

# 王者

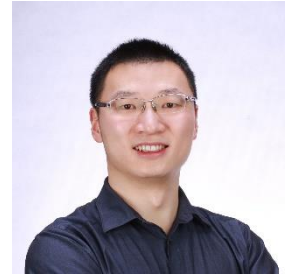
香港科技大学，助理教授

邮箱: cezhuwang@ust.hk

电话: (+852) 2358 8753

网站: <https://walterzwang.github.io/>

地址: 学术大楼 3564 室, 香港科技大学, 清水湾, 香港特别行政区



## 个人简介

王者, 香港科技大学土木与环境工程系助理教授, **2021 海外优青**, 曾任劳伦斯伯克利国家实验室科学家。清华大学本科 (双学位, 均排名第一), 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); 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、智慧运维、智能建造技术。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能力研究, 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:在行业顶尖期刊发表论文 74 篇, 其中第一作者 23 篇, 通讯作者 6 篇, 共同第一作者 5 篇, ESI 高被引论文 2 篇, Nature 子刊 3 篇。王者现任 SCI 期刊 Energy and Buildings, Building Simulation 以及中文期刊《建筑节能》编委, 任 Frontiers in Built Environment 副主编; 曾获 **2019 国家科技进步二等奖**, **2018 北京市科学技术一等奖**, 2020 华夏建设科学技术一等奖; 获香港机电署举办的 2022 国际建筑机电人工智能挑战赛第一名。

## 工作经历

2021.11 至今

香港科技大学, 助理教授

- PC, Toward 2060 Carbon Neutrality: Life-cycle Planning and Design of Photovoltaic Integrated Green Roof (PVIGR) Systems for Hong Kong and the Greater Bay Area (346 万港币, 香港研究资助局合作研究项目, C6003-22Y)
- PI, 室内消毒与环境控制智能机器人 (72 万人民币, 佛山市政府课题 SHCIRI-FSNH-2203)
- PI, 电力需求响应软件架构研究 (60 万人民币, 美的研发课题)
- PI, An AI-assisted solution for low-cost high-resolution urban scale environmental simulation (36 万港币, Fei Chi En Education and Research Fund)
- PI, 超大型数据中心制冷系统智能化节能方案研究 (30 万人民币, 2022 腾讯基础平台技术犀牛鸟专项研究计划)

2018.07-2021.10

美国劳伦斯伯克利国家实验室, 项目科学家

- co-PI, Reinforcement Learning for Building Control (0.2M USD, 美国 LBNL 课题: BU21-036)
- 核心研究者, Integrating Sensor Data with Physics-Based Models (1.5M USD, 美国能源部课题: EE-5B37579)
- 主要研究者, Hierarchical Occupancy Responsive MPC (3.0M USD, 美国能源部课题: EE-5B24502)
- 主要研究者, End-Use Load Profiles for the U.S. Building Stock (1.2M USD, 美国能源部课题: EE-5B35033)

2017.10-2018.06

加州伯克利大学, 博士后研究员

- 核心研究者, Personalized Wearable Comfort Devices (0.5M USD, 美国 NSF 课题)

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

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## 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 (2017)，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，公共政策，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
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## 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>
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## 学术服务

- 2020 till now      *Building Simulation*, **Subject Editor** in *Building Control*  
建筑节能，编委
- 2021 till now      *Energy and Buildings*, **Section Editor** in *Intelligent Building and Smart Control*  
*Frontiers in Built Environment*, **Associate Editor**
- 2020, 2021      *International Workshop on Reinforcement Learning for Energy Management in Buildings & Cities (RLEM)*, <https://rlem-workshop.net/>, **Technical Program Committee Member**
- 2015 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*
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## 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 国家科学技术进步二等奖，证书号：2019-J-22101-2-01-R09
2. 2022 国际建筑机电人工智能挑战赛一等奖，香港机电署，学生第一作者，本人通讯作者（奖金 20 万港币）
3. 《绿色公共建筑环境与节能设计关键技术研究与应用》，2018 北京市科学技术一等奖

4. 《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

## 人才称号

1. 海外优青，2021
2. 乔治布什总统基金会 Fellow，2021
3. 清华大学紫荆学者，2017
4. 清华大学苏世民学者，2016

## 专利

1. 王者，一种智能温控器和智能温控器的控制方法，中国专利申请号：202210667572.X，初审合格
2. 林波荣、赵海湑、王者，一种用于洗碗机的热回收装置，中国专利号：ZL 201320328067.9

## 学术文章

谷歌学术引用: 3492; h-index: 34; i10-index: 60; ESI 高被引论文: 2

(#: 共同第一作者; \*: 通讯作者)

1. **Wang, Z.\*** and He, Y., 2023. AlphaHydrogen: A virtual platform for simulating and evaluating station-based regional hydrogen-electricity networks with distributed renewables, buildings, and fuel-cell vehicles. *Energy Conversion and Management*, 280, p.116802.
2. **Wang, Z.\***, 2022. How frequent should we measure the indoor thermal environment. *Building and Environment*, 222, p.109464.
3. **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.
4. **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.
5. **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.
6. **Wang, Z.** and Hong, T., 2020. Reinforcement Learning for Building Controls: The opportunities and challenges. *Applied Energy*, 269, p.115036.
7. **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.
8. **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.
9. **Wang, Z.** and Hong, T., 2020. Generating realistic building electrical load profiles through the Generative Adversarial Network (GAN). *Energy and Buildings*, p.110299.
10. **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.
11. **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.
12. **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.
13. **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.
14. **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.
15. **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.

16. **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.
17. **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.
18. **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.
19. **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)
20. **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.
21. **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.
22. **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.
23. **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.
24. Liu, S.<sup>\*,#</sup>, **Wang, Z.**<sup>\*,#</sup>, Schiavon, S., He, Y., Luo, M., Zhang, H. and Arens, E., 2020. Predicted percentage dissatisfied with vertical temperature gradient. *Energy and Buildings*, p.110085.
25. Wang, J.<sup>#</sup>, **Wang, Z.**<sup>#</sup>, Zhou, D. and Sun, K., 2019. Key issues and novel optimization approaches of industrial waste heat recovery in district heating systems. *Energy*, p.116005.
26. Wang, J.<sup>#</sup>, **Wang, Z.**<sup>\*,#</sup>, 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.
27. Liu, Y.<sup>#</sup>, **Wang, Z.**<sup>#</sup>, 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.
28. Touzani, S.<sup>#</sup>, Prakash, A.K.<sup>#</sup>, **Wang, Z.**<sup>#</sup>, 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.
29. Luo, M., **Wang, Z.**<sup>\*</sup>, 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
30. Zhong, H., Guo, M., Wang, Y. and **Wang, Z.**<sup>\*</sup>, 2023. Quantify the magnitude and energy impact of overcooling in a sub-tropical campus building. *Building and Environment*, p.110033.
31. Wang, Y., Wang, X., Zheng, L., Gao, X., **Wang, Z.**<sup>\*</sup>, You, S., Zhang, H. and Wei, S., 2023. Thermo-hydraulic coupled analysis of long-distance district heating systems based on a fully-dynamic model. *Applied Thermal Engineering*, 222, p.119912.
32. Blum, D., **Wang, Z.**, Weyandt, C., Kim, D., Wetter, M., Hong, T. and Piette, M.A., 2022. Field demonstration and implementation analysis of model predictive control in an office HVAC system. *Applied Energy*, 318, p.119104.
33. Kim, D., **Wang, Z.**, Brugger, J., Blum, D., Wetter, M., Hong, T. and Piette, M.A., 2022. Site demonstration and performance evaluation of MPC for a large chiller plant with TES for renewable energy integration and grid decarbonization. *Applied Energy*, 321, p.119343.
34. Luo, N., **Wang, Z.**, Blum, D., Weyandt, C., Bourassa, N., Piette, M.A. and Hong, T., 2022. A three-year dataset supporting research on building energy management and occupancy analytics. *Scientific Data*, 9(1), p.156.
35. Wang, M., **Wang, Z.**, Geng, Y. and Lin, B., 2022. Interpreting the neural network model for HVAC system energy data mining. *Building and Environment*, 209, p.108449.
36. Pinto, G., **Wang, Z.**, Roy, A., Hong, T. and Capozzoli, A., 2022. Transfer learning for smart buildings: A critical review of algorithms, applications, and future perspectives. *Advances in Applied Energy*, p.100084.
37. Li, H., **Wang, Z.** and Hong, T., 2021. A synthetic building operation dataset. *Scientific data*, 8(1), pp.1-13.
38. 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.

39. 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.
40. 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.
41. 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.
42. 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.
43. 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.
44. 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
45. 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.
46. 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
47. 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.
48. 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.
49. Perera, A.T.D., Zhao, B., **Wang, Z.**, Soga, K. and Hong, T., 2023. Optimal design of microgrids to improve wildfire resilience for vulnerable communities at the wildland-urban interface. *Applied Energy*, 335, p.120744.
50. Su, Y., Cheng, H., **Wang, Z.** and Wang, L., 2022. Impacts of the COVID-19 lockdown on building energy consumption and indoor environment: A case study in Dalian, China. *Energy and Buildings*, 263, p.112055.
51. 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.
52. 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.
53. 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).
54. 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.
55. 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.
56. 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.
57. 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)
58. 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.
59. 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.
60. 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.
61. 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.
62. 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.
  63. 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.
  64. 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.
  65. Liu, Y., Li, H., Zheng, P., Wu, H., **Wang, Z.**, Li, Z. and Lin, B., 2023. Non-invasive measurements of thermal discomfort for thermal preference prediction based on occupants' adaptive behavior recognition. *Building and Environment*, 228, p.109889.
  66. Tang, H., Yu, J., Lin, B., Geng, Y., **Wang, Z.**, Chen, X., Yang, L., Lin, T. and Xiao, F., 2023. Airport terminal passenger forecast under the impact of COVID-19 outbreaks: A case study from China. *Journal of Building Engineering*, 65, p.105740.
  67. He, Y., Zhou, Y., Yuan, J., Liu, Z., **Wang, Z.** and Zhang, G., 2021. Transformation towards a carbon-neutral residential community with hydrogen economy and advanced energy management strategies. *Energy Conversion and Management*, 249, p.114834.
  68. 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.
  69. 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
  70. 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
  71. 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.
  72. 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.
  73. 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.
  74. Dong, B., Liu, Y., Mu, W., Jiang, Z., Pandey, P., Hong, T., Olesen, B., Lawrence, T., O’Neil, Z., Andrews, C. and Azar, E.,..., **Wang, Z.** ... 2022. A global building occupant behavior database. *Scientific data*, 9(1), p.369.

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