#	**Rania Labib** BSc in Architectural Engineering, PhD in Architecture, and LEED AP	
Title:	Assistant Professor & Director of the Artificial Intelligence for High Performance Buildings Lab at Prairie View A&M University (Part of Texas A&M University)	
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Presentation title:	**Supercharging Traditional AI Models: Combining Physics-based Neural Networks with Optimization Methods for Enhanced Building Performance Simulations**	

In the evolving AI landscape, this research examines the transformative potential of Physics-Informed Neural Networks (PINNs) for building performance simulations. Unlike standard Neural Networks, PINNs embed physics equations into their training, enabling predictions that align with real-world physics. When paired with Multi-Objective Optimization (MOO), their efficiency is amplified. Furthermore, parallel computing was integrated to enhance computational speed significantly.

The study employed the radiative transfer differential equation in a deep learning model to predict daylighting autonomy in an office space. This equation considers both direct and diffuse light interactions, including absorption and scattering. The model was informed by 700 data points capturing varied office parameters.

To fine-tune the equation constants, a MOO approach was adopted. Merging MOO with PINNs initially presented computational challenges. By leveraging parallel computing with four GPUs, the computation time was drastically reduced.

The adaptability of PINNs across physics-driven domains, combined with MOO and parallel computing, paves the way for a new era in AI approaches for the AEC industry.

Short CV:

Dr. Labib is an Assistant Professor & Director of the Artificial Intelligence for High Performance Buildings Lab at Prairie View A&M University, Part of Texas A&M University. Dr. Labib earned her Ph.D. in Architecture from Texas A&M University, focusing on the integration of IoT and AI in buildings. She also holds a Post Graduate Certificate in Machine Learning from Cornell University. Additionally, she is a recognized LEED Accredited Professional.

CV:	

With over 14 years of experience in architecture, teaching, and research, Dr. Rania Labib stands at the forefront of integrating machine learning with building performance simulations and computer vision. As an assistant professor and the director of the Artificial Intelligence and High-Performance Buildings lab (AI & HPB) at Prairie View A&M University, a part of the Texas A&M University system, her mission is to elevate AI education and research in the built environment, seamlessly blending her expertise in both AI and buildings sciences.

Having secured close to $1 million in grants from the Department of Education and the National Science Foundation, Dr. Labib's commitment to her field is undeniable. She has authored numerous journal and conference papers, addressing research topics such as machine learning-driven building performance simulations, computer vision recognition, high-performance computing in AEC, and the design of comfortable indoor spaces. Dr. Labib earned her Ph.D. in Architecture from Texas A&M University, focusing on the integration of the Internet of Things (IoT) and AI in buildings. She also holds a Post Graduate Certificate in Machine Learning from Cornell University. Additionally, she is a recognized LEED Accredited Professional.

Her accomplishments also include an honorable mention in the 2016 National Science Foundation's Graduate Research Fellowship Program. Currently, as the president of the IBPSA-USA Houston Chapter, she recently led the chapter to earn the prestigious 2022 IBPSA-USA Outstanding Chapter Award.