JIN WEN

Professor, Ph. D

Department of Civil, Architectural, and Environmental Engineering

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## PROFESSIONAL EXPERIENCE

* **Associate Dean for Faculty Advancement**, College of Engineering, Drexel University, Philadelphia, Pennsylvania, July 2022 to present
* **Professor,** Department of Civil, Architectural, and Environmental Engineering, Drexel University, Philadelphia, Pennsylvania, September 2016 to present
* **Associate Professor,** Department of Civil, Architectural, and Environmental Engineering, Drexel University, Philadelphia, Pennsylvania, September 2010 to August 2016
* **Assistant Professor,** Department of Civil, Architectural, and Environmental Engineering, Drexel University, Philadelphia, Pennsylvania, September 2003 to September 2010
* **Research Assistant**, Iowa Energy Center Energy Resource Station, Ankeny, Iowa, September 2000 to August 2003
* **Research Assistant**, Department of Mechanical and Industrial Engineering, The University of Iowa, Iowa City, Iowa, August 1998 to August 2003
* **Engineer and Training Officer**, Johnson Controls (Beijing) Ltd., Beijing, China, July 1997 to May 1998

## EDUCATION

* **Ph.D.**, Dept. of Mechanical and Industrial Engineering, The University of Iowa, 2003
* **M.S.**, Dept. of Flying Vehicles Design and Applied Mechanics, Beijing University of Aeronautics and Astronautics, 1997
* **B.S.**, Dept. of Flying Vehicles Design and Applied Mechanics, Beijing University of Aeronautics and Astronautics, 1995

## PROFESSIONAL ACTIVITIES

Dr. Wen is actively engaged in creating a diverse, equal, inclusive, and supportive environment for her college, as well as teaching and research in architectural engineering. She develops machine learning and artificial intelligence based strategies to transform building control and commissioning for grid-interactive efficient buildings. She explores opportunities to improve the built environment for better human wellbeing and social equity. Her research has been continuously funded by federal sources, such as the National Science Foundation, Department of Energy, National Institute of Standards and Technology, and by the industry, such as American Society of Heating, Ventilating, and Air Conditioning Engineers (ASHRAE). She currently serves as the Member of ASHRAE’s Research Administration Committee, which oversees and coordinates all ASHRAE research activities. She is the Task Leader for International Energy Agency (IEA)’s Energy in Buildings and Communities (EBC) Annex 81 (Data-Driven Smart Buildings) Task C (Applications) Dr. Wen was selected as the U.S. Fulbright Scholar for 2019-2020 (Sweden).

## JOURNAL PUBLICATIONS (Google Scholar h-index: 28, total citation: 3181)

1. Wen, J. and T. F. Smith, "Absorption of solar energy in a room", Solar Energy, Vol. 72, No. 4, pp. 283 - 297, 2002.
2. Wen, J. and T. F. Smith, "Development and validation of online parameter estimation for HVAC systems", Journal of Solar Energy Engineering, Vol. 125, No. 3, pp. 324 - 330, 2003.
3. J. Gao, Y. Sun, J. Wen, and T. F. Smith, "An experimental study of energy consumption and thermal comfort for electric and hydronic reheats", Energy and Buildings, Vol. 37, No. 3, pp. 203 - 214, 2004.
4. Yu., X., Wen, J., and Smith, T. F., "A model for the dynamic response of a cooling coil", Vol. 37, No. 12, pp. 1278 – 1289, Energy and Buildings, 2005.
5. Chebihi, A., Byun, K., Wen, J., and Smith, T. F., "Radiant cooling of an enclosure", Vol. 47, No. 3, pp. 229 – 252, Energy Conversion and Management, 2005.
6. Wen, J. and T. F. Smith, "Development and validation of online models with parameter estimation for building zone with VAV system", Energy and Buildings, Vol. 39, Issue 1, pp. 13-22, 2007.
7. Chen, Y. and J. Wen, "Sensor system design for building indoor air protection", Building and Environment, Vol. 43, pp. 1278-1285, 2008.
8. Commerford, E., P. L. Gurian , J. Wen, and S. R. Cook, “Design of a site-built integrated collector storage solar water heater under uncertainty", The Open Renewable Energy Journal, Vol. 1, pp. 17-25, 2008.
9. Wen, J., W. Sun, and S. Dost, "Impact of pressurization on energy consumption for laboratories and cleanrooms", ASHRAE Transactions, Vol. 115, Pt 1, pp. 496 - 506, 2009.
10. Chen, Y. and J. Wen, “Comparison of sensor systems designed using Multizone, Zonal, and CFD data for protection of indoor environments", Building and Environment, Vol. 45, No. 4, pp. 1061-1071, 2010.
11. Li, S. and J. Wen, “Development and validation of a dynamic air handling unit model - Part I ( RP 1312) ", ASHRAE Transactions, Vol. 116, Pt. 1, pp. 45 - 56, 2010.
12. Li, S., J. Wen, X. Zhou, and C. J. Klaassen, “Development and validation of a dynamic air handling unit model - Part II ( RP 1312)", ASHRAE Transactions, Vol. 116, Pt 1, pp. 57 - 73, 2010.
13. Ng, Y. L. C., and J. Wen, “Estimating building airflow network using CO2 measurements from a distributed sensor network", Invited Paper, HVAC&R Research, Vol. 17, Issue 3, pp. 344-365, 2011.
14. Langevin, J., Jin Wen & Patrick L. Gurian, “Relating occupant perceived control and thermal comfort: Statistical analysis on the ASHRAE RP-884 database”, Invited Paper, HVAC&R Research, Vol. 18:1-2, 179-194, 2012.
15. Ng, Y. L. C., and J. Wen, “Inverse estimation of indoor airflow patterns using singular value decomposition”, Applied Mathematical Modeling, Vol. 36, Issue 6, pp. 2627–2641, 2012.
16. Chen, Y. Lisa and Jin Wen, "The selection of the most appropriate airflow model for designing indoor air sensor systems", Building and Environment, Vol. 50, pp. 34–43, 2012.
17. Langevin, J., P. L. Gurian, and J. Wen, “Reducing energy consumption in low income public housing: Interviewing residents about energy behaviors”, Applied Energy, Vol. 102, pp. 1358–1370, 2012.
18. Langevin, J., J. Wen, and P. L. Gurian, "Modeling thermal comfort holistically: Bayesian estimation of thermal sensation, acceptability, and preference distributions for office building occupants", Building and Environment, Vol. 69, pp. 202 – 226, 2013.
19. Liu R., J. Wen, X. Zhou, and C. Klaassen, “Stability and accuracy of VAV box control at low flows Part 1 laboratory test setup and VAV sensor test”, HVAC&R Research, Vol. 20, No. 1, pp. 3-18, 2014.
20. Liu R., J. Wen, X. Zhou, and C. Klaassen, and A. Regnier, “Stability and accuracy of VAV box control at low flows Part 2: controller test, system test, and field test”, HVAC&R Research, Vol. 20, No. 1, pp. 19-35, 2014.
21. Li, S., and J. Wen, " A model-based fault detection and diagnostic methodology based on PCA method and wavelet transform", Energy & Buildings, Vol 68, Part A, pp. 63 - 71, 2014.
22. Liu, R., J. Wen, M. Waring, " Improving airflow measurement accuracy in VAV terminal units using flow conditioners ", Building and Environment, Vol. 71, pp. 81-94, 2014.
23. Xiao, F., Y. Zhao, J. Wen, and S. W. Wang, “Bayesian network based FDD strategy for variable air volume terminals”, Automation in Construction, Vol. 41, pp. 106-118, 2014.
24. Li, S. and J. Wen, “Application of pattern matching method for detecting faults in Air Handling Unit system”, Automation in Construction, Vol. 43, pp. 49–58, 2014.
25. Li X., and J. Wen, “Review of building energy modeling for control and operation”, Renewable and Sustainable Energy Reviews, Vol. 37, pp. 517-537, 2014.
26. Li X., and J. Wen, “Building energy consumption on-line forecasting using physics based system identification”, Energy and Buildings, Vol. 82, pp. 1-12, 2014.
27. Zhao, Y., F. Xiao, J. Wen, Y. Lu, S. Wang, “A robust pattern recognition-based fault detection and diagnosis (FDD) method for chillers”, HVAC&R Research, Vol. 20, No. 7, pp. 798-809, 2014.
28. Langevin, J., P. L. Gurian, and J. Wen, “Tracking the human-building interaction: Findings from a longitudinal field study of occupant behavior in air-conditioned offices”, Journal of Environmental Psychology, Vol. 42, pp. 94-115, 2015.
29. Zhao, Y., J. Wen, and S. Wang, “Diagnostic Bayesian networks for diagnosing air handling units faults - Part II: Faults in coils and sensors”, Applied Thermal Engineering, Vol. 90, pp. 145-157, 2015.
30. Langevin, J., J. Wen, and P. L. Gurian, “Simulating the human-building interaction: Development and validation of an agent-based model of office occupant behaviors”, Building and Environment, Vol. 88, pp. 27-45, 2015. (**2015 B&E BEST PAPER AWARD**)
31. Langevin, J., J. Wen, and P. L. Gurian, “Quantifying the human-building interaction: Considering the active, adaptive occupant in building performance simulation”, Energy and Buildings, Vol. 117, pp. 372-386, 2016.
32. Li, X., J. Wen, and E. Bai, “Developing a whole building cooling energy forecasting model for on-line operation optimization using proactive system identification”, Applied Energy, Vol. 164, pp. 69–88, 2016.
33. Zhao, Y., J. Wen, F. Xiao, X. Yang, and S. Wang. "Diagnostic Bayesian networks for diagnosing air handling units faults -Part I: faults in dampers, fans, filters and sensors", Applied Thermal Engineering, Vol. 111, pp. 1272-1286, 2017.
34. Li, X., Wen, J., Liu, R., & Zhou, X. “Commercial building cooling energy forecasting using proactive system identification: A whole building experiment study”, Science and Technology for the Built Environment, Vol. 22, No. 6, pp. 674-691, 2016.
35. Li, X., Wen, J., “System identification and data fusion for on-line adaptive energy forecasting in virtual and real commercial buildings”, Energy and Buildings Vol. 129, pp. 227-237, 2016.
36. Pourarian, S., A. Kearsley, J. Wen, A. Pertzborn, "Efficient and robust optimization for building energy simulation", Energy and Buildings, Vol. 122, pp. 53-62, 2016.
37. Li, X., Wen, J. and Malkawi, A., “An operation optimization and decision framework for a building cluster with distributed energy systems”, Applied Energy, Vol. 178, 98-109, 2016.
38. Odonkor, P., K., Lewis, J. Wen, and T. Wu, “Adaptive energy optimization in Net Zero building clusters”, ASME Journal of Mechanical Design, Vol. 138, doi:10.1115/1.4033395, 2016.
39. Pourariana, S., J. Wen, D. Veronica, A. Pertzborn, X. Zhou, and R. Liu “A tool for evaluating fault detection and diagnostic methods for fan coil units”, Energy and Buildings, Vol. 136, pp. 151-160, 2017.
40. Li, X., J. Wen, “Net-zero energy building clusters emulator for energy planning and operation evaluation”, Computers Environment and Urban Systems, Vol. 62, pp. 168-181, 2017.
41. Hendricken, L., J. Wen, J., and P. L. Gurian, “Development of a new reduced order model for predicting the energy savings of multi-ECM permutations”, Energy and Buildings, Vol. 182, pp. 287-299, 2019.
42. Zhang, L., and J. Wen, “A systematic feature selection procedure for short-term data-driven building energy forecasting model development”, Energy and Buildings, Vol. 183, pp. 428-442, 2019.
43. Ben-David, T., A Rackes, L.J. Lo, J. Wen, and M.S. Waring, “Optimizing ventilation: Theoretical study on increasing rates in offices to maximize occupant productivity with constrained additional energy use”, Building and Environment, Vol. 166, 106314, 2019.

DOI: https://doi.org/10.1016/j.buildenv.2019.106314

1. Chung, D., J. Wen, “Building envelope moisture transport in the context of assembly aging and uncertainty”, Technology|Architecture + Design, Vol. 3(2), pp. 221-233, 2019.

DOI: https://doi.org/10.1007/s12273-019-0594-5

1. Chung, D., J. Wen, and L.J. Lo. “Development and verification of the open source platform, HAM-Tools, for hygrothermal performance simulation of buildings using a stochastic approach”, Building simulation. Vol.13 (3), pp. 497-514, 2020.

DOI: https://doi.org/10.1007/s12273-019-0594-5

1. Zhang, L., M. Alahmad, and J. Wen, “Comparison of time-frequency-analysis techniques applied in building energy data noise cancellation for building load forecasting: A real-building case study”, Energy and Buildings, Vol. 231, pp. 110592, 2021.

DOI: https://doi.org/10.1016/j.enbuild.2020.110592

1. Zhang, L. and J. Wen, “Active learning strategy for high fidelity short-term data-driven building energy forecasting”, Energy and Buildings, Vol. 244, pp. 111026, 2021.

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1. Zhang, L., J. Wen, Y. Li, J. Chen, Y. Ye, Y. Fu, W. Livingood, “A review of machine learning in building load prediction”, Applied Energy, Vol. 285, pp. 116452, 2021.

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1. Awada, M., B. Becerik-Gerber, S. Hoque, Z. O'Neill, G. Pedrielli, J. Wen, T. Wu, “Ten questions concerning occupant health in buildings during normal operations and extreme events including the COVID-19 pandemic”, Building and Environment, Vol. 188, pp. 107480, 2021.

DOI: https://doi.org/10.1016/j.buildenv.2020.107480

1. Lu, X., Y. Fu, Z. O'Neill, J. Wen, “A holistic fault impact analysis of the high-performance sequences of operation for HVAC systems: Modelica-based case study in a medium-office building”, Energy and Buildings, Vol. 252 (1), pp. 111448. 2021.

DOI: https://doi.org/10.1016/j.enbuild.2021.111448

1. Fu, Y., Z. O'Neill, Z. Yang, V. Adetola, J. Wen, L. Ren, T. Wagner, Q. Zhu, T. Wu, “Modeling and evaluation of cyber-attacks on grid-interactive efficient buildings”*,* Applied Energy, Vol. 303, pp.117639, 2021.

DOI: https://doi.org/10.1016/j.apenergy.2021.117639

1. Pang, Z., B. Becerik-Gerber, S. Hoque, Z. O'Neill, G. Pedrielli, J. Wen, T. Wu, “How work from home has affected the occupant's well-being in the residential built environment: an international survey amid the COVID-19 pandemic”, ASME Journal of Engineering for Sustainable Buildings and Cities, Vol. 2(4), pp. 041003, 2021.

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1. Yang, T., A. Bandyopadhyay, Z. O’Neill, J. Wen, B. Dong, “From occupants to occupants: A review of the occupant information understanding for building HVAC occupant-centric control”, Building Simulation, Vol. 15, pp. 913-932, 2022

DOI: https://doi.org/10.1007/s12273-021-0861-0

1. Chen, Y., J. Wen, J. Lo, “Using weather and schedule based pattern matching and feature based PCA for whole building fault detection--Part I development of the method”, ASME Journal of Engineering for Sustainable Buildings and Cities, Vol. 3(1), pp. 011001, 2022.

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1. Chen, Y., J. Wen, J. Lo, “Using weather and schedule based pattern matching and feature based PCA for whole building fault detection --Part II field evaluation”, ASME Journal of Engineering for Sustainable Buildings and Cities. Vol, 3(1), pp. 011002, 2022. <https://doi.org/10.1115/1.4052730>.
2. M. Awada, B. Becerik-Gerber, E. White, S. Hoque, Z. O'Neill, G. Pedrielli, J. Wen, T. Wu, “Occupant health in buildings: Impact of the COVID-19 pandemic on the opinions of building professionals and implications on research”, Building and Environment, Vol. 207 (A), pp. 108440, 2022,

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1. Chen, Y., G. Lin, Z. Chen, J. Wen, J. Granderson, “A simulation-based evaluation of fan coil unit fault effects”, Energy and Buildings, Vol. 263, pp. 112041, 2022.

DOI: https://doi.org/10.1016/j.enbuild.2022.112041.

1. Huang, J., J. Wen, H. Yoon, O. Pradhan, T. Wu, Z. O'Neill, K. S. Candan, “Real vs. simulated: Questions on the capability of simulated datasets on building fault detection for energy efficiency from a data-driven perspective”, Energy and Buildings, Vol. 259, pp. 111872, 2022.

DOI: https://doi.org/10.1016/j.enbuild.2022.111872.

1. Chen, C. T. Dietz, N. H. Fefferman, J. Greig, K. Cetin, C. Robinson, L. Arpan, M. Schweiker, B. Dong, W. Wu, Y. Li, H. Zhou, J. Wu, J. Wen, J. S. Fu, T. Hong, D. Yan, H. Nelson, Y. Zhu, X. Li, L. Xie, R. Fu, “Extreme events, energy security and equality through micro- and macro-levels: Concepts, challenges and methods”, Energy Research & Social Science, Vol. 85, pp. 102401, 2022.

DOI: <https://doi.org/10.1016/j.erss.2021.102401>.

1. Chen, Z., J. Wen, A. J. Kearsley, and A. Pertzborn, “Evaluating the performance of an Inexact Newton method with a preconditioner for dynamic building system simulation”, Journal of Building Performance Simulation, Vol. 15(1), pp. 112-127, 2022.

DOI: 10.1080/19401493.2021.2007285

1. Yassaghi, H., N. Mostafavi, J. Wen, S. Hoque, “Partitioning climate, users, and thermophysical uncertainties from building energy use: a Monte Carlo & ANOVA approach”, Buildings, Vol. 12(2), pp. 95, 2022.

DOI: https://doi.org/10.3390/buildings12020095

1. Huang, J., H. Yoon, O. Pradhan, T. Wu, J. Wen, Z. O'Neill, K. S. Candan, “A Cosine-based correlation information entropy approach for building automatic fault detection baseline construction”, Science and Technology for the Built Environment, Accepted, 2022.

DOI: <https://doi.org/10.1080/23744731.2022.2080110>

1. Chen, Y., J. Wen, O. Pradhan, T. Wu, and L. Lo, “Using Discrete Bayesian Networks for Diagnosing and Isolating Cross-level Faults in HVAC Systems”, Applied Energy, 327: 120050, 2022.

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## BOOK CHAPTERS

* Wen, J., Y. Chen, and A. L., Regnier, “Building Fault Detection and Diagnostics”, in Encyclopedia of Systems and Control, Springer, 2019,

http://springer.iq-technikum.de/referenceworkentry/10.1007/978-1-4471-5102-9\_100080-1

* Wen, J. and A. L., Regnier, “Chapter: AHU AFDD”, in Automated Diagnostics and Analytics for Buildings, by B. L. Capehart, and M. R. Brambley, CRC Press, 2014, ISBN 9781498706117.

## SELECTED CONFERENCE PUBLICATIONS since 2011

1. J. Langevin, J. Wen, S. Hsieh, D. Novosel, and M. S. Waring, “Occupant Comfort, Productivity, and Personal Control in Ten Normative and High Performance Office Buildings, ” : Indoor Air 2011; June 5-10, 2011; Austin, TX.
2. Hendricken, L., J. Wen, and A. Persily. Framework and Case Study for Understanding Factors Impacting Outdoor Contaminant Entry into Commercial Buildings. The Department of Homeland Security Science Conference, Washington, D.C. 2011. Poster.
3. Hendricken, L., Otto, K., Wen, J., Gurian, P.L. and Sisson, W. (2012). Capital Costs and Energy Savings Achieved by Energy Conservation Measures for Office Buildings in the Greater Philadelphia Region. Paper presented at SimBuild 2012, Madison, WI
4. Langevin, J., Wen, J., Gurian, P.L., Hsieh, S. & Novosel, D. (2012, July). Behavior in the Built Environment: Findings from a Survey of Occupants in Twenty Air-Conditioned Office Buildings. Paper presented at Healthy Buildings 2012, Brisbane, AUS
5. Langevin J, Wen J and Gurian P L. Tracking Long-Term Occupant IEQ Outcomes: A Longitudinal Survey Tool. Presented at: IAQ 2013; October 15-18, 2013; Vancouver, CAN.
6. Taylor, R., P. Casey, L. Hendricken, K. Otto, W. Sisson, P. Gurian, J. Wen. The Simulation of Long Term Trends in Building Energy Consumption Due to the Impact of Market-Based Policies to Encourage Adoption of Energy Conservation Measures. CLIMA 2013 - 11th REHVA World Congress and 8th International Conference on IAQVEC, 2013, Prague, Czechoslovakia.
7. Taylor, Russell, Patrick Casey, Liam Hendricken, William Sisson, Patrick Gurian, Jin Wen, Vivian Loftness, Erica Cochran. Projections of Paths to Transformative Change in the Built Environment through Quantitative Modeling of Policies, Market Mechanisms and Behavior.FutureBuild Conference, 2013, Bath, England.
8. Hendricken, Liam, Russell Taylor, Patrick Casey, Michael Hamilton, Patrick Gurian, Jin Wen, Vivian Loftness, Erica Cochran, Alex Waegel, William Sisson. Pareto Efficient Retrofit Package Selection for Multi-Family Low-Rise buildings in the Philadelphia Metropolitan Region .FutureBuild Conference, 2013, Bath, England.
9. Langevin, J., "Simulating the human-building interaction: Development and validation of an agent-based model of office occupant behaviours" Windsor 2014 conference, April 10-13, 2014, Windsor Great Park, UK.
10. Li, X., Wen, J. & Wu, T. Net-Zero Energy Impact Building Clusters Emulator for Operation Strategies Assessment, Paper presented at the ASHRAE 2014 Annual conference; Jun. 2014, 2014, Seattle, WA.
11. Li, X., J. Wen, “System Identification for Building Energy Estimation,” IEEE CASE, August, 2014, Taipei, Taiwan.
12. Langevin, J., J. Wen, and P. L. Gurian, “Including Occupants in Building Performance Simulation: Integration of an Agent-Based Occupant Behavior Algorithm with EnergyPlus”, ASHRAE/IBPSA- USA 2014 Simulation Conference, September, 2014, Atlanta, GA.
13. Pourarian, S., J. Wen, X. Li, D. Veronica, X. Zhou, R. Liu, “Tools for Evaluating Air Flow Network of Dual Duct Double Fan Systems,” ASHRAE/IBPSA- USA 2014 Simulation Conference, September, 2014, Atlanta, GA.
14. Li, X., J. Wen, “Building Energy Consumption On-Line Forecasting Using System Identification and Data Fusion,” ASME 2014 Dynamic systems and Control Conference, October, 2-14, San Antonio, TX.
15. Regnier, A., J. Wen, J. Schwakoff, “Automated Diagnostics for AHU-VAV Systems using Pattern Matching”, Proceedings of the 1st ACM Conference on Embedded System for Energy-Efficient Buildings, November, 2014, Memphis, TN.
16. Li, X., Wen, J., Bai, E.W. “Building Energy Forecasting Using System Identification based on System Characteristics Test”, in 2015 Workshop on Modeling and Simulation of Cyber-Physical Energy Systems; Apr. 13-17, 2015,Seattle, WA, USA
17. Li, X., Wen, J., Wu, T. “Comparison of On-line Building Energy Forecasting Model Using System Identification Method and Other Inverse Modeling Methods”, in ASHRAE 2015 Annual Conference; Jun. 27 –Jul. 1, 2015, Atlanta, GA, USA.
18. Zhang, L., and J. Wen, “Experiment Design and Training Data Quality of Inverse Model for Short-term Building Energy Forecasting,” 2016 Purdue High Performance Buildings Intelligent Building Operation Session, July 2016, West Lafayette, IN.
19. Regnier, A. and Wen, J., “Automated Fault Diagnostics for AHU-VAV Systems: A Bayesian Network Approach,” 2016 Purdue High Performance Buildings Intelligent Building Operation Session, July 2016, West Lafayette, IN.
20. Z. Chen, J. Wen, A. J Kearsly, and A. J Pertzborn. 2016. "Scaling Methods for Dynamic Building System Simulation in an HVACSIM+ Environment." Poster presented at NIST ITL Science Day, NIST, Oct 13th, 2016, Gaithersburg, MD.
21. Y. Chen, J. Wen, A. Reigner. “Using Pattern Matching and Principal Component Analysis Method for Whole Building Fault Detection.” 2017 ASHRAE Annual Conference. June 25th-28th, 2017, Long Beach, CA.
22. L. Zhang, J. Wen. 2017. “A Systematic Feature Selection Procedure for Data-driven Building Energy Forecasting Model Development.” ASHRAE Annual Conference. July 26th, 2017 Long Beach, CA.
23. Z. Chen, J. Wen, A. J Kearsly, and A. J Pertzborn. 2017. "Scaling Methods for Dynamic Building System Simulation in an HVACSIM+ Environment." 15th IBPSA conference, August 7th-9th, 2017, San Francisco, CA.
24. Y. Chen, J. Wen. 2017, “Whole Building System Fault Detection Based on Weather Pattern Matching and PCA Method.” 3rd International Conference on Control Science and Systems Engineering (ICCSSE 2017. August 18th-19th, 2017). Beijing, China
25. Zhang, L., J. Wen, and Y. Chen, Systematic Feature Selection Process Applied in Short-Term Data-Driven Building Energy Forecasting Models: A Case Study of a Campus Building, ASME 2017 Dynamic Systems and Control Conference; October 11-13, 2017, Tysons, VA.
26. Y. Chen, J. Wen. 2017, “A Whole Building Fault Detection Using Weather Based Pattern Matching and Feature Based PCA Method”, IEEE Big Data, December 11th - 14th, 2017, Boston, MA.
27. Y. Chen, J. Wen, T. Chen, O. Pradhan, “Bayesian Networks for Whole Building Level Fault Diagnosis and Isolation, 5th International High Performance Buildings Conference, July 9th-12th, 2018, West Lafayette, IN.
28. L. Zhang and J. Wen, “Application of Active Learning in Short-term Data-driven Building Energy Modeling”, 5th International High Performance Buildings Conference, July 9th-12th, 2018, West Lafayette, IN.
29. Y. Chen, J. Wen, T. Chen, O. Pradhan, “Development and Field Evaluation of Data-Driven Whole Building Fault Detection and Diagnosis Strategy”, 2018 Prognostics and Health Management Conference, September 24th to 27th, Philadelphia, PA.
30. O. Pradhan, A. Pertzborn, L. Zhang, and J. Wen, “Development and Validation of a Simulation Testbed for the Intelligent Building Agents Laboratory (IBAL) Using Trnsys”, ASHRAE 2020 Summer Conference, June 29th to July 2nd, 2020, Virtual.
31. Huang, J., T Wu, H Yoon, O Pradhan, J Wen, Z O'Neill, Automatic Fault Detection Baseline Construction for Building HVAC Systems using Joint Entropy and Enthalpy. in IIE Annual Conference. Proceedings. 2021. Institute of Industrial and Systems Engineers (IISE).
32. Li, G., Y Fu, A Pertzborn, J Wen, Z O’Neill, An Ice Storage Tank Modelica Model: Implementation and Validation. in Modelica Conferences. 2021, Virtual
33. Y. Fu, Z. O'Neill, J. Wen, and V. Adetola, A Flexible and Generic Functional Mock-up Unit Based Threat Injection Framework for Grid-Interactive Efficient Buildings (VC-21A-A001), in ASHRAE Summer Conference. 2021. Virtual.
34. T. Stief, M. Safari, H. Johnson, J. Wen, and P. Gurian, Cold Climate Heat Pump Capital Costs with and without Electrical Resistance Backup (VC-21A-C033), in ASHRAE Summer Conference. 2021. Virtual.
35. Z. Chen, J. Wen, S. T. Bushby, C. Calfa, Y. Fu, G. Grajewski, Y. Li, L. J. Lo, Z. O’Neill, W. V. Payne, A. Pertzborn, Z. Yang, Y. Zhang, A Hardware-in-the-Loop Approach for Laboratory Performance Verification of Flexible Building Equipment in a Typical Commercial Building (VC-21A-A006), in ASHRAE Summer Conference. 2021. Virtual.
36. O. Pradhan, J. Wen, Y. Chen, T. Wu, Z. O’Neill, Dynamic Bayesian Network for Fault Diagnosis (VC-21A-A002), in ASHRAE Summer Conference. 2021. Virtual.
37. Yang, T., A. Bandyopadhyay, Z. O'Neill, J. Wen and A. Rogers. Comparisons of Rule-based Fault Detection and Diagnostic Methods for Residential Vapor Compression Cycle systems, in ASHRAE Summer Conference. June 25th to June 29th, 2022. Toronto, ON, Canada.
38. Chen, Y., G. Lin, Z. Chen, J. Wen, J. Granderson, “A Simulation-Based Method to Analyze Fan Coil Unit Fault Impacts”, in ASHRAE Summer Conference. June 25th to June 29th, 2022. Toronto, ON, Canada.
39. Chen, Z., J. Wen, S. Bushby, C. Calfa, Y. Fu, G. Grajewski, Y. Li, J. Lo, Z. O’Neill, W. V. Payne, A. Pertzborn, Z. Yang, “Development of a Hardware-in-the-Loop Testbed for Laboratory Performance Verification of Flexible Building Equipment in Typical Commercial Buildings”, in ASHRAE Summer Conference. June 25th to June 29th, 2022. Toronto, ON, Canada.
40. Li, G., Y. Fu, A. Pertzborn, Z O’Neill, J. Wen, “Demand Flexibility Evaluation for Building Energy Systems with Thermal Energy Storages Using Model Predictive Control”, in ASHRAE Summer Conference. June 25th to June 29th, 2022. Toronto, ON, Canada.
41. Kimball, R.L., J. Wen, Z. O'Neill, T. Yang, Y. Li, Developing Learning-Based Models for Occupant Centric Control, 2022 Herrick Conferences. July 10th – July 14th, 2022. Purdue University, West Lafayette, IN.
42. Pradhan, O., D. Halleberg, Z. Chen, J. Wen, T. Wu, K. S. Candan, Z. O’Neill, Lagged-kNN Based Data Imputation Approach for Multi-Stream Building Systems Data, 2022 Herrick Conferences. July 10th – July 14th, 2022. Purdue University, West Lafayette, IN.
43. Huang, J., T. Li, Y. Xu, T. Wu, H. Yoon, J. R. C. and K. M. Bennett, EE-SMOTE: An oversampling method in conjunction with information entropy for imbalanced learning, May 21st – 24th, 2022 IISE Annual Conference & Expo.
44. Z. Chen, J. Wen, S. T. Bushby, J. Lo, Z. O’Neill, W. V. Payne, A. Pertzborn, C. Calfa, Y. Fu, G. Grajewski, Y. Li, L. Z. Yang, "An Analysis of the Hybrid Internal Mass Modeling Approach in EnergyPlus", eSim 2022 Conference, June, 2022, Ottawa, Canada.

## INVITED PRESENTATIONS since 2015

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| 2022 | Wen, J., “Data, Human, Built Environment - Impact of Sustainable Buildings in Arid Environment on the Indoor and Outdoor Air Quality”, Impact of Sustainable Buildings in Arid Environment on the Indoor and Outdoor Air  Quality Workshop, May, Doha, Qatar. |
| 2022 | Wen, J., O. Pradhan, “Securing Grid-interactive Efficient Buildings - Understand cyber and physical fault impact and develop diagnosis strategies through a simulation study”, 2022 IEEE Power & Energy Society General Meeting (GM), July, Denver, CO. |
| 2021 | Wen, J. “Data-Driven Approaches for Fault Detection and Diagnosis”, i-Hub Data Clearing House Summit IV, in conjunction with The Australian Institute of Refrigeration, Air conditioning and Heating (AIRAH)’s Future of HVAC 2021, November, Virtual. |
| 2021 | Wen, J. “Data Driven Smart Buildings”, Invited Seminar, The 2nd International Conference for Global Chinese Academia on Energy and Built Environment, July, Virtual. |
| 2021 | Wen, J. “Active Learning Strategy for High Fidelity Short-Term Data-Driven Building Load Forecasting”, Invited Speaker for EPRI Webinar Demystifying AI/ML Applications and Demonstrations in Grid-Interactive Efficient Buildings, June, Virtual. |
| 2021 | Wen, J. “Simulating Occupant Comfort and Behavior for GEB Load Flexibility Emulation”, Invited Seminar, ASHRAE Summer Conference Seminar Approaches and Applications of Occupant Information Modeling, June, Virtual. |
| 2021 | Wen, J., “Data Driven Smart Buildings”, Invited Seminar, Sonny Astani Department of Civil and Environmental Engineering, University of Southern California, February, Virtual. |
| 2021 | Wen, J. “Simulating Occupant Comfort and Behavior for GEB Load Flexibility Emulation”, Invited Seminar, ASHRAE Summer Conference Seminar Approaches and Applications of Occupant Information Modeling, June, Virtual. |
| 2021 | Wen, J., “Data Driven Smart Buildings”, Invited Seminar, Sonny Astani Department of Civil and Environmental Engineering, University of Southern California, February, Virtual. |
| 2020 | Wen, J. “Data Driven Energy Forecasting Model for Building-Grid Integration”, Invited Seminar, ASHRAE Summer Conference Seminar Approaches and Applications of Occupant Information Modeling, June, Virtual. |
| 2019 | Wen, J. “Automated Fault Detection and Diagnosis for HVAC Systems– Needs, Challenges, and Promising Data-driven Methods”, Keynote Speaker, National Hungary Building Engineering Day, November, Budapest, Hungary. |
| 2019 | Wen, J. “Building Doctor's Medicine Cabinet (BDMC): Data-Driven Services for High Performance and Sustainable Buildings”, NSF Workshop on Dynamic Interaction of Embodied Human and Machine Intelligence, Los Angeles, CA. |
| 2019 | Wen, J., and L. Zhang, “Data-driven Whole Building Energy Forecasting Model for Data Predictive Control”, University of Southern California, February, Virtual. |
| 2019 | Wen, J., and L. Zhang, “Data Driven Energy Forecasting Model for Building-Grid Integration”, CASCADE Workshop/Retreat on Big Data Challenges, Techniques, and Applications, ASU, April, Phoenix, AZ. |
| 2018 | Wen, J., and J. Langevin, “Human-Building Thermal Interaction Modeling and Validation” NSF RCN-SEES: Predictive Modeling Network for Sustainable Human - Building Ecosystems Workshop, May, Carnegie Mellon University, Pittsburgh, PA. |
| 2016 | Wen, J., “From Big Data to Big Energy Saving - Improving Building Energy Efficiency and Building-Human interactions through Advanced Control, Operation and Data Analytics,” Invited Presentation, ASHRAE Philly Chapter, November, Philadelphia, PA. |
| 2016 | Wen, J., “From Big Data to Big Energy Saving - Improving Building Energy Efficiency and Building-Human interactions through Advanced Control, Operation and Data Analytics,” Invited Seminar, Beijing University of Civil Engineering and Architecture, August, Beijing, China. |
| 2016 | Wen, J., A. Regnier, and Y. Chen, “Automated Diagnostic Developments & Case Studies - VOLTTRON-Compatible AHU Diagnostic System,”, Invited Presentation, 2016 Purdue High Performance Buildings Intelligent Building Operation Session, July, West Lafayette, IN. |
| 2015 | Wen, J., “From Big Data to Big Energy Saving - Improving Building Energy Efficiency through Advanced Operation and Building Analytics”, Invited Seminar**,** The U.S. Department of Energy, Building Technologies Office, July, Washington D.C.. |
| 2015 | A. Regnier, and J. Wen, “Automatic Fault Detection and Diagnostics for Air-Handling Units”, Invited Speaker, DOE VOLTTRON Workshop, July, Arlington, VA. |
| 2015 | A. Regnier and J. Wen, “FDD for AHUs: A Value Proposition for Building Operators?”, Invited Speaker, ASHRAE Summer Conference, July, Atlanta, GA. |
| 2015 | Wen, J., “Leaping from Smart Buildings to Smart Cities”, Invited Seminar, 2015 UTEP Industrial, Manufacturing and Systems Engineering Day, University of Texas at El Paso, April, El Paso, TX. |

## PROFESSIONAL SOCIETIES AND SERVICES

* American Society of Heating, Refrigerating and Air-Conditioning Engineers, member
  + **Research Admission Committee, Member (2020 - present)**
  + Chair for TC 7.5 Smart Building Systems (2019, 2020)
  + Past vice and research chairs for TC 7.5 Smart Building Systems
  + Past chair for TC 7.5 Smart Building Systems – Fault Detection and Diagnosis subcommittee
* **Task C Leader**, IEA EBC Annex 81 (Data Driven Smart Buildings)
* **Associate Editor**, ASME Journal of Engineering for Sustainable Buildings and Cities
* **Technical Advisory Board Member**
  + 2022-2025: *Development and Validation of Smart Building Technology Modules for Academic and Professional Education,* funded by the U.S. Department of Energy under FOA No. DE-FOA- 0002196, conducted by Slipstream Group, Inc.
  + 2021-2024: *Sensor Impact Evaluation and Verification*, funded by the U.S. Department of Energy under FOA No. DE-LC-000L070, conducted by Oak Ridge National Laboratory (ORNL), Pacific Northwest National Laboratory (PNNL) and National Renewable Energy Laboratory (NREL)
  + 2021-2024: *Building Controls for Energy Efficiency: Adaptive Control*, U.S. Department of Energy Sensors and Control Group, conducted by PNNL, Lawrence Berkeley Laboratory, and NREL
* **Reviewer for Funding Agencies**
  + U.S. National Science Foundation: continuously since 2004
  + U.S. Department of Energy: continuously since 2006
  + Swiss National Science: 2020
  + Iowa Energy Center: 2007, 2013, 2014, 2015, 2016
  + HongKong Research Council: continuously since 2010
  + HongKong Central Policy Unit Public Policy Funding: 2014
* **Reviewer for Journals**
  + Applied Energy, continuously since 2013
  + ASHRAE Transactions, continuously since 2004
  + Energy and Building, continuously since 2009
  + Building and Environment, continuously since 2009
  + Science and Technology for the Built Environment, continuously since 2007
  + International Journal of Heat and Mass Transfer, 2005
  + ASME Transactions, 2005, 2009, 2010
  + ASME Solar Engineering Journal, 2004, 2013
  + Journal of Infrastructure Systems, 2007
* **Editor or Session Chair for the following Conferences:**
  + Associate Editor, IEEE CASE Conference 2013
  + Session Chair, SPIE, 2004; Purdue High Performance Building Conference, 2010; ASHRAE Winter Conference, 2008, 2014; ASHRAE Summer Conference, 2014; ASHRAE Summer Conference, 2015.
  + Program Committee member for ACM International Conference on Embedded Systems For Energy-Efficient Built Environments (BuildSys) since 2015
* **University and Department Committees since 2010 (selected):**
  + University Senate 2018, 2019
  + University Tenure Appeal Committee 2018, 2019 (President’s appointee)
  + ASHRAE Drexel Student Chapter advisor since 2015
  + COE Tenure and Promotion Committee, **chair** (2018), member (2019)
  + COE Dean’s Search Committee, member, 2011
  + COE Strategic Planning Committee, member, 2011
  + IEXE Director Search Committee, member, 2013
  + Department Tenure and Promotion Committee, member (2014, 2016)
  + Department Tenure and Promotion Committee, **chair** (2017, 2018, 2020)
  + Department Faculty Search Committee member, 2011, 2014, 2015
  + Department Head Search Committee, member, 2014
  + Department Faculty Search Committee, **chair**, 2021
  + Department MS Level Planning Committee, **chair**, 2021

## CURRENT and RECENTLY ACCOMPLISHED PROJECTS (selected)

Project Title: Hardware-in-the-Loop Laboratory Performance Verification of Flexible Building Equipment in a Typical Commercial Building Sponsor: DOE

Total Award Amount: $2.1 M

Total Award Period Covered: 5/01/2020-04/30/2023 PI

Project Title: PIRE: Building Decarbonization via AI-empowered District Heat Pump Systems Sponsor: NSF

Total Award Amount: $1.5 M (Drexel $374,987)

Total Award Period Covered: 1/01/2023-12/31/2025 CO-PI (Drexel PI)

Project Title: Securing Grid-interactive Efficient Buildings (GEB) through Cyber Defense and Resilient System (CYDRES) Sponsor: DOE

Total Award Amount: $2.5M (Drexel $399,986)

Total Award Period Covered: 5/01/2020-04/30/2022 CO-PI (Drexel PI)

Project Title: Collaborative Research: CPS: TTP Option: Medium: i-HEAR:

immersive Human-On-the-Loop Environmental Adaptation for Stress Reduction Sponsor: NSF

Total Award Amount: $1.2M (Drexel $499,988)

Total Award Period Covered: 7/01/2021-06/30/2023 CO-PI

Project Title: Collaborative Research: AccelNet: An International Network of Networks for Well-being in the Built Environment (IN2WIBE) Sponsor: NSF

Total Award Amount: $750,000 (Drexel $243,717)

Total Award Period Covered: 10/01/2019-09/30/2022 CO-PI (Drexel PI)

Project Title: IoT Based Comfort Control and Fault Diagnostics System (i-COMFORT) for Energy Efficient Residential Houses Sponsor: DOE

Total Award Amount: $850,000 (Drexel $190,000)

Total Award Period Covered: 03/01/2019-02/28/2022 CO-PI (Drexel PI)

Project Title: International Workshop on Connecting Woman Faculty in Sustainable Building Research (WISB) Sponsor: NSF

Total Award Amount: $50,000

Total Award Period Covered: 2/1/2018 – 1/31/2019 PI

Project Title: Building Doctor's Medicine Cabinet (BDMC): Data-Driven Services for High Performance and Sustainable Buildings Sponsor: NSF

Total Award Amount: $750,000 (Drexel $192,985)

Total Award Period Covered: 9/1/2018 – 8/31/2021 CO-PI (Drexel PI)

Project Title: A Simulation Testbed for the Intelligent Building Agents Laboratory – Improving the Measurement Science for Building Control Strategies

Sponsor: National Institute of Standard Technology

Total Award Amount: $99,994

Total Award Period Covered: 9/1/2017 – 8/31/2018 PI

Project Title: VOLTTRON Compatible Whole Building root-Fault Detection and Diagnosis

Sponsor: DOE

Total Award Amount: $200,000

Total Award Period Covered: 10/1/2015 – 12/31/2018 PI

Project Title: Advanced Solver and Interface Development for HVACSIM+

Sponsor: National Institute of Standard Technology

Total Award Amount: $240,500

Total Award Period Covered: 8/1/2015 – 7/31/2017 PI

Project Title: CPS: Synergy: Collaborative Research: SMARTER - Smart Manager for Adaptive and Real-Time Decisions in building clustERs Sponsor: NSF

Total Award Amount: $ 1M (Drexel: 400,000.00)

Total Award Period Covered: 10/1/2012 – 9/30/2015 CO-PI (Drexel PI)

## AWARDS (Personal and Research Group)

* 2004 Fellowship for ExcEEd 6-days Engineering teaching workshop
* 2005 Fellowship (for Travel Support) for China-US Special Workshop on Multiple Hazards Resistant Strategy and Monitoring Technologies for Large Public

Buildings

* 2006 Fellowship (for Travel Support) for NSF US-Taiwan Workshop on Smart

Structural Technology for Seismic Hazard Mitigation

* 2006 Fellowship for NSF Nano for Educator Workshop
* 2006 Fellowship for NSF CMS/BES Divisions Workshop for the Advancement and

Retention of Underrepresented & Minority Engineering Educators (WEE 06)

* 2006 PhD Student Y. Lisa Chen was awarded the NSF GRFP
* 2010 Fellowship (Travel Support) for the first US-Israel Workshop on Sustainable

Buildings – Material and Energy, Haifa, Israel

* 2011 Invited by the British Government as one of the seven American experts,

attending the UCL Anglo – American Symposium: Sustainable Energy Management and the Built Environment - Sharing Anglo-American Best Practice

* 2011 PhD student J. Langevin was awarded the NSF GRFP
* 2013 PhD student J. Langevin was awarded the ASHRAE Grant in Aid and was

featured in the ASHRAE Society Newspaper

* 2014 PhD student J. Langevin was awarded the 1st Place at Drexel IEEE Graduate

Poster Competition

* 2014 PhD student J. Langevin was awarded the Drexel’s Best Dissertation Award
* 2014 PhD student A. L. Regnier was awarded “Best Demo” at the 2014 ACM

BuildSys Conference, for his demonstration titled Automated Diagnostics for AHU-VAV Systems Using Pattern Matching

* 2019 FULBRIGHT US Scholar (Sweden)
* 2020 ELATES Fellow
* 2021 Longsview Fellow
* 2022 ASHRAE Distinguished Service Award

## CURRENT AND PAST PHD STUDENTS

|  |  |  |
| --- | --- | --- |
| Name | Thesis | Graduation Year |
| Shun Li | A Model-Based Fault Detection and Diagnostic Methodology for Secondary HVAC Systems | 2010 |
| Y. Lisa Chen Ng | Framework for the Utilization of Forward and Inverse Airflow Models in Systematic Sensor System Design for Indoor Air | 2011 |
| Ran Liu | Accuracy and Stability of VAV Box Control at Low Flows | 2012 |
| Jared Langevin | Human Behavior and Low Energy Architecture - Linking Environmental Adaptation, Personal Comfort, & Energy Use in the Built Environment | 2014 |
| Xiwang Li | Net-zero Building Cluster Simulations and On-line Energy Forecasting for Adaptive and Real-Time Control and Decisions | 2015 |
| Shokouh Pourarian | Tools for Evaluating Fault Detection and Diagnostic Methods for HVAC Secondary Systems of a Net Zero Building | 2016 |
| Liam Hendricken | Regional Energy Simulation: Defining, Automating, and Applying Methods to Create Representative Building Stocks at a Sub-National Level | 2018 |
| Liang Zhang | Data-driven Whole Building Energy Forecasting Model for Data Predictive Control | 2018 |
| Daniel Chung | Evaluation of Building Envelope Performance including Uncertainty and Degradation within a Multi-Objective Optimization Framework | 2019 |
| Yimin Chen | Data-driven Whole Building Fault Detection and Diagnosis | 2019 |
| Zhelun Chen | Advanced Solver Development for Large-Scale Dynamic Building System Simulation | 2019 |
| Adam Regnier | Automated Fault Diagnostics for AHU-VAV Systems: A Novel Pattern Matching Approach | 2020 |

Current students: Steve Snyder (part-time, candidate), Ojas Pradhan (candidate), Richard Kimball (candidate), Yicheng Li (candidate), Jose Moussa, Noreshvarman Manisagar

## COURSES TAUGHT

MEM 413: HVAC Loads

Senior undergraduate course. Taught annually since 2009. Typical enrollment 20-30 students.

MEM 414 HVAC Equipment

Senior undergraduate course. Taught annually since 2009. Typical enrollment 40-60 students.

AE 430 Control Systems for HVAC

Senior undergraduate course. Taught annually since 2006. Typical enrollment 10-20 students.

AE 220 Introduction to HVAC

Pre-Junior undergraduate course. Taught annually from 2003 till 2008. Typical enrollment 20-30 students.

AE 551 Building Energy System Modeling I

Graduate course. Taught bi-annually since 2010. Typical environment 5-10 students.

AE 552 Building Energy System Modeling II

Graduate course. Taught bi-annually since 2010. Typical environment 5-10 students.

AE 550: Comfort Analysis and Indoor Air Quality

Graduate course. Taught annually from 2004 till 2008. Typical environment 5-10 students.