王者

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个人简介

王者，香港科技大学土木与环境工程系助理教授，曾任劳伦斯伯克利国家实验室科学家。清华大学本科，剑桥大学硕士，清华大学博士（导师：朱颖心教授、林波荣教授），美国加州伯克利大学博士后；北京市优秀毕业生（2011，2017），入选清华大学首批苏世民学者（2016），紫荆学者（2017），受邀以中方唯一青年学者代表身份在刘延东副总理、克里国务卿主持的第七届中美人文交流高层对话（2016）上发言，曾被纽约时报（New York Times）报道（2016 年 1 月 11 日）。

王者的主要研究方向是未来建筑节能低碳和智慧运维技术。面向我国新时期城镇化进程中的节能低碳、智能健康需求，围绕智能建筑的“人员--环境--计算”三要素开展基础原理和创新技术研究，在(1)人员与建筑环境交互模式、交互数据采集与预测新模型；(2)空间环境状态感知与大数据分析；(3)能源与环境系统智能控制优化算法等三方面取得系列创新成果。以主要研究员身份参加美国能源部、美国自然科学基金委资助的 5 项课题（总经费 560 万美元），在 Renewable and Sustainable Energy Reviews (IF: 12.1), Applied Energy(IF: 8.9)等行业顶尖 SCI 期刊和 IEEE Big Data, ACM 等学科交叉领域共发表论文 59 篇，其中第一作者 19 篇，通讯作者 3 篇，共同第一作者 5 篇，ESI 高被引论文 2 篇；迄今谷歌学术引用 1918 次，其中 2020 年以来引用 1371 次，h-index23。王者现任 SCI 期刊 Frontiers in Built Environment 副主编，Building Simulation 和中文核心期刊《建筑节能》编辑，曾获国家科技进步二等奖（2019，排名 9/10），北京市科学技术一等奖（2018，排名 10/15），华夏建设科学技术一等奖（2020，排名 10/15）。

工作经历

2021.11 至今 **香港科技大学，助理教授**

2018.07-2021.10 **美国劳伦斯伯克利国家实验室，项目科学家**

- 美国能源部课题：Integrating Sensor Data with Physics-Based Models，核心研究者
  - 基于大规模智能网联温控器数据推断美国住宅建筑热性能
  - 美国住宅建筑需求响应潜力分析
- LBNL 课题：Reinforcement Learning for Building Control，核心研究者
  - 搭建适用于强化学习的模拟环境，开源软件开发中
  - 基于 DDPG、SAC 等强化学习算法开发建筑控制器
  - 研究设计分布式多智能体(distributed multi-agent)强化学习架构
- 美国能源部课题：Hierarchical Occupancy Responsive MPC，主要研究者
  - 开发建筑和园区尺度的模型预测控制器
  - 开发模型预测控制工具 MPCPy，成果开源软件 1
- 美国能源部课题：End-Use Load Profiles for the U.S. Building Stock，主要研究者
  - 开发人员行为模拟工具以生成更准确的建筑负荷，成果开源软件 2
  - 基于数据驱动方法预测建筑负荷

2017.10-2018.06 **加州伯克利大学，博士后研究员**

- 美国 NSF 课题：Personalized Wearable Comfort Devices，核心研究者
  - 开发测试高能效穿戴式个性化舒适设备
  - 开发数据驱动模型预测个性化人员舒适度

2016.12-2018.06 **世界银行，能源咨询专家**

- 世界银行&住建部：中国城市建筑节能和可再生能源应用项目，咨询专家
  - 基于主元分析(PCA)研究城市形态对城市用能和碳排放的影响

教育经历

2011.08-2017.07 **清华大学，建筑技术，博士**

- 哈佛大学访问学者，2015
- 获得：*国家奖学金* (2012)，*清华大学综合优秀奖学金* (2012, 2015)，*波音奖学金* (2015)，*北京建筑设计院优秀学生奖学金* (2016)，*北京市优秀毕业生*，*建筑学院优秀博士论文* (2017)
- 共青团清华大学建筑学院委员会书记，2011-2013

2016.08-2017.07 **清华大学苏世民书院，国际事务，硕士**

- 受邀在 2016 年第七轮中美人文交流高层磋商全体会议（由中国副总理刘延东和美国国务卿克里主持）上发言，唯一中国青年学者代表
- 学生自治委员会成员 (110 名学生中选举产生 12 名)

2013.10-2014.09 **剑桥大学，能源技术，硕士**

- 获得：*Wing Yip 奖学金*（每年 3 人）

2008.09-2011.07 **清华大学，经济学，学士**

- 平均绩点 92.8/100, 排名 1 /126

2007.09-2011.07 **清华大学，土木工程，学士**

- 平均绩点 91.3/100, 排名 1/29
- 获得：*国家奖学金* (2009, 2010)，*波音奖学金* (2011)，*北京市优秀毕业生*(2011)，*清华大学优秀毕业生*(2011)，*优秀学位论文* (2011)
- 清华大学学生网络电视台台长，2010-2011

开源软件

MPCPy	Python-based open-source platform for model predictive control in buildings https://github.com/lbl-srg/MPCPy
Modelica Buildings Library	Dynamic simulation models for building energy and control systems https://github.com/lbl-srg/modelica-buildings

学术服务

2021 till now	副主编， *Frontiers in Built Environment*
2020 till now	编辑， *Building Simulation*, *Building Energy Conservation*
2020	基金评委， *The Dunhill Medical Trust, UK*
2020, 2021	学术委员会委员， *International Workshop on Reinforcement Learning for Energy Management in Buildings & Cities (RLEM)*, https://rlem-workshop.net/
till now	审稿人， *Applied Energy, Energy, Building and Environment, Energy and Building, Journal of Building Engineering, Building Simulation, Environmental Science and Pollution Research, Science and Technology for the Built Environment, SoftwareX, Journal of Building Performance Simulation, Applied Thermal Engineering, Advanced Engineering Informatics, Frontiers in Built Environment, International Journal of Biometeorology, Journal of Asian Architecture and Building Engineering, Journal of the Taiwan Institute of Chemical Engineer, Sustainable Cities and Society, Engineering*

获奖

1. 《绿色公共建筑环境与节能设计关键技术研究与应用》，2019 年国家科学技术进步奖二等奖，证书号：2019-J-22101-2-01-R09，个人排名 9/10
2. 《绿色公共建筑环境与节能设计关键技术研究与应用》，2018 年北京市科学技术奖一等奖，个人排名 10/15
3. 《公共建筑室内环境智能监控和节能关键技术研究》，2020 华夏建设科学技术一等奖，个人排名 10/15

专利

1. Lin, BR., Zhao, HT., and **Wang, Z.**, A Waste Heat Recovery System Designed for Dishwasher. Chinese Patent Number: ZL 201320328067.9

学术文章

(#: 共同第一作者; *: 通讯作者)

1. **Wang, Z.**, Chen, B., Li, H. and Hong, T., 2021. AlphaBuilding ResCommunity: A multi-agent virtual testbed for community-level load coordination. Advances in Applied Energy, 4, p.100061.
2. **Wang, Z.**, Hong, T. and Li, H., 2021. Informing the planning of rotating power outages in heat waves through data analytics of connected smart thermostats for residential buildings. Environmental Research Letters, 16(7), p.074003.
3. **Wang, Z.**, Hong, T., Li, H. and Piette, M.A., 2021. Predicting city-scale daily electricity consumption using data-driven models. Advances in Applied Energy, 2, p.100025.
4. **Wang, Z.** and Hong, T., 2020. Reinforcement Learning for Building Controls: The opportunities and challenges. Applied Energy, 269, p.115036.
5. **Wang, Z.**, Hong, T. and Piette, M.A., 2020. Building thermal load prediction through shallow machine learning and deep learning. Applied Energy, 263, p.114683.
6. **Wang, Z.** and Hong, T., 2020. Learning occupants' indoor comfort temperature through a Bayesian inference approach for office buildings in United States. Renewable and Sustainable Energy Reviews, 119, p.109593.
7. **Wang, Z.** and Hong, T., 2020. Generating realistic building electrical load profiles through the Generative Adversarial Network (GAN). Energy and Buildings, p.110299.
8. **Wang, Z.**, Hong, T., Piette, M.A. and Pritoni, M. 2019, Inferring occupant counts from Wi-Fi data in buildings through machine learning, Building and Environment, 158, pp. 281-294.
9. **Wang, Z.**, Parkinson, T., Li, P., Lin, B. and Hong, T., 2019. The Squeaky wheel: Machine learning for anomaly detection in subjective thermal comfort votes. Building and Environment, 151, pp.219-227.
10. **Wang, Z.**, Zhang, H., He, Y., Luo, M., Li, Z., Hong, T. and Lin, B., 2020. Revisiting individual and group differences in thermal comfort based on ASHRAE database. Energy and Buildings, 219, p.110017.
11. **Wang, Z.**, Wang, J., He, Y., Liu, Y., Lin, B. and Hong, T., 2020. Dimension analysis of subjective thermal comfort metrics based on ASHRAE Global Thermal Comfort Database using machine learning. Journal of Building Engineering, 29, p.101120.
12. **Wang, Z.**, Hong, T. and Piette, M.A., 2019. Predicting plug loads with occupant count data through a deep learning approach. Energy, 181, pp.29-42.
13. **Wang, Z.**, Warren, K., Luo, M., He, X., Zhang, H., Arens, E., Chen, W., He, Y., Hu, Y., Jin, L. and Liu, S., 2019. Evaluating the comfort of thermally dynamic wearable devices. Building and Environment, p.106443.
14. **Wang, Z.**, Hong, T. and Piette, M.A., 2019. Data fusion in predicting internal heat gains for office buildings through a deep learning approach. Applied Energy, 240, pp.386-398.
15. **Wang, Z.**, Hong, T. and Jia, R., 2018. Buildings. Occupants: a Modelica package for modelling occupant behaviour in buildings. Journal of Building Performance Simulation, pp.1-12.
16. **Wang, Z.**, Luo, M., Geng, Y., Lin, B. and Zhu, Y., 2018. A model to compare convective and radiant heating systems for intermittent space heating. Applied Energy, 215, pp.211-226.
17. **Wang, Z.**, de Dear, R., Luo, M., Lin, B., He, Y., Ghahramani, A. and Zhu, Y., 2018. Individual difference in thermal comfort: A literature review. Building and Environment, 138, pp. 181-193 (highly cited paper)

18. **Wang, Z.**, Zhao, Z., Lin, B., Zhu, Y. and Ouyang, Q., 2015. Residential heating energy consumption modeling through a bottom-up approach for China's Hot Summer–Cold Winter climatic region. Energy and Buildings, 109, pp.65-74.
19. **Wang, Z.**, Zhao, H., Lin, B., Zhu, Y., Ouyang, Q. and Yu, J., 2015. Investigation of indoor environment quality of Chinese large-hub airport terminal buildings through longitudinal field measurement and subjective survey. Building and Environment, 94, pp.593-605.
20. **Wang, Z.**, de Dear, R., Lin, B., Zhu, Y. and Ouyang, Q., 2015. Rational selection of heating temperature set points for China's hot summer–Cold winter climatic region. Building and Environment, 93, pp.63-70.
21. **Wang, Z.**, Lin, B. and Zhu, Y., 2015. Modeling and measurement study on an intermittent heating system of a residence in Cambridgeshire. Building and Environment, 92, pp.380-386.
22. Liu, S.*,#, **Wang, Z.***,#, Schiavon, S., He, Y., Luo, M., Zhang, H. and Arens, E., 2020. Predicted percentage dissatisfied with vertical temperature gradient. Energy and Buildings, p.110085.
23. Wang, J.#, **Wang, Z.**#, Zhou, D. and Sun, K., 2019. Key issues and novel optimization approaches of industrial waste heat recovery in district heating systems. Energy, p.116005.
24. Wang, J.#, **Wang, Z. ***,#, de Dear, R., Luo, M., Ghahramani, A. and Lin, B., 2018. The uncertainty of subjective thermal comfort measurement. Energy and Buildings, 181, pp.38-49.
25. Liu, Y.#, **Wang, Z.**#, Lin, B., Hong, J. and Zhu, Y., 2018. Occupant satisfaction in Three-Star-certified office buildings based on comparative study using LEED and BREEAM. Building and Environment, 132, pp.1-10.
26. Touzani, S.#, Prakash, A.K.#, **Wang, Z.**#, Agarwal, S., Pritoni, M., Kiran, M., Brown, R. and Granderson, J., 2021. Controlling distributed energy resources via deep reinforcement learning for load flexibility and energy efficiency. Applied Energy, 304, p.117733.
27. Luo, M., **Wang, Z.***, Ke, K., Cao, B., Zhai, Y. and Zhou, X., 2018. Human metabolic rate and thermal comfort in buildings: The problem and challenge. Building and Environment, 131, pp. 44-52
28. Li, H., **Wang, Z.** and Hong, T., 2021. A synthetic building operation dataset. Scientific data, 8(1), pp.1-13.
29. Li, H., **Wang, Z.**, Hong, T. and Piette, M.A., 2021. Energy Flexibility of Residential Buildings: A Systematic Review of Characterization and Quantification Methods and Applications. Advances in Applied Energy, p.100054.
30. Li, H., **Wang, Z.**, Hong, T., Parker, A. and Neukomm, M., 2021. Characterizing patterns and variability of building electric load profiles in time and frequency domains. Applied Energy, 291, p.116721.
31. Wang, M., **Wang, Z.**, Geng, Y. and Lin, B., 2021. Interpreting the neural network model for HVAC system energy data mining. Building and Environment, p.108449.
32. Li, H., **Wang, Z.** and Hong, T., 2021. Occupant-Centric key performance indicators to inform building design and operations. Journal of Building Performance Simulation, pp.1-29.
33. Hong, T., **Wang, Z.**, Luo, X. and Zhang, W., 2020. State-of-the-art on research and applications of machine learning in the building life cycle. Energy and Buildings, p.109831.
34. Jiang, Y., **Wang, Z.**, Lin, B. and Mumovic, D., 2020. Development of a health data-driven model for a thermal comfort study. Building and Environment, p.106874.
35. Liu, Y., **Wang, Z.**, Zhang, Z., Hong, J. and Lin, B., 2018. Investigation on the Indoor Environment Quality of health care facilities in China. Building and Environment, 141, pp. 273-287
36. Luo, M., **Wang, Z.**, Zhang, H., Arens, E., Filingeri, D., Jin, L., Ghahramani, A., Chen, W., He, Y. and Si, B., 2020. High-density thermal sensitivity maps of the human body. Building and Environment, 167, p.106435.
37. Luo, M., **Wang, Z.**, Brager, G., Cao, B. and Zhu, Y., 2018. Indoor climate experience, migration, and thermal comfort expectation in buildings. Building and Environment, 141, pp. 262-272
38. Lin, B., **Wang, Z.**, Sun, H., Zhu, Y. and Ouyang, Q., 2016. Evaluation and comparison of thermal comfort of convective and radiant heating terminals in office buildings. Building and Environment, 106, pp.91-102.
39. Lin, B., **Wang, Z.**, Liu, Y., Zhu, Y. and Ouyang, Q., 2016. Investigation of winter indoor thermal environment and heating demand of urban residential buildings in China's hot summer–Cold winter climate region. Building and Environment, 101, pp.9-18.
40. Guo, X., Lee, K., **Wang, Z.** and Liu, S., 2021. Occupants' satisfaction with LEED-and non-LEED-certified apartments using social media data. Building and Environment, p.108288.
41. He, Y., Zhou, Y., **Wang, Z.**, Liu, J., Liu, Z. and Zhang, G., 2021. Quantification on fuel cell degradation and techno-

economic analysis of a hydrogen-based grid-interactive residential energy sharing network with fuel-cell-powered vehicles. Applied Energy, 303, p.117444.

42. Chen, B., Jin, M., **Wang, Z.**, Hong, T. and Bergés, M., 2020, November. Towards Off-policy Evaluation as a Prerequisite for Real-world Reinforcement Learning in Building Control. In Proceedings of the 1st International Workshop on Reinforcement Learning for Energy Management in Buildings & Cities (pp. 52-56).
43. Hong, T., Chen, C.F., **Wang, Z.** and Xu, X., 2020. Linking human-building interactions in shared offices with personality traits. Building and Environment, 170, p.106602.
44. Jiang, Y., Luo, Z., **Wang, Z.** and Lin, B., 2019. Review of thermal comfort infused with the latest big data and modeling progresses in public health. Building and Environment, 164, p.106336.
45. He, Y., Chen, W., **Wang, Z.** and Zhang, H., 2019. Review of fan-use rates in field studies and their effects on thermal comfort, energy conservation, and human productivity. Energy and Buildings, 194, pp. 140-162.
46. Geng, Y., Ji, W., **Wang, Z.**, Lin, B. and Zhu, Y., 2018. A review of operating performance in green buildings: Energy use, indoor environmental quality and occupant satisfaction. Energy and Buildings. 183, pp.500-514. (highly cited paper)
47. Lin, B., Liu, Y., **Wang, Z.**, Pei, Z. and Davies, M., 2016. Measured energy use and indoor environment quality in green office buildings in China. Energy and Buildings, 129, pp.9-18.
48. Cho, B., Dayrit, T., Gao, Y., **Wang, Z.**, Hong, T., Sim, A. and Wu, K., 2020, December. Effective Missing Value Imputation Methods for Building Monitoring Data. In 2020 IEEE International Conference on Big Data (Big Data) (pp. 2866-2875). IEEE.
49. He, Y., Arens, E., Li, N., **Wang, Z.**, Zhang, H., Yongga, A. and Yuan, C., 2020. Modeling solar radiation on a human body indoors by a novel mathematical model. Building and Environment, p.107421.
50. Wang, Z., Yu, H., Luo, M., **Wang, Z.**, Zhang, H. and Jiao, Y., 2019. Predicting older people's thermal sensation in building environment through a machine learning approach: Modelling, interpretation, and application. Building and Environment, 161, p.106231.
51. Wang, J., Hua, J., Fu, L., **Wang, Z.** and Zhang, S., 2019. A theoretical fundamental investigation on boilers equipped with vapor-pump system for Flue-Gas Heat and Moisture Recovery. Energy, 171, pp.956-970.
52. Luo, M., Ke, Z., Ji, W., **Wang, Z.**, Cao, B., Zhou, X. and Zhu, Y., 2019. The time-scale of thermal comfort adaptation in heated and unheated buildings. Building and Environment, 151, pp.175-186.
53. Geng, Y., Yu, J., Lin, B., **Wang, Z.** and Huang, Y., 2017. Impact of individual IEQ factors on passengers' overall satisfaction in Chinese airport terminals. Building and Environment, 112, pp.241-249.
54. Chen, C.F., De Simone, M., Yilmaz, S., Xu, X., **Wang, Z.**, Hong, T. and Pan, Y., 2021. Intersecting heuristic adaptive strategies, building design and energy saving intentions when facing discomfort environment: A cross-country analysis. Building and Environment, 204, p.108129.
55. Li, Z., Lin, B., Zheng, S., Liu, Y., **Wang, Z.** and Dai, J., 2020, August. A review of operational energy consumption calculation method for urban buildings. Building Simulation, Vol. 13, No. 4, pp. 739-751
56. Hong, T., Macumber, D., Li, H., Fleming, K. and **Wang, Z.**, 2020, June. Generation and representation of synthetic smart meter data. Building Simulation, Vol. 13, No. 4, pp. 1205–1220
57. Ghahramani, A., Galicia, P., Lehrer, D., Varghese, Z., **Wang, Z.** and Pandit, Y., 2020. Artificial Intelligence for Efficient Thermal Comfort Systems: Requirements, Current Applications and Future Directions. Frontiers in Built Environment, 6.
58. Luo, M., Arens, E., Zhang, H., Ghahramani, A. and **Wang, Z.**, 2018. Thermal comfort evaluated for combinations of energy-efficient personal heating and cooling devices. Building and Environment, 143, pp.206-216.
59. Taylor, J., Liu, Y., Lin, B., Burman, E., Hong, S.M., Yu, J., **Wang, Z.**, Mumovic, D., Shrubsole, C., Vermeer, D. and Davies, M., 2018. Towards a framework to evaluate the 'total'performance of buildings. Building Services Engineering Research and Technology, p.0143624418762662.

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