

AN INTEGRATED APPROACH TOWARDS AUTONOMOUS, INTELLIGENT, AND SUSTAINABLE CONSTRUCTION

Speaker

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Abstract

Concrete construction is responsible for 6-8% of the global carbon emission. Meanwhile, conventional concrete infrastructure is prone to degradation due to durability issues and disasters, which may need frequent repairs and re-construction, therefore increasing the carbon emission over life cycles. As climate extremes intensify and natural disasters grow in frequency and severity, infrastructure worldwide face unprecedented challenges. These challenges demand innovative techniques for more sustainable, durable, and resilient infrastructure.

Canada is facing a severe housing shortage. In 2025, Canadian government is launching the largest house building program since the World War II. Meanwhile, the north America is facing a huge construction labor shortage with over 1/5 of the construction projects delayed or cancelled due to the lack of skilled workers. This mismatched demand and supply calls for innovative techniques to boost the construction productivity.

This seminar will introduce an integrated approach to address the above challenges by exploiting the usage of advanced materials, design and construction. We will start with advanced materials, such as Ultra-high-performance concrete (UHPC), and their structural behavior and design. These advanced materials can reduce material usage as well as enhance infrastructure durability and resilience. We will then discuss various ways of integrating these advanced materials with advanced design methods, such as topology optimization and energy-efficient facades. These advanced designs can minimize the initial carbon footprint during construction stage and operational energy during usage stages. Finally, we will present our robotic construction techniques, which benefit from and support the adoption of advanced materials and designs.

Ultimately, this presentation will envision a future where we can build in a more autonomous, intelligent and sustainable manner.

Biography

Dr. Shao is an assistant professor at McGill university. Prior to joining McGill, he worked as a postdoctoral scholar at the University of California, Berkley. He received his M.S. and Ph.D. degrees from Stanford University and his B.S. degree from Hunan University. His current research focuses on sustainable infrastructure through the development and application of high-performance materials, optimization tools, and autonomous construction methods. His research outcomes have led to over 30 top journal publications and have been adopted by design standards and real-world applications.



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**RM6580 (Lift 27/28),
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