

# Wentao Zhao

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## RESEARCH INTEREST

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- **Theories:** Combinatorial Optimization, Stochastic Optimization, Machine Learning
- **Applications:** Transportation, Shared Mobility, Logistics

## EDUCATION

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**Columbia University** GPA: 3.74/4.00 **New York, US**

**M.S. in Industrial Engineering & Operations Research** Sept. 2020 – Dec. 2021

- Courses: Linear Programming, Discrete Optimization, Convex Optimization, Real Analysis

**Zhejiang University** GPA: 3.70/4.00

**Hangzhou, CN**

**B.S. in Mechanical Engineering**

Sept. 2016 - May 2020

- Courses: Control Algorithms, Data Structures, Numerical Methods in Engineering

**University of Wisconsin-Madison**

**Madison, US**

**Visiting Student in Industrial & Systems Engineering**

Jan. 2019 - May 2019

- Courses: Stochastic Processes, Simulation Modeling and Analysis, Decision Analysis

**Awards:** Advanced Honor Class of Engineering Education (Honor Program of Engineering College), Zhejiang Provincial Government Scholarship (10%), Research Special Scholarship (selected excellent research student)

## PUBLICATIONS

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### Journal:

- W. Hu, **W. Zhao**, et al., Design Optimization of Composite Wind Turbine Blades Considering Tortuous Lightning Strike and Non-Proportional Multi-Axial Fatigue Damage. *Engineering Optimization* (2019): 1-19.

### Conference:

- **W. Zhao**, Yikang Hua, Xin Wang, Energy-sponge Electric Vehicle Sharing System Design, Transportation Research Board 2021 (Post).
- W. Hu, **W. Zhao (Presenter)**, et al, Reliability Analysis of Wind Turbine Blades Considering Lightning Strike, NAWEA/WindTech 2019 Conference (Presentation).

### Papers Under Review

- **W. Zhao**, Yikang Hua, Xin Wang, Energy-Sponge Electric Vehicle Sharing System Design (2020, submitted to Transportation Research Part C: Emerging Technology).

### Working Papers

- **W. Zhao**, Yikang Hua, Xin Wang, Optimized Energy-Sponge Electric Vehicle Sharing System with Integration of Renewable Energy.
- **W. Zhao**, Xuan Di, An End-to-End Machine Learning Approach for Vehicle Sharing System Operations.

## RESEARCH EXPERIENCES

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**Columbia University, School of Civil Engineering**

**New York, US**

*Research Assistant*

Jun. 2021 – Dec. 2021

- Proposed a learning-based approach that embeds a graph convolutional neural network model into a local search algorithm to learn the matching policy in the vehicle sharing operations
- Designed a novel training method that ensembles imitation learning and evolutionary strategy; Trained the model to imitate the Blossom algorithm first and self-evolute by interacting with the environment
- Developed a shared fleet simulation environment leveraging the historical taxi data in New York for testing different management strategies

- Conducted a series of experiments and showed that the proposed method outperformed the traditional heuristic algorithm in terms of customer satisfaction and computation efficiency

**University of Wisconsin-Madison, School of Industrial & System Engineering**

**Madison, US**

*Remote Research Assistant*

Jul. 2020 – Mar. 2021

- Proposed a robust and stochastic optimization model for a spatially distributed electric vehicle fleet with renewable energy integrated to serve as a backup reservation interfacing with transportation and power grid system
- Developed a data-driven approach for constructing uncertainty set in robust optimization to deal with the temporal-spatial correlation in uncertain renewable energy generation and avoid over-conservative
- Proved that the above robust and stochastic optimization model under correlated uncertainty can be linearized by adding auxiliary variables and extra constraints

**University of Wisconsin-Madison, School of Industrial & System Engineering**

**Madison, US**

*Research Assistant*

May 2019 – Jan. 2020

- Established a profit-driven planning framework for electric vehicle sharing system to optimize its strategies in energy bidding, serving customers, charging, and relocation
- Implemented a two-stage stochastic model for electric vehicle sharing management incorporating the uncertainty of customer demand in spatiality, temporality, and quantity
- Built and solved the stochastic model via Python and Gurobi; Conducted a case study in Austin to demonstrate the managerial insights

**Zhejiang University, School of Mechanical Engineering**

**Hangzhou, CN**

*Research Assistant*

Sept. 2018 – Apr. 2019

- Modeled both the lightning strike dielectric breakdown failure and multi-axial fatigue failure mechanisms for the structural design of composite wind turbine blades
- Proposed a design optimization framework that integrates realistic lightning strike electrostatic and fatigue analyses for designing reliable and economical composite wind turbine blades
- Conducted a case study of the structural design optimization of a 5 MW composite wind turbine blade using the framework with two optimization solvers: sequential quadratic programming and Bayesian optimization

## **SELECTED PROJECTS**

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**NeurIPS 2021 Competition – Machine learning for Combinatorial Optimization**

**New York, US**

*Team Leader*

Jun. 2021 – Oct. 2021

- Improved the branch-and-bound algorithm by replacing the heuristic branching policy with a sophisticatedly trained graph convolutional neural network model
- Designed and built a Singularity container for running and evaluating algorithms on the high-performance computing cluster

**Amazon Last-Mile Routing Research Challenge**

**New York, US**

*Team Leader*

Jun. 2021 – Oct. 2021

- Realized an attention model in the Transformer architecture for route optimization problems under realistically sized problem instances
- Trained the model via reinforcement learning and imitation learning; Conducted experiments to compare different training methods

## **SKILLS AND INTERESTS**

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- **Computer Skills:** Python, C, Gurobi, MATLAB, Latex
- **Languages:** Mandarin (native), English (fluent)