Zhiying Xiao Ph.D.

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Education

Worcester Polytechnic Institute *Worcester, MA*

PhD in Civil Engineering *Aug 2019 - Dec 2023*

- **Research:** Passive Building Envelopes for reducing heating and cooling loads
- **Courses:** Machine Learning, Heat Transfer, Thermodynamics, Composite Material, Algorithm Design & Analysis, Big data Analytic, Machine Learning for Science & Engineering
- **GPA:**4.0/4.0

Hunan University *Changsha, China*

Master in Structural Engineering/Civil Engineering *Sep 2013 - Jun 2016*

- **Research:** Hydrodynamics for foundation of offshore Wind-turbines
- **Course:**Finite element method, High-rise structure design, Structural Dynamics, Structural mechanics; Elastic mechanics
- **GPA:**84.3/100

Hunan University *Changsha, China*

Bachelor in Civil Engineering *Sep 2009 - Jun 2013*

- **Thesis:** Design for a Steel-Structure Apartment
- **Course:**Concrete structure design, Steel structure design, Structural mechanics; Soil Mechanics, Fluid Mechanics
- **GPA:**88.6/100

Work Experience

National Renewable Energy Laboratory (NREL) *Golden, CO*

Postdoctoral Researcher–Mechanical Engineering *2024-present*

- Performed laboratory experiments on materials and thermal components.
- Examined and validated the experimental results using analytical and numerical models.
- Developed, designed, and analyzed new thermal switches for dynamic building envelopes.

Worcester Polytechnic Institute *Worcester, MA*

Teaching/Research Assistant *Aug 2019 - Dec 2023*

- Assisted in courses including Fluid Dynamics, Hydraulics, Structural Analysis, Geology, Foundation Engineering, and Solid Mechanics.
- Investigated the heat transfer and optical transfer processes of a novel solid-solid phase change material.
- Developed a thermal battery system for buildings based on sorbent material with a group of three.

POWERCHINA Kunming Engineering Corporation Limited *Kunming, China*

Structural Engineer *Aug 2016 - Aug 2019*

- Completed structural design and analysis for buildings over 10,000m^2 with a group of four. Projects include high-rise Concrete Structures, three-floor Masonry structures, and Underground structures
- Directed the project of Dwelling for the Nangong 1th hydropower station. Managed the professional work of the design team and coordinated the progress of the project.
- Directed research activities and authorized two Chinese Patents.

Projects

Insertable thermal switches-Thermal Storage for dynamic building envelopes *Golden, CO*

National Renewable Energy Laboratory (NREL) *Feb 2024 - Present*

- Developed heat transfer models to determine and opyimize the design of thermal switches.
- Conducted indoor and outdoor tests to validate the thermal performance of thermal switches.

Novel cement insulation material-based building cladding system *Golden, CO*

National Renewable Energy Laboratory (NREL) *Oct 2024 - Present*

- Characterized the thermal and mechanical performance of a novel cement insulation material.
- Simulated the energy and cost savings of the cladding on buildings across US climate zones.

Supermarket refrigeration and HVAC system optimization *Golden, CO*

National Renewable Energy Laboratory (NREL) *Oct 2024 - Present*

- Reviewed current metrics for thermal systems, including HVAC, heater, and thermal energy storage systems.
- Reviewed current configurations and working principles of thermal network systems in a supermarket.

Adaptive Building Enclosure Systems Using Cellular Solid-Solid Phase Change Materials (SS-PCM) with Variable Transparency *Worcester, MA*

Worcester Polytechnic Institute *Jan 2020 - Dec 2023*

- Developed 1D/3D thermal transfer models to investigate the thermal performance of SS-PCM system on applied building enclosures.
- Designed and optimized the structure of the SS-PCM; identified the essential factors that affect the thermal benefits of such SS-PCM systems.

Smart LCST/UCST polymer-sorbent based thermal storage battery *Worcester, MA*

Worcester Polytechnic Institute *Jan 2020 - Dec 2021*

- Established heat transfer and mass transfer model for the adsorption process of PNIPAM/Zeolite system.
- Designed and optimized the design of the system; identified the essential factors that affect the thermal benefits of thermal storage systems.

Machine learning method to predict SS-PCM optical property *Worcester, MA*

Worcester Polytechnic Institute *Oct 2022 - Dec 2023*

- Obtained optical property data from COMSOL simulations of porous SS-PCM, which has approximately 200 samples & 7 attributes.
- developed different models, such as linear regression, Decision Tree, Random Forest, K Nearest Neighbor, and Support Vector Machine to recognize patterns in the existing data.
- To assess the performance of the model, metrics like R2 and MSE are adopted.
- The random forest model results in the best performance, of which the testing R2 reaches above 0.9.The bootstrapping method was applied to resample the dataset.

Wu Ai-Design for Shear Wall structures *Kunming, China*

POWERCHINA Kunming Engineering Corporation Limited *Jan 2018 - Jun 2019*

- Developed structural models for 11-floored and 18-floored Shear-Wall buildings; conducted 8-degree intensity (under Chinese Standard) seismic dynamic analysis; completed 100+ pieces of structural construction drawings
- Collaborated and solved conflicts with architectures, drainage engineers, HVAC engineers, and constructors.

Skills

Programming	Python, Matlab, C/C++.
Engineering tools	AutoCAD, SolidWorks, Revit, EnergyPlus, COMSOL Multiphysics, ANSYS, ETABS/SAP2000.
Data visualization	Tableau, MATLAB (for data analysis), Python libraries (NumPy, Pandas, Matplotlib.)
Machine Learning	TensorFlow, PyTorch, Scikit-learn.
Experiment	Hands-on experience with differential thermal cycling units, heat flow meters, thermocouples, and heat flux sensors. Raspberry Pi for data acquisition and control with modules such as TB6612FNG, INA219, and TCA9548A.
Soft Skills	Innovation, Time Management, Collaboration, Analytical Problem-Solving, Technical Documentation, Persuasive Presentation.

Publications

1. **Xiao, Zhiying**, Kishore, Ravi Anant, Booten, Chuck. Demonstration and Characterization of Insertable Passive Thermal Switches for Dynamic Building Envelopes. Cell Reports Physical Science. 2025 June.
2. **Zhiying Xiao**, R. Bousselham, M. Tao, et al. Machine Learning-Optimized Porous Thermally Responsive SS-PCM with Switchable Transparency for Adaptive Building Envelope Coatings. Energy and Buildings. 2025
3. **Zhiying Xiao**, Sajith Wijesuriya, Kishore, Ravi Anant, et al. Experimental Characterization and Potential Energy Savings Benefits of Insulated Cladding for US Residential Buildings. Energy and Buildings. 2025
4. R. Bousselham, **Z. Xiao**, M. Tao, et al. A Bioinspired Approach for Adaptive Solid- Solid Phase Change Material Coatings with Optimized Surface Features for Passive Thermal Regulation. Solar Energy Materials And Solar Cells. 2026
5. Kishore, Ravi Anant, **Xiao, Zhiying**, Booten, Chuck, et al., "Retrofittable Thermal Switches for Dynamic Building Envelopes Integrated with Thermal Energy Storage. 2024 ACEEE Summer Study on Energy Efficiency in Buildings.
6. **Zhiying Xiao**, P. Mishra, A. Mahdavi Nejad, M. Tao, S. Granados-Focil, S. Van Dessel, Thermal optimization of a novel thermo-optically responsive SS-PCM coatings for building enclosures, Energy and Buildings, 247 (2021) 111129
7. El Ouaragli J, **Xiao, Zhiying**, Tao M, Granados-Focil S, Van Dessel S. A novel passive polymer-sorbent thermal battery for low-temperature energy applications: A numerical feasibility study. Journal of Energy Storage. 2022 Dec 10;56:105971.
8. Zhong W, Deng L, **Xiao Zhiying**. Flow past a rectangular cylinder close to a free surface. Ocean Engineering. 2019 Aug 15;186:106118.

Patents

US patent, 2024	Thermal Diode and Thermal Switch Bi-Directional Heat Transfer in Building Envelopes
Chinese Utility Model Patent, 2019	Prefabricated Bay Window
Chinese Utility Model Patent, 2017	A kind of Bi-directional Sliding Seismic Isolation Devices