Xinyue (Leslie) Xu

Curriculum Vitae

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Professional Profile

Ph.D. candidate in Architectural Engineering focusing on building energy modeling, retrofit analysis, energy efficiency evaluation, and data-driven decision support. Skilled at analyzing building performance data, developing reproducible workflows, and translating technical findings into practical recommendations for energy savings, retrofit planning, and decarbonization. Experienced with DOE ResStock, OpenStudio/EnergyPlus-based analysis, climate-zone comparisons, and retrofit scenario evaluation. Interested in supporting utility energy efficiency programs, M&V, retro-commissioning, and customer-focused implementation of building performance improvements.

Professional Interests

• Building Energy Efficiency • Energy Audits and Assessments • Measurement and Verification • Retro-Commissioning • Building Energy Modeling • Utility Energy Efficiency Programs • Retrofit Evaluation • Decarbonization Planning • HVAC and Envelope Performance • Energy Data Analysis • OpenStudio/EnergyPlus • Technical Reporting • Customer-Focused Engineering Support

Education

Pennsylvania State University, State College, PA, USA — Aug. 2019 – Aug. 2026
Ph.D., Architectural Engineering; Ph.D. Minor in Computational Science

Arizona State University, Tempe, AZ, USA — Aug. 2022 – Dec. 2024
M.S., Computer Science (Machine Learning)

Tongji University, Shanghai, China — Jul. 2015 – May 2019
B.S., Built Environment and Energy Engineering; Outstanding Graduate

Technical Skills

Programming: Python, MATLAB, SQL, R
Simulation Tools: EnergyPlus, OpenStudio, Revit, AutoCAD, Civil 3D, Abaqus, COMSOL Multiphysics
Energy Efficiency Skills: Building energy modeling, retrofit evaluation, energy efficiency analysis, utility data analysis, envelope and HVAC performance assessment, climate-zone analysis, decarbonization planning, technical reporting
Advanced Modeling: Bayesian inference, uncertainty quantification, causal inference, physics-informed machine learning, LLM-assisted retrofit recommendation workflows

Research Experience

Multi-Agent Framework for Climate-Adaptive Retrofit Decision Support — Feb. 2025 – Present
Python, LLMs

- Developed an LLM-assisted framework that converts household descriptions and building attributes into structured retrofit reasoning inputs for downstream simulation, classification, and recommendation tasks.
- Built a multi-agent decision pipeline that combines housing-stock lookup, climate-specific building performance reasoning, and retrofit recommendation generation.
- Aligned recommendations with climate-zone-specific retrofit standards and translated model outputs into interpretable decision support for non-expert users.
- Advanced a research direction connecting building energy simulation, domain-adapted AI, and agentic workflows for scalable retrofit assessment.

Equitable Residential Retrofit Diagnostics Across U.S. Climate Zones — Aug. 2024 – Present
Python, EnergyPlus

- Developed an information-theoretic framework to identify feature-level drivers of residential energy inefficiency across heterogeneous housing stocks, using large-scale simulation and survey-linked building datasets.
- Integrated Jensen-Shannon Divergence, concentration index analysis, and Oaxaca-Blinder decomposition to connect physical building deficiencies with income-stratified energy-efficiency disparities.
- Translated climate-dependent disparity diagnostics into retrofit priorities by benchmarking building envelope characteristics against code-informed performance targets.
- Demonstrated how data-driven diagnostics can support equitable retrofit prioritization, targeted weatherization, and policy-relevant resource allocation across climates.

Multi-Factor Retrofit Diagnosis Toolkit for U.S. Residential Buildings Aug. 2025 – Present

Python

- Designed a diagnostic toolkit to assess retrofit needs across physical, environmental, and socioeconomic dimensions.
- Integrated climate and weather-zone information, social vulnerability indicators, building physical features, and energy consumption profiles into a unified analysis pipeline.
- Built scalable workflows to identify high-priority retrofit targets and support transparent, equity-oriented building energy decisions.

Causal Discovery and Causal Inference in Building Energy Research Feb. 2026 – Present

- Conducting a systematic review of causal discovery and causal inference methods for building energy systems.
- Reviewed methods across data-driven paradigms, knowledge-driven causal graphs, hybrid approaches, and LLM-assisted causal reasoning.
- Synthesizing methodological gaps and research opportunities for moving building energy analysis from correlation-based prediction toward actionable causal decision support.

Uncertainty Quantification in ML-Based Building Energy Modeling Aug. 2023 – Jan. 2025

Python

- Reviewed 141 studies on uncertainty quantification in machine-learning-based building energy modeling.
- Developed a taxonomy of deterministic and stochastic UQ methods across uncertainty sources, quantification principles, evaluation metrics, and implementation strategies.
- Identified gaps in quantifying aleatoric uncertainty, out-of-distribution robustness, and scalable uncertainty in high-dimensional engineering systems.

Physics-Guided Bayesian Neural Networks for Dynamical Systems Aug. 2023 – Jan. 2025

Python, PyTorch

- Designed PG-BNNs that embed physical conservation laws as soft constraints within Bayesian deep learning.
- Benchmarked MC-dropout ANNs, standard BNNs, and PG-BNNs on vibration dynamics problems.
- Showed that PG-BNNs improved predictive accuracy and generalization under sparse and shifted data conditions.

Information-Theoretic and Bayesian Model Selection for Physical Models May 2020 – Aug. 2025

MATLAB

- Investigated how selection criteria balance fit, complexity, and generalization in physics-based model calibration.
- Evaluated the sensitivity of AIC, BIC, DIC, and related criteria to prior informativeness, reparameterization, model form, data availability, and calibration structure.
- Calibrated a hierarchy of thermal models for double-pane windows and identified limitations of classical criteria in distinguishing effective model fidelity from redundant complexity.

Computer Vision-Based Floor Plan Analysis for Real-Time Cost Estimation Aug. 2025 – Dec. 2025

Python, YOLO

- Built a YOLO-based computer vision workflow to recognize construction elements from architectural floor plans.
- Connected recognition with a cost database to support automated quantity takeoff and rapid early-stage quotation.
- Demonstrated the potential of vision-based AI to reduce manual estimation time and improve pricing transparency in construction workflows.

Building Parameter Enrichment Using Gaussian Naive Bayes Feb. 2024 – Dec. 2024

Python

- Developed a probabilistic classifier to infer missing wall-insulation features from building contextual information.
- Optimized model performance via grid search and evaluated accuracy, precision, F1-score, and uncertainty.
- Used probabilistic entropy for predictive confidence and support building-envelope vulnerability assessment.

Peer-Reviewed Journal Publications

J1. **X. Xu**, S. Chen, G. Chi, J. Wang. Unequal and remediable building conditions underpin residential energy efficiency disparities across U.S. climates. **Status:** Under review.

J2. T. Xiao, **X. Xu**, P. Xu. From correlation to causation in building energy research: Methods, applications, and opportunities. **Status:** In preparation.

J3. **X. Xu**, J. Wang. Information-theoretic and Bayesian model selection for physics-based model calibration: Balancing fit, complexity, and generalization. *Information Sciences*, 726, 122743, 2026.https://doi.org/10.1016/j.ins.2025.122743

J4. **X. Xu**, Y. Hu, S. Atamturktur, L. Chen, J. Wang. Systematic review on uncertainty quantification in machine learning-based building energy modeling. *Renewable and Sustainable Energy Reviews*, 218, 115817, 2025. https://doi.org/10.1016/j.rser.2025.115817

J5. **X. Xu**, J. Wang. Comparative analysis of physics-guided Bayesian neural networks for uncertainty quantification in dynamic systems. *Forecasting*, 7(1), 9, 2025. https://doi.org/10.3390/forecast7010009

J6. S. Paneru, **X. Xu**, J. Wang, G. Chi, Y. Hu. Assessing building thermal resilience in response to heatwaves through integrating a social vulnerability lens. *Journal of Building Engineering*, 2024. https://doi.org/10.1016/j.jobe.2024.111219

J7. C. Chen, J. Wang, H. Zhang, **X. Xu**, E. Hinkle, X. Chao, Q. Shi. Dual impacts of solar-reflective facades in high-density urban areas on building energy use and outdoor thermal environments. *Energy and Buildings*, 2024. https://doi.org/10.1016/j.enbuild.2024.114926

J8. C. Ehrett, A. Brown, C. Kitchens, **X. Xu**, R. Platz, S. Atamturktur. Simultaneous Bayesian calibration and engineering design with an application to a vibration isolation system. *Journal of Verification, Validation and Uncertainty Quantification*, 2023. https://doi.org/10.1115/1.4050075

Conference Presentations

12th IAQVEC: Indoor Air Quality, Ventilation & Energy Conservation in Buildings	Los Angeles, CA
Presenter	May 2026
ASME Verification, Validation, and Uncertainty Quantification Symposium	College Station, TX
Presenter	May 2024
IMAC-XLII, Society for Experimental Mechanics	Orlando, FL
Presenter	Jan. 2024
IMAC-XLI, Society for Experimental Mechanics	Austin, TX
Presenter	Feb. 2023
4th Asia Conference of International Building Performance Simulation Association	Hong Kong
Presenter	Dec. 2018
1st International Conference on Urban and Rural Energy and Environment	Jilin, China
Presenter	Feb. 2018

Honors and Awards

The Kissinger Scholarship ($750)	May. 2026
The Kissinger Scholarship ($800)	Dec. 2024
The Wormley Family Graduate Fellowship ($3,000)	Jun. 2023
Louis S. and Sara S. Michael Endowed Graduate Fellowship in Engineering ($3,000)	Jun. 2022
University Graduate Fellowship ($30,000 per year)	Aug. 2019 – May 2024
Glenn E. Singley Memorial Graduate Fellowship ($8,000)	Aug. 2019
Outstanding Graduate of Tongji University	May 2019
Best Presentation Award from Sakura Science Club of Japan	Jan. 2018
Student Scholarship of Tongji University	May 2015 – May 2019