

Xinyi Zhao

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RESEARCH TOPICS

My research and expertise mainly focus on Operations Research and Machine Learning in Smart Grid and Transportation, including several topics:

- Two-stage stochastic/robust integer programming for integrated power systems under uncertainty.
- Distributionally robust optimization framework for quantifying and analyzing system flexibility.
- Fleet electrification considering operations of coupled transportation and power systems.
- Modified progressive hedging algorithm which is faster than Benders decomposition.
- Deep reinforcement learning approach for optimal power flow of distribution networks.

SUMMARY OF QUALIFICATIONS

- Programming experience with Python (Pytorch, Numpy, Scipy, Pandas, Sklearn, Matplotlib, etc), Matlab (Yalmip), R, Julia, and C proven in coursework and research.
- Strong understanding of decision making and optimization mathematics such as mixed-integer programming and data-driven optimization.
- Advanced knowledge of LaTeX, Microsoft Office Suite.
- Excellent oral and written communication skills.
- Fluent in English (TOEFL: 112) and Mandarin.

EDUCATION BACKGROUND

University of Washington

Seattle, US

Ph.D. in Industrial Engineering, [Department of Industrial & Systems Engineering](#)

Sept. 2021-Present

Completed Courses: Machine Learning; Stochastic Processes; Integer Programming; Statistical Quality Engineering

GPA: 3.96/4.00; Advised by: [Prof. Chaoyue Zhao](#)

Tsinghua University

Shenzhen, China

M.S. in Electrical Engineering, [Tsinghua-Berkeley Shenzhen Institute](#)

Sept. 2018-Jun. 2021

Thesis: *Active Distribution System Planning Considering Energy Storage Systems Participating in Multiple Ancillary Services*

GPA: 3.98/4.00 (Rank 1/128); Co-advised by: [Prof. Hongbin Sun](#) and [Prof. Xinwei Shen](#)

Wuhan University

Wuhan, China

B.Eng. in Electrical Engineering, Department of Electrical Engineering and Automation

Sept. 2014-Jun. 2018

GPA: 3.87/4.00 (Rank 4/340)

RELEVANT EXPERIENCE

National Renewable Energy Laboratory (NREL)

Golden, Colorado

Hydrogen Systems for Performance-based Value Stacking

Jun. 2022-Sept. 2022

◇ Simulated the daily hydrogen load based on the data of a hydrogen fueling station

- Modeled the fueling process of the hydrogen-fueled trucks based on the queueing theory, which can be separated into two events: their arrivals and departures from the hydrogen station.

◇ Developed a planning model for the integrated hydrogen energy system

- Implemented the stochastic planning model with Python and solved with Google OR-Tools. The long-term profitability of the integrated system under both current and future conditions was compared in the planning results.

Smart Grid and Renewable Energy Laboratory

Shenzhen, China

Distribution System Planning Considering Regulation Services and ESS Degradation

Sept. 2018-Jun. 2021

◇ Considered degradation model of storage units in distribution system planning

- Added a linear degradation penalty term in the objective to avoid excessive charge/discharge of ESSs;
- Compared degradation curves of ESSs in different cases, and identified that the storage lifetime was prolonged for one year when considering degradation penalty.

◇ **Developed Gaussian mixture model to generate stochastic scenarios**

- Adopted GMM to model distributions of load demand, LMP, regulation signals and prices accurately to generate diverse stochastic scenarios.

◇ **Modified progressive hedging algorithm**

- Proved that a rational average solution is superior to the traditional mathematical expectation ($\sum_{s \in S} \theta_s \cdot X_s$) on stable convergence when implementing *non-anticipativity* constraints;
- Found that with parallel computing and gap-dependent penalty factors, the modified progressive hedging outperformed Gurobi and the L-shaped method.

PUBLICATIONS

◇ **Journals:**

- **Xinyi Zhao**, Xinwei Shen, Qinglai Guo, Hongbin Sun and Shmuel S. Oren. *A Stochastic Distribution System Planning Method Considering Regulation Services and Energy Storage Degradation*. **Applied Energy**, 2020, 277:115520. [\[PDF\]](#)
- Haizhou Liu, Xinwei Shen, Qinglai Guo, Hongbin Sun, Mohammad Shahidehpour, Wenzhi Zhao, **Xinyi Zhao**. *Application of Modified Progressive Hedging for Stochastic Unit Commitment in Electricity-Gas Coupled Systems*. **CSEE Journal of Power and Energy Systems**, 2020, 7(4): 840-849. [\[PDF\]](#)

◇ **Conferences:**

- **Xinyi Zhao**, Xinwei Shen, Hongkun Chen, *et al.* *A Two-Stage Multi-Objective Planning Strategy for Electric Vehicle Charging Stations Considering Power-loss Sensitivity in Distribution System*. **2nd IEEE Conference on Energy Internet and Energy System Integration**, 2018. [\[PDF\]](#)
- **Xinyi Zhao**, Xinwei Shen, Tian Xia, *et al.* *Optimal Distribution System Planning Considering Regulation Services and Degradation of ESSs*. **11th International Conference on Applied Energy**, 2019. [\[PDF\]](#)
- Yuquan Liu, **Xinyi Zhao**, Xinwei Shen, *et al.* *A Distribution System Expansion Planning Method Considering Integrated Energy Service Providers' Revenue on Energy Storage Investment*. **25th International Conference on Electricity Distribution**, 2019. [\[PDF\]](#)
- **Xinyi Zhao**, Yiyun Yao, Weijia Liu, *et al.* *A Hydrogen Load Modeling Method for Integrated Hydrogen Energy System Planning*. **14th Conference on Innovative Smart Grid Technologies**, 2023. [\[PDF\]](#)

◇ **Patent:**

- **Xinyi Zhao**, Linxin Yin, Shinan Song, Huiyi Hu, Zhi Zhang and Yu Zheng. *Human Body Knee Jerk Intelligent Diagnosis and Treatment Percussion Hammer based on Six-axis Acceleration Transducer*. (**No: 201710279460.6**, **Invention Granted**), 2017. [\[Abstract\]](#)

TEACHING

- | | |
|---|---------------------|
| • TA, Reinforcement Learning for Energy Systems (16 hrs), Prof. Scott Moura | <i>Summer, 2020</i> |
| • TA, Introduction of Smart Grid (32 hrs), Prof. Ye Guo and Prof. Yinliang Xu | <i>Spring, 2020</i> |
| • TA, Energy-Environment and Data-Information 100 level (16 hrs), Prof. Xuan Zhang | <i>Fall, 2019</i> |

AWARDS

Graduate Career:

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|--|-------------------|
| • Honorable Mention by the Renewable Energy Scholarship Foundation | <i>Apr. 2023</i> |
| • UW College of Engineering Dean's Fellowship | <i>Sept. 2021</i> |
| • Tsinghua Comprehensive Scholarship | <i>Sept. 2019</i> |

Undergraduate Career:

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|---|-------------------|
| • First Prize in the 10th National University Students Electrical Math Modeling Competition | <i>Aug. 2017</i> |
| • First Power Exploration Scholarship of Wuhan University (3/340) | <i>Sept. 2016</i> |
| • China National Scholarship (Top 0.2% of all undergraduate students in China) | <i>Nov. 2015</i> |
| • First-class Student Scholarship & Merit Student Scholarship of Wuhan University | <i>Nov. 2015</i> |
| • Merit Freshmen Scholarship of Wuhan University (Top 5% of students enrolled at WHU) | <i>Dec. 2014</i> |

INVITED PRESENTATION

- Conference oral presentation: *Optimal Distribution System Planning Considering Regulation Services and Degradation of Energy Storage Systems*. **ICAE 2019**, Västerås, Sweden, selected for further considerations in **Applied Energy** (Top 5%). [\[PPT\]](#)

(Updated on April 12, 2023.)