INTERVIEWS WITH PHD PROGRAM ALUMNI

[PK] Please synthesize the nature of your research performed as a student at IIT and why you believe it is essential.

[LM] In my opinion, research involves original work in answering a question or solving a problem. Thus, I attempted to answer the question how can reinforced concrete tall buildings be more sustainable and to solve the problem using BIM-based LCA method to analyze and optimize the embodied energy and environmental impacts of them. Also, my research contributes to the new question of how architects can use data analysis in the architecture design phase to achieve better sustainability performance of projects. I think my research involves defining the question, solving and forming the question, and raising a new question is essential.

[PK] As a PhD student at IIT, what benefits did you realize being located in Chicago through your research?

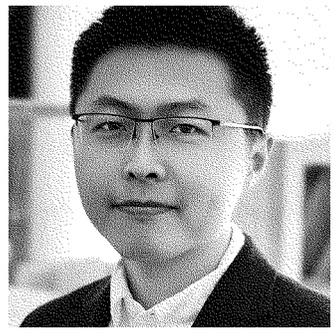
[LM] As a PhD student at COA of IIT, I think the academic reputation in architectural design and the industrial connection in architecture and construction fields benefit me a lot through my research. The IIT main campus is designed by Mies, and the college of architecture is located at Crown Hall, one of the most famous modern buildings in architectural history. Studying in such a masterpiece motivates me everyday. The city of Chicago is also a modern architecture city, there are many architectural firms in this city. I utilized both academic and industrial resources to finish my research.

[PK] Why do you consider it essential that future researchers continue your work? Which fields within your research would you like to see developed by future researchers?

[LM] I think my research can represent a trend of architecture and built environment research in the future. The world is full of data, my research is data-driven quantitative research and interdisciplinary research. I believe that as an architect and researcher, it is essential to learn new skills such as data science, machine learning, and artificial intelligence, because the world is changing rapidly and one of the most important aspects is collecting, analyzing, and using data. One of the limitations of my research is limited data collecting and data analyzing, so I hope future researchers can have plenty of data to research.

LIJIAN MA

Interview conducted by Piyush Khairnar, February 2023.



[PK] How does your research impact the professional practice of architecture? How would you apply your research findings in an architectural project?

[LM] My research developed a framework of BIM-based LCA to analyze the embodied energy and environmental impacts of buildings. It can be utilized in all architecture and construction design phases to evaluate and optimize the sustainability of the project. For example, I will use my research in the early design phase of a project to have a general understanding of its embodied energy and environmental impacts. Then I can understand what part of the project occupies the most portion of embodied energy and environmental impacts, so I can think of optimization methods. It also can be a good way to compare different design scenarios by their sustainable performance.

[PK] What research areas require immediate attention as we address climate change and resiliency?

[LM] I believe that the embodied energy or carbon of buildings requires immediate attention. As you know, the architecture and construction industry contributes one third of the greenhouse gas emissions to the world, which should be considered seriously. Moreover, the embodied energy or carbon of tall buildings is an overlooked area in the research compared with operational energy or carbon. Thus, it is essential that more and more research involving the embodied energy or carbon be conducted in the future.

Dr. Ma is currently an Intermediate Architect at Tilton Kelly+Bell (TKB) and an Adjunct Professor at Illinois Institute of Technology (IIT). He holds a PhD in Architecture from IIT, a B.S. and M.S. in Architectural Design from Polytechnic University of Turin in Italy.

Dr. Ma's research focuses on life-cycle assessment and environmental impacts of buildings, high-rise buildings' embodied energy and carbon, computational architectural design, and innovative construction technologies, incorporating interdisciplinary approaches. He has published several peer-reviewed articles. Dr. Ma is also active in the architecture industry. By integrating knowledge and technology to design practice, Dr. Ma is discovering unique ways for sustainable architecture in the future.

ZAHIDA KHAN

Interview conducted by Piyush Khairnar, February 2023.

[PK] Please synthesize the nature of your research performed as a student at IIT and why you believe it is essential.

[ZK] We often measure the success of a public urban space through the number of people present in that space. In other words, this human behavior serves as the key performance indicator in the design of public space, which, if integrated into the design process could lead to meaningful results. My doctoral research, "*Predicting and Simulating Outdoor Thermal Comfort-Based Human Behavior in Urban Environments,*" is an interdisciplinary study focused on microclimate-driven human spatial behaviors in outdoor urban spaces. It not only developed a novel methodology to predict human behavior but also developed a tool to simulate human behavior, based on Outdoor Thermal Comfort (OTC) in urban environments. The nature of this study is important to ensure architects and urban planners design cities focused around what I call "human-eco-centric" — a design philosophy that puts people and ecology at its center while making informed decisions to design the built environment. These cities are sustainable and create livable and healthy communities.

The interdisciplinary approach required to research this topic is critical here because collaboration helps us understand the topic from different perspectives. The two-fold advantage I see with this intervention is (a) the richness in understanding the complexity of human behavior and the sophistication this topic can carry when different perspectives are added as layers which we tend to overlook when working in a silo; and (b) the potential opportunity for future research it paves due to the pushes and pulls from different disciplines.

[PK] As a PhD student at IIT, what benefits did you realize being located in Chicago through your research?

[ZK] The urban setting of tall buildings in Chicago exemplifies a typical future city, or I should say it sows the seeds of what the future city would look like in the era of escalated urbanization and the boom in global population. The city provides a perfect platform to research and predict how we will, or we can, handle issues related to this ongoing escalated urbanization. The issues we are looking for are associated with social, cultural, economic, political, and environmental. Chicago, with its current urban morphology, strong historical background around these issues, and icon of an engineering feat, served as a perfect case study for my research topic. I had easy access to my case study Daley Plaza in downtown Chicago, which was critical to my research methodology. In my earlier research stages, I benefited tremendously from the resources that the Chicago-based organization CTBUH (Council of Tall Buildings and Urban Habitat) provided to students and researchers interested in tall buildings and urban habitat investigation.

[PK] Why do you consider it essential that future researchers continue your work? Which fields within your research would you like to see developed by future researchers?

[ZK] Human behavior is a complex topic and studying it from one perspective limits its holistic understanding. If you had asked me about the need or the potential of future research around this topic, say 25 years back, I would say it would be challenging. But in this age of data and technological advancement, there is an immense opportunity to take this research to the next level and address the primary focus of design: people aka users aka occupants. We really need to understand how built environments affect the users/occupants/people and vice versa to ensure a resilient built environment for livable communities that promotes health, nurtures inclusivity and equity, and advocates freedom of views with strong leadership and community engagement.

The fields within my research that I would like to see developed by future researchers are environmental science, environmental psychology, and environmental computer science. Some key topics for future research include explorations of various research methodologies around large data mining of human behavior, creating predictive models for different climate regions, and investigating economic and social drivers using the same research methodology.

[PK] How does your research impact the professional practice of architecture? How would you apply your research findings in an architectural project?

[ZK] One of the key outcomes of my study was developing HuBeSIM — a human behavior simulation tool that can be used to assess outdoor public space design in urban environments. The tool was developed in Rhino grasshopper, a popular digital design software used in professional architectural practice. Many times, the architects and planners are not sure if their outdoor public space design will give the same results as intended, especially where the performance indicator is people/users. HuBeSIM addresses this gap and helps the design industry and its partners to make informed design choices by creating what-if scenarios for various design options they conceptualize. The significance of this research is to ensure a "human-eco-centric" design for cities where people and ecology drive the performance criteria of sustainable development.

[PK] What research areas require immediate attention as we address climate change and resiliency?

[ZK] Among various research areas to address climate change and resiliency, I believe the interaction between the built environments and occupant/user behavior is critical and requires immediate attention. Research topics such as and not limited to occupant health and wellness inside and outside the buildings; occupant behavior impacting performance goals namely net zero energy and net zero carbon; and occupant behavior to ensure economic equity are some topics that the researchers can prioritize for their research work.

Zahida Khan is an Assistant Professor in the Department of Architecture at Ball State University in Muncie, Indiana. She received her PhD in Architecture in 2022 and her M. Arch in 2017 from the College of Architecture, Illinois Institute of Technology in Chicago. Her pedagogy of architectural education stems from her substantial experience in the profession and academia. She has worked for more than 13 years as a professional architect with international architectural design practices in North America, the Middle East, Africa, and Asia. She specializes in high-performance building design and advocates a "human-eco-centric" design philosophy for sustainable cities concretized through an integrated design approach and high-performance built environments.

Her doctoral research investigated the interrelationship between human behavior, microclimates, and urban morphology in outdoor public spaces using research methodologies such as predictive modeling, agent-based modeling, and CFD simulation. Her key area of interest includes thermal comfort-driven human behavior, microclimates in public spaces, and high-performance building design.

She is a recipient of academic merit scholarships at CoA-IIT for her M. Arch and PhD programs as well as a full travel scholarship for an international doctoral workshop in Shanghai. She is a registered architect at the Council of Architecture in India and a LEED AP (BD+C) at USGBC.

YOHAN KIM

Interview conducted by Piyush Khairnar, February 2023.

[PK] Please synthesize the nature of your research performed as a student at IIT and why you believe it is essential.

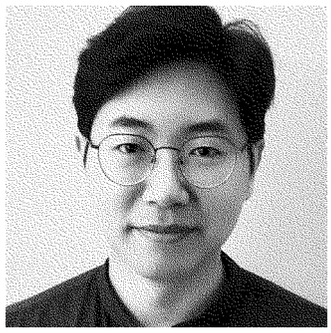
[YK] My dissertation entitled "The Feasibility of Double-Skin Facades to Provide Natural Ventilation in Tall Office Buildings" investigates the impact of double-skin facade configurations on indoor airflow behavior in tall office buildings and the integration of computational simulation into the design process. The research aims to develop a performance-based double-skin facade design guideline that helps predict the performance of double-skin facades in the early design stage. Further insight on indoor airflow behaviors analyzed in this research helps architects and designers to come up with ideas on proper double-skin facade designs for natural ventilation in tall office buildings, which has proven to be an effective passive strategy in improving energy efficiency and providing healthy environments.

[PK] As a PhD student at IIT, what benefits did you realize being located in Chicago through your research?

[YK] As is well-known, Chicago is the spiritual home of tall buildings and the site of the Home Insurance Building, completed in 1885 and considered by many to be the first skyscraper. It was meaningful that I conducted research on a sustainable design strategy for tall office buildings, living in the city that affects not only my daily life, but also possibly my view on the topic. What I explored and experienced in the city significantly influenced the foundation of my research, which has the early generation of tall office buildings that used to be naturally ventilated and the new generation in which innovative building technologies are implemented.

[PK] Why do you consider it essential that future researchers continue your work? Which fields within your research would you like to see developed by future researchers?

[YK] This research addresses several important issues on wind-driven natural ventilation in tall office buildings and the potential application of double-skin facades to provide it. In addition to the performance of double-skin facade configurations, some practical considerations for the design were discussed in my dissertation. However, the discussion can be extended further for a holistic view on the research topic, with respect to structural systems, Life Cycle Analysis, thermal comfort, etc. to enhance the feasibility of double-skin facades for tall office buildings.



[PK] How does your research impact the professional practice of architecture? How would you apply your research findings in an architectural project?

[YK] One of the research objectives was to develop a double-skin facade design guideline that can assist architects in their design of double-skin facades in the early design stage and add value to the collaboration of architects and engineers aiming for sustainable tall office buildings. Thus, I believe my research findings can be integrated into the design process as the design guideline provides useful information on the proper design of openings and cavities (e.g., size and location) based on the performance.

[PK] What research areas require immediate attention as we address climate change and resiliency?

[YK] There has been plenty of interest in sustainable buildings or cities that can reduce carbon emissions to slow climate change. Also, human behavior is responsible for climate change as individual lifestyles significantly affect energy consumption and carbon emissions. It is important to explore the impact of passive design strategies on human behavior and thermal perception in buildings. For instance, occupants can tolerate a wider range of temperatures in naturally ventilated buildings than air-conditioned buildings. Therefore, this psychological adaptation needs further attention as it would meaningfully affect energy consumption, and thus carbon emissions.

Yohan Kim is a Visiting Assistant Professor and Assistant Director of the Master of Tall Buildings and Vertical Urbanism program in the College of Architecture at the Illinois Institute of Technology (IIT), Chicago. He is also Academic Coordinator at Council on Tall Buildings and Urban Habitat (CTBUH). In his role, he administers the CTBUH research and design competitions, and academic programs. He holds a PhD in architecture and a Master of Architecture, both from IIT.

Kim's research centers on high-performance building facades, natural ventilation in tall office buildings, and computational fluid dynamics (CFD) modeling and analysis. His doctoral dissertation, entitled "The Feasibility of Double-Skin Facades (DSFs) to Provide Natural Ventilation in Tall Office Buildings," investigates the impact of DSF configurations on indoor airflow behavior in tall office buildings and the integration of computational simulation into the design process. He was awarded the ARCC 2022 King Medal for Excellence in Architectural + Environmental Design Research. His areas of interest include sustainable tall buildings, performance-based facade design, double-skin facades, natural ventilation, parametric design studies, and CFD simulation.