Xinyang **Liu**

104 S Mathews Ave, Urbana, IL 61801

(+1) 410-537-0042 | xl50@illinois.edu | Google Scholar

Research Interest

My research focuses on design for sustainability and its integration with lifecycle decisions (e.g., maintenance, inventory management, remanufacturing). Leveraging tools and concepts from optimization, predictive modeling, and uncertainty quantification, I'm seeking to provide methodologies and practical solutions to achieve sustainability goals in a closed-loop supply chain.

Education

University of Illinois at Urbana Champaign (UIUC) *Urbana, IL*

PH.D. IN INDUSTRIAL ENGINEERING (MINOR IN STATISTICS) *Aug. 2018 - Exp. Dec. 2023*

- **Thesis**: Integrated Design and Operational Decision Making under Uncertainty for Enhanced Lifecycle Performances of Engineering Systems
- **Committee**: Pingfeng Wang (chair), Harrison Kim, Qiong Wang, Chenhui Shao
- **Selected Courses**: Applied Nonlinear Programming, Optimization Methods for Large Scale Networks, Network Analysis of Systems, Optimal System Design, Deep Learning, Online Learning, Data Mining, Reliability Engineering, Probabilistic Risk Assessment, Applied Stochastic Processes

Tsinghua University (THU) *Beijing, China*

B.E. IN INDUSTRIAL ENGINEERING *Aug. 2014 - Jul. 2018*

- **Thesis**: Automated Guided Vehicle Scheduling in Automation Warehouses
- **Advisors**: Zuo-Jun (Max) Shen, Lei Zhao

Journal Article Publications

1. **Xinyang Liu**, Zhuoyuan Zheng, Esra Büyüktahtakın, Zhi Zhou, and Pingfeng Wang, (2021). Battery Asset Management with Cycle Life Prognosis. *Reliability Engineering & System Safety*, 216, 107948.

2. **Xinyang Liu**, and Pingfeng Wang, (2022). Valuation of Continuous Monitoring Systems for Engineering System Design in Recurrent Maintenance Decision Scenarios. *Journal of Mechanical Design*, 144(9), 091702.

3. **Xinyang Liu**, Sayan Ghosh, Yongming Liu, and Pingfeng Wang, (2022). Towards Integrated Design and Operation of Complex Engineering Systems With Predictive Modeling: State-of-the-Art and Challenges. *Journal of Mechanical Design*, 144(9), 090801.

4. **Xinyang Liu**, Ankush Mishra, Chao Hu, and Pingfeng Wang, (2023). Reliability-informed End-of-use Decision Making for Product Sustainability using Two-stage Stochastic Optimization. *Applied Mathematical Modelling*, 121, 364-385.

5. **Xingyang Liu**, Mohammad Behtash, Pingfeng Wang and Chao Hu, (2023). Reman Co-Design: A Combined Design and Remanufacturing Optimization Framework for the Sustainable Design of High-Value Components. *Journal of Mechanical Design.* doi: https://doi.org/10.1115/1.4063660.

6. **Xinyang Liu** and Pingfeng Wang, (2023). Integrated Sustainable Product Design with Warranty and End-of-use Considerations. *Journal of Mechanical Design.* In Press and Online Available.

7. Hao Wu, **Xingyang Liu**, and Pingfeng Wang, (2023). A Conformal Inference Method for Uncertainty Quantification in Lithium-ion Battery RUL and SOH Prediction. Submitted to Elsevier Journal of Reliability Engineering & Systems Safety.

8. **Xingyang Liu**, Mohammad Behtash, In-Bum Chung, Pingfeng Wang, and Chao Hu, (2023). Sustainable Design Decision Support: Promoting Practical Design Changes for Remanufacturing. Submitted to ASME Journal of Mechanical Design.

9. Akash Singh, **Xingyang Liu**, Pingfeng Wang, and Yumeng Li, (2023). Uncertainty Quantification for Machine Learning Interatomic Potentials. Submitted to Elsevier Journal of Materials & Design.

10. **Xingyang Liu**, Pingfeng Wang, and Yumeng Li, (2023). Resource Allocation Optimization in Remanufacturing with Conformal Prediction-Based Uncertainty Modeling. In preparation.

11. Sara Kohtz, **Xingyang Liu**, and Pingfeng Wang, (2023). Adaptive Conformal Prediction for Online Prognosis with Heterogeneous Data Sources. In preparation.

12. Yanwen Xu, **Xingyang Liu**, Zheng Liu, and Pingfeng Wang, (2023). Multi-task Learning for Reliability-based Product Family Design Considering Resilience and Environmental Sustainability. In preparation.

Conference Proceedings

1. **Xinyang Liu**, and Pingfeng Wang, (2023). Integrated Sustainable Product Design with Warranty and End-of-Use Considerations. *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC).* Forthcoming.

- **Best Paper, 2023 American Society of Mechanical Engineers (ASME) Design Automation Conference (DAC) Best Paper Award**

2. **Xinyang Liu**, Ankush Mishra, Chao Hu, and Pingfeng Wang, (2023). Multi-Stage Product Family Design for Reliability with Remanufacturing. *Annual Reliability and Maintainability Symposium (RAMS).* pp. 1-6.

- **Best Paper, 2023 IEEE Reliability and Maintainability Symposium (RAMS) Best Paper Award**

3. **Xinyang Liu**, Harrison Kim, and Pingfeng Wang, (2022). Multi-Generational Product Family Design for Reliability and Environmental Sustainability. *IISE Annual Conference.* pp. 1-6.

4. **Xinyang Liu**, and Pingfeng Wang, (2022). Joint Optimization of Reliability, Warranty, and Price for a Product Family. *Annual Reliability and Maintainability Symposium (RAMS).* pp. 1-6.

5. **Xinyang Liu**, and Pingfeng Wang, (2021). Value of Information for Continuous Monitoring Systems in Recurrent Maintenance Decision Scenarios. *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (IDETC).* Vol. 85383, p. V03AT03A040.

6. **Xinyang Liu**, and Pingfeng Wang, (2021). A New Approach for the Assessment of Maintenance Policies on Stochastically Deteriorating Systems. *Annual Reliability and Maintainability Symposium (RAMS).* pp. 1-6.

7. **Xinyang Liu**, and Pingfeng Wang, (2020). Maintenance Decision Making using State Dependent Markov Analysis with Failure Couplings. *Asia-Pacific International Symposium on Advanced Reliability and Maintenance Modeling (APARM).* pp. 1-6.

8. **Xinyang Liu**, and Pingfeng Wang, (2020). Value of Continuous Monitoring Systems in Recurrent Decision Scenarios. *IISE Annual Conference.* pp. 25A-30A.

9. **Xinyang Liu**, and Pingfeng Wang, (2019). Battery Asset Management with Remaining Cycle Life Prognosis. *IISE Annual Conference.* pp. 154-159.

Conference Presentations

08/2023	**IDETC,** Integrated Sustainable Product Design with Warranty and End-of-Use Considerations	*Boston, MA*
01/2023	**RAMS,** Multi-Stage Product Family Design for Reliability with Remanufacturing	*Orlando, FL*
05/2022	**IISE,** Multi-Generational Product Family Design for Reliability and Environmental Sustainability	*Seattle, WA*
01/2022	**RAMS,** Joint Optimization of Reliability, Warranty, and Price for a Product Family	*Tucson, AZ*
08/2021	**IDETC,** Value of Information for Continuous Monitoring Systems in Recurrent Maintenance Decisions	*Virtual*
05/2021	**RAMS,** A New Approach for the Assessment of Maintenance Policies on Stochastically Deteriorating Systems	*Virtual*
11/2020	**IISE,** Value of Continuous Monitoring Systems in Recurrent Decision Scenarios	*Virtual*
08/2020	**APARM,** Maintenance Decision Making using State Dependent Markov Analysis with Failure Couplings	*Virtual*
09/2019	**INFORMS,** Value of Continuous Monitoring Systems in Recurrent Decision Scenarios	*Seattle, WA*
05/2019	**IISE,** Battery Asset Management with Remaining Cycle Life Prognosis	*Orlando, FL*

Honors & Awards

2023 **IDETC DAC Best Paper Award**

1 out of 136 accepted papers, one of the most competitive and prestigious awards in the field of design optimization, Media Mention in UIUS ISE News

2023 **IEEE RAMS Best Paper Award**

1 out of 120 accepted papers, awarded for exceptional technical impact, clarity of exposition in the written paper, and excellence in presentation

2022-2023 **William A Chittenden II Fellowship (UIUC)**

1 out of 160 graduate students, awarded for a distinguished research profile at the intersection of healthcare and engineering, supported by maintaining full GPA throughout the PhD study

2015-2016 **Scholarship for Excellent Social Work (THU)**

1 out of 60 students in my same grade, in recognition of outstanding contribution to well-organized student activities and the commitment to fostering a sense of belonging among students

Research Projects

DOE REMADE Multi-Generational Sustainable Product Development Project

UIUC, Iowa State University, Deere and Company, Green Electronics Council (GEC) *2020 - 2022*

- **Project goal**
  - Modeled complex interdependencies between product commonality decisions, profitability, and environmental sustainability by embedding market-driven end-of-life options into multi-generational product family optimization.
  - Enabled robust environmental-economic tradeoffs by integrating profitability model into the design optimization process.
- **Key achievements**
  - Led the research collaboration with Iowa State's team on end-of-life decision optimization under uncertain product demand. Our publication received the prestigious 2023 RAMS Best Paper Award.
  - Spearheaded the development of a reliability module within a multi-generation product family design trade-off evaluation tool. Supervised an undergraduate student in seamlessly integrating this module with the existing life cycle assessment tool.
  - Collaborated closely with engineers at DEERE and research scientists at GEC to gather and analyze product lifecycle data, facilitating the quantification of multi-generational sustainable product development requirements.
- **Project Continuation Plan**
  - To enhance the current predictive modeling approach based on product reliability properties by incorporating real-time condition assessment information, to reduce the impact of uncertainties stemming from usage and core return processes.

DOE REMADE Design Decision Support for Remanufacturing Project

University of Connecticut, UIUC, Deere and Company, Automotive Parts Remanufacturers Association *2022 - PRESENT*

- **Project goal**
  - Developed a comprehensive framework for the identification, evaluattion and validation of design changes for remanufacturing, leveraging warranty and usage data to enhance product lifecycle sustainability.
  - Created a practical and user-friendly application based on the framework, facilitating informed design for remanufacturing decisions in the industrial context.
- **Key achievements**
  - Led the research in collaboration with UConn's team, focusing on the joint optimization of design and remanufacturing decisions. The work on reliability design decision optimization was honored with the 2023 DAC Best Paper Award.
  - Worked closely with design and remanufacturing engineers at DEERE, collecting crucial data on failure modes, reuse statistics, and experimental validation results to establish the design for remanufacturing framework.
  - Facilitated structured discussions and collaborative tool development sessions to effectively onboard fellow student researchers who were new to the field of sustainable design.
- **Project Continuation Plan**
  - To integrate three essential elements of existing design for remanufacturing efforts: design guidelines, post-design forecasting under uncertainty, and the seamless incorporation of remanufacturing feedback into the design process. This holistic approach will lead to a sustainable development policy for both design and remanufacturing practices.

Professional Experience

Meta, Advertiser Product Optimization Team

Menlo Park, CA

Research Data Scientist Intern *Summer 2022*

- Contributed to the experimentation of a custom event optimization product within the organization.
- Pioneered the design and implementation of a novel product performance evaluation mechanism, which played a crucial rule in generating valuable custom event recommendations.
- Lead the collaboration with data and software engineers to construct an efficient product-related data pipeline, optimizing query processes and facilitating rigorous metric validation.

FM Global, Engineering and Research Division *Norwood, MA*
Research Intern *Summer 2020*

- Worked on the pioneer equipment monitoring and Internet of Things (IoT) project at FM Global, a leading mutual insurance company known for its data-driven approach to risk assessment and premium determination.
- Designed and developed an innovative online health diagnosis tool utilizing real-time monitoring data. This tool significantly contributed to informed maintenance decisions and proactively prevented equipment failure.
- Demonstrated the potential for future collaborations by laying the groundwork for integrating IoT technologies into sustainable system development within the FM Global research team.

UC Berkeley, Industrial Engineering and Operations Research *Berkely, CA*
Undergraduate researcher *Summer 2017*

- Developed an integer programming model for combined task assignment and path finding problem; relaxed the constant-speed assumption to multi-speed levels.
- Established a heuristic algorithm based on anonymous multiple agent path finding (MAPF) and conflict-based search (CBS); enhanced the efficiency of task-scheduling and routing decisions.
- Proved the bound of the proposed heuristic algorithm based on worst case analysis.

Teaching & Mentoring Experience

Graduate Teaching Assistant *UIUC*
SE450 Decision Analysis (Grad) *Fall semesters, 2018 - 2022*

- Organized course contents, held pre-exam review sessions, and guided graduate projects

Research Mentor *UIUC*
Product sustainability evaluation tool development *Fall 2022*

- Supervised a junior on integrating newly-designed reliability module in the lifecycle analysis tool to quantify the trade-off between economic and environmental objectives for multi-generational production families

Academic Service

- **Ad hoc Reviewer**: *Reliability Engineering & System Safety, IEEE Transactions on Reliability, Computers & Industrial Engineering, Asia-Pacific International Symposium on Advanced Reliability and Maintenance Modeling, Annual Reliability and Maintainability Symposium*
- **Organizer**: Session chair for IISE Annual Meeting 2019

Affiliations

- Student member, Institue of Industrial Engineers, *IIE* (2018 – present)
- Student member, Institute for Operations Research and the Management Sciences, *INFORMS* (2019 – present)
- Student member, American Society of Mechanical Engineers, *ASME* (2020 – present)

Skills

Programming Python, R, MATLAB, SQL
Tools CPLEX, Gurobi, PyTorch
Languages English (fluent), Chinese (native)