solidworks, AutoCad) and fabrication (via 3D print, CNC).

Working Experience

Teaching Assistant **Xi'an, Shaanxi**

Modern Signal Processing Techniques and Its Applications Sep 2023 - Present

- Daily course Q&A; Send and receive assignments
- Grade assignments, quizzes, and finals

Honors and Awards

QU&HE Fault Diagnosis Scholarship 2021

Outstanding Graduate Student, Xi'an Jiaotong University 2021

SMC Scholarships, SMC 2019

School Scholarships, Xi'an Jiaotong University 2018, 2020, 2022

Merit Student, Xi'an Jiaotong University 2018, 2020

Service

Educator Volunteer, Junior High, Shangluo, Henan 2022

University Admissions Assistant, Xi'an Jiaotong University 2021

Class Student Representative 2019

Outstanding "C9+100" Educator Volunteer, Junior High, Liantang, Jiangxi 2018

Skills

Programming	Python (PyTorch, TensorFlow), MATLAB, LaTeX, C/C++, Linux (Ubuntu)
Mechanical Design	SolidWorks, AutoCAD, Inventor, ANSYS
Languages	Mandarin (Native), English (Fluent, TOEFL: 92)