

# Xinyi Zhao

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## RESEARCH TOPICS

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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

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- 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

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### 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

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### 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**

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◇ **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. [\[PDF\]](#)

◇ **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**

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

**AWARDS**

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**Graduate Career:**

- UW College of Engineering Dean's Fellowship Sept. 2021
- Tsinghua Comprehensive Scholarship Sept. 2019

**Undergraduate Career:**

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

**INVITED PRESENTATION**

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- 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 November 9, 2022.)