Yuan JIANG

Ph.D. Candidate, Industrial & Enterprise Systems Engineering
University of Illinois Urbana-Champaign, IL, USA
(+1) 217-693-8624 yuanj5@illinois.edu https://yuanjiang-lance.github.io Google Scholar

My research aims to develop physics-informed digital twins for safety-critical engineering systems, integrating multi-physics modeling, data-efficient machine learning, and uncertainty-aware decision-making. I focus on energy storage, aerospace propulsion, additive manufacturing, and electro-mechanical systems, with applications in reliability assessment, prognostics, condition monitoring, and design optimization.

Education

University of Illinois Urbana-Champaign — **Urbana, IL, USA**
Ph.D., Industrial Engineering — Aug 2023 – May 2027 (Expected)
Advisor: Prof. Pingfeng Wang

Tongji University — **Shanghai, China**
M.Sc., Vehicle Engineering — Sep 2020 – Jun 2023
Advisor: Prof. Gang Niu
Thesis: Time-frequency feature extraction and health monitoring of rail short-pitch damage

Tongji University — **Shanghai, China**
B.Sc., Vehicle Engineering — Sep 2015 – Jul 2020

Research Interests

- Physics-informed machine learning and neural operator methods for multi-physics systems
- Digital twins and multi-fidelity modeling for reliability, safety, and life prediction of engineering systems
- Prognostics and health management under uncertainty for energy, aerospace, and manufacturing systems
- Reliability-based design optimization and decision-making using data-driven and physics-based models

Publications

8 published peer-reviewed journal papers (4 first-author), including JMD, RESS, IEEE TII, MSSP.

[#] indicates equal contribution.

Journal Papers

[J1] **Yuan Jiang**, Alexandra N. Leeming, Joshua L. Rovey, and Pingfeng Wang, Remaining Useful Life Prediction for Hall Thrusters based on Adaptive Self-Cognizant Dynamic System and Multi-Physics Modeling. *Journal of Mechanical Design*, (2026) 1-27. DOI: 10.1115/1.4070967.
- ASME DAC Paper of Distinction (Top 10 over 103)

[J2] **Yuan Jiang**, Zheng Liu, Pouya Kabirzadeh, Yulun Wu, Yumeng Li, Nenad Miljkovic, and Pingfeng Wang. Multi-fidelity Physics-informed Convolutional Neural Network for Heat Map Prediction of Battery Packs. *Reliability Engineering & System Safety*, 256 (2025) 110752. DOI: 10.1016/j.ress.2024.110752.

[J3] Zheng Liu, Yanwen Xu, **Yuan Jiang**, Anabel Renteria, Parth Bansal, Chenlong Xu, Pingfeng Wang, and Yumeng Li. Uncertainty Quantification of Additively Manufactured Architected Cellular Materials for Energy Absorption Applications. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part B: Mechanical Engineering*, 11 (3) (2025). DOI: 10.1115/1.4066933.

[J4] Pouya Kabirzadeh, Zheng Liu, Mostafa Olyaei, Haoyun Qiu, Yashraj Gurumukhi, Harsh Tyagi, **Yuan Jiang**, Vivek S Garimella, Bakhshish Preet Singh, Yumeng Li, Pingfeng Wang, and Nenad Miljkovic. Integrating Heat Transfer and Control Optimization: A Comprehensive Review of Battery Thermal Management Systems. *Journal of Energy Storage*, 131 (2025) 117289. DOI: 10.1016/j.est.2025.117289.

[J5] Yuejian Chen, Zihan Li, **Yuan Jiang**, Chunsheng Yang, Min Xia, and Ke Feng. Enhanced Sparse LPV-ARMA Model with Ensemble Basis Functions for Mechatronic Transmission Fault Detection Under Variable Speed Conditions. *IEEE Internet of Things Journal*, 12 (11) (2025) 17223-17232. DOI: 10.1109/JIOT.2025.3535580.

[J6] Yuejian Chen, Zihan Li, **Yuan Jiang**, Dao Gong, and Kai Zhou. Sparse LPV-ARMA Model for Non-stationary Vibration Representation and its Application on Gearbox Tooth Crack Detection Under Variable Speed Conditions. *Mechanical Systems and Signal Processing*, 224 (2025) 112161. DOI: 10.1016/j.ymssp.2024.112161.

[J7] **Yuan Jiang**, Yuejian Chen, and Pinfeng Wang. An Iterative Adaptive Vold-Kalman Filter for Non-stationary Signal Decomposition in Mechatronic Transmission Fault Diagnosis Under Variable Speed Conditions. *IEEE Transactions on Industrial Informatics*, 20 (8) (2024) 10510-10519. DOI: 10.1109/TII.2024.3393536.

[J8] **Yuan Jiang** and Gang Niu. An Iterative Frequency-domain Envelope-tracking Filter for Dispersive Signal Decomposition in Structural Health Monitoring. *Mechanical Systems and Signal Processing*, 179 (2022) 109329. DOI: 10.1016/j.ymssp.2022.109329.

Journal Papers in Review

[J9] **Yuan Jiang**, Yiyue Jiang, Zheng Liu, and Pingfeng Wang. Physics-informed Cross-attention Operator Network with Hard-constrained Fourier Features for Heat Map Prediction of Large-scale Battery Packs. *Engineering Applications of Artificial Intelligence*. (Under first round of revision)

[J10] **Yuan Jiang**, Yiyue Jiang, Zheng Liu, Yuejian Chen, and Pingfeng Wang. Iterative Dispersive Vold-Kalman Filter with Local Adaptive Bandwidth: Algorithm and Applications in Structural Health Monitoring. *IEEE Transactions on Industrial Informatics*. (Under first round of revision)

[J11] Yiyue Jiang, **Yuan Jiang**, Pingfeng Wang. A Review on Mitigating Thermal Runaway Propagation in Battery Packs: from Mechanisms to Modeling and Design Optimization. *Energy Advances*. (Under first round of review)

Conference Proceedings

[C1] Alexandra N. Leeming, **Yuan Jiang**, Stephen Messing, Siyuan Wang, Pingfeng Wang, Peter D. Dragic, J. Gary Eden, Joshua L. Rovey, Valentin Korman, Kurt Polzin, Exploration of an In-Situ Hall Thruster Erosion and Plasma Diagnostic Sensor, *2026 AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum)*, Orlando, FL, USA. 12 Jan. 2026, 14 Pages. DOI: 10.2514/6.2026-0929

[C2] Zheng Liu[#], **Yuan Jiang**[#], Yumeng Li, and Pingfeng Wang, Physics-Informed Machine Learning Enhanced Battery Pack Optimization, *2025 IEEE/AIAA Transportation Electrification Conference and Electric Aircraft Technologies Symposium (ITEC+ EATS)*, Anaheim, CA, USA. 18 June 2025, 5 Pages. DOI: 10.1109/ITEC63604.2025.11098093.

[C3] **Yuan Jiang**, Alexandra N. Leeming, Joshua L. Rovey, and Pingfeng Wang, Prognostics of Hall Thruster Erosion using Multiphysics-based Modeling and Machine Learning, *2025 Annual Reliability and Maintainability Symposium (RAMS 2025)*, Destin, FL, USA. 27 Jan. 2025, 7 Pages. DOI: 10.1109/RAMS48127.2025.10935282.

[C4] Zheng Liu[#], **Yuan Jiang**[#], Yumeng Li, and Pingfeng Wang, Physics-informed Machine Learning for Battery Pack Thermal Management, *2025 Annual Reliability and Maintainability Symposium (RAMS 2025)*, Destin, FL, USA. 27 Jan. 2025, 7 Pages. DOI: 10.1109/RAMS48127.2025.10935157.

[C5] Shimeng Yang, **Yuan Jiang**, Zheng Liu, and Pingfeng Wang, Transductive Transfer Learning Features for Prognostics and Health Management, *2025 Annual Reliability and Maintainability Symposium (RAMS 2025)*, Destin, FL, USA. 27 Jan. 2025, 7 Pages. DOI: 10.1109/RAMS48127.2025.10935143.

[C6] Parth Bansal, **Yuan Jiang**, Zhou Li, Sergio Cordero, Zahra Heussen, Debbie Senesky, Pingfeng Wang, and Yumeng Li, Multiphysics Modeling and Simulation of Gas Sensor for NO_2 Detection, *ASME International Mechanical Engineering Congress and Exposition (IMECE 2024)*, Portland, OR, USA, 17 Nov. 2024, 6 Pages. DOI: 10.1115/IMECE2024-145663.

[C7] **Yuan Jiang** and Gang Niu, Rail Local Damage Detection based on Recursive Frequency-domain Envelope Tracking Filter and Rail Impact Index, *2022 Global Reliability and Prognostics and Health Management (PHM 2022)*, Yantai, China. 13 Oct. 2022, 7 Pages. DOI: 10.1109/PHM-Yantai55411.2022.9942082.

- IEEE PHM Best Paper Award (Top 1 over 274)

[C8] Hongyang Zhao, **Yuan Jiang**, and Gang Niu, A Tacholess Order Tracking Method based on Extended Intrinsic Chirp Component Decomposition for Gears under Large Speed Variation Conditions, *Journal of Physics: Conference Series*, 2184 (1) (2022) 12052. DOI: 10.1088/1742-6596/2184/1/012052.

[C9] **Yuan Jiang**, Hongyang Zhao, and Gang Niu, Intelligent Rolling Bearing Fault Diagnosis under Variable Speed Conditions without Tachometers, *2021 Global Reliability and Prognostics and Health Management (PHM 2021)*, Nanjing, China. 15 Oct. 2021, 7 Pages. DOI: 10.1109/PHM-Nanjing52125.2021.9613049.

Research Leadership

Physics-informed Digital Twin Modeling for Hall Thruster Degradation and Prognostics
Sponsor: Air Force Office of Scientific Research (AFOSR)

- Led the development of a multi-fidelity digital twin framework that integrates physics-based plasma simulations and physics-informed neural surrogates for data-efficient modeling of Hall thruster erosion and degradation under sparse observations.
- Proposed uncertainty-aware prognostic methodologies that couple physics-informed surrogate models with Bayesian state estimation, enabling online update and remaining useful life prediction under variable operating and environmental conditions.

Physics-informed Machine Learning for Battery Thermal-Health Management and Design Optimization
Sponsor: National Science Foundation (NSF)

- Led the development of physics-informed neural operator and CNN-based surrogate models for data-efficient, multi-fidelity thermal field modeling in lithium-ion battery packs with complex geometries.
- Formulated a unified learning–optimization framework that couples learned thermal surrogates with reliability-aware design optimization, enabling robust layout-level decision-making under data and model uncertainty.
- Provided technical mentoring and methodological guidance to junior researchers and collaborators, supporting the application of physics-informed modeling frameworks to battery thermal runaway and transmission system diagnostics.

Data-driven Signal Processing for Non-stationary System Diagnostics
Sponsor: National Science Foundation (NSF)

- Led the development of data-driven time-frequency signal processing methodologies for diagnostics of non-stationary systems

under variable operating conditions, establishing robust and physically interpretable feature extraction from noisy sensor data.
- Established a methodological bridge between classical signal processing and data-driven modeling by formalizing signal representations that interface naturally with prognostic and health monitoring workflows.

Awards & Honors

Paper Awards

1. **ASME-DAC Paper of Distinction**, *Design Automation Committee (DAC), ASME* 2025
2. **Outstanding Master's Thesis Award**, *Tongji University* 2023
3. **IEEE PHM Best Paper Award**, *IEEE Reliability Society* 2022

Fellowships & Scholarships

1. **Jerry Dobrovolny Fellowship**, *University of Illinois Urbana-Champaign* 2023
2. **National Scholarship of China**, *Ministry of Education of the People's Republic of China* 2019, 2022

Service Awards

1. **IEEE TIM Outstanding Reviewer**, *IEEE Instrumentation and Measurement Society* 2025

Academic Service

Journal Reviewer

- Reliability Engineering & System Safety
- Engineering Applications of Artificial Intelligence
- IEEE Transactions on Reliability
- Neurocomputing
- Journal of Process Control
- Mechanical Systems and Signal Processing
- IEEE Transactions on Instrumentation & Measurement
- ISA Transactions
- IEEE Sensors Journal
- Computers & Structures

Conference Reviewer

- ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC-CIE)

Teaching Experience

Teaching interests include reliability engineering, engineering design and analysis, data-driven methods, physics-informed modeling for engineering systems.

Teaching Assistant

SE 411: Reliability Engineering **University of Illinois Urbana-Champaign**
Main instructor: Prof. Krishnan Girish Spring 2025

- Delivered guest lectures on reliability analysis and reliability-based design optimization, covering problem formulation, algorithmic implementation, and engineering interpretation.
- Designed an RBDO course project and mentored students on modeling, optimization algorithms, and coding implementation.
- Led exam review sessions with structured problem-solving tutorials to reinforce core concepts and analytical skills.

SE 450: Decision Analysis **University of Illinois Urbana-Champaign**
Main instructor: Prof. Pingfeng Wang Fall 2024, Fall 2025

- Contributed to undergraduate instruction by leading discussion sections and providing academic support via office hours.
- Delivered exam review lectures covering multivariate decision making, decision trees, and uncertainty-based decision making, with an emphasis on systematic problem formulation and solution strategies.

Rail Vehicle Systems Health Management **Tongji University**
Main instructor: Prof. Gang Niu (Instructed in English) Spring 2022

- Supported course delivery by assisting lectures and coordinating laboratory components for an undergraduate course.
- Led laboratory sessions on bearing and gearbox test rigs, covering experimental setup, data acquisition, and signal processing.
- Instructed students on vibration-based fault diagnosis using FFT, wavelet transforms, and machine learning methods.

Work Experience

NIO Automobile, Inc., *Power System Intern* May – Aug 2023
Developed data-driven condition monitoring and fault detection methods for EV power swap and charging systems, translating large-scale operational and sensor data into real-time health indicators and early-warning signals.

NIO Automobile, Inc., *Battery Testing Intern* Feb – May 2021

Conducted experimental testing and data analysis for lithium-ion batteries, supporting model validation and data-informed performance assessment under real-world operating conditions.

HiRain Technologies, *Autonomous Driving Development Intern* Jun – Aug 2022
Contributed to perception software development and data processing pipelines for multi-camera autonomous driving systems, with exposure to large-scale, high-throughput data integration and real-time system constraints.