"Emergence through Conflict: The Multi-Disciplinary Design System (MDDS)"

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Room 3-133

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Abstract:
Design involves solving what Herbert Simon terms an ill-structured problem. An ill-structured problem is one that cannot be solved by a linear chain of reasoning derived from the problem statement. Furthermore, a design problem might not have a unique solution but a multiplicity of solutions. These design problem characteristics imply the need for many assumptions within the design process that can only be verified after a solution is reached. In addition, given the numerous inputs that feed into design, it is not surprising that design presents a technical challenge even within relatively well-developed disciplines. The problem is further complicated in multi-disciplinary design problems by the need to satisfy several functional and performance requirements at the same time.

This talk will present a framework and a group of systematic methodologies to construct a computational Multi-Disciplinary Design System (MDDS) that can support the design of complex systems within a variety of domains. The way in which the resulting design system is constructed, and the capabilities it brings to bare, are different from the methods used in traditional sequential design.

The MDDS embraces diverse areas of research that include design science, systems theory, artificial intelligence, design synthesis and generative algorithms, mathematical modeling and disciplinary analyses, optimization theory, data management and model integration, and design experiments among others.

Using MDDS, vast design spaces can be searched while solutions are intelligently modified, their performance evaluated, and their results aggregated into compatible sets for design decisions. The MDDS emergent properties are not detectable through the properties and behaviors of its parts, and can only be enucleated through a holistic approach. The MDDS is an adaptable system that is continuously dependent on, and responsive to, the uncertainties of the design process. The evolving MDDS is thus characterized as a multi-level, multi-module, multi-variable and multi-resolution system.

Bio:
Anas Alfaris is a Research Scientist in the Engineering Systems Division (ESD) at MIT. His work focuses on the development of Computational Design Systems for the design of Complex Engineered Systems. His expertise span several fields including Generative Performance-Based Design Systems, Systems Modeling & Engineering, Integrated Modeling and Simulation, and Multi-Disciplinary Analysis and Optimization.

Anas received his training in several disciplines including Architecture, Engineering, and Computer Science. He started his career by earning a bachelor degree in Architecture and Building Engineering from KSU in Saudi Arabia. He then received a Masters in Building Technology followed by a Master of Science in Architectural Studies with a focus on computational design systems, both from the University of Pennsylvania. Anas subsequently received a Master of Science in Computation for Design and Optimization from the Center for Computational Engineering at the School of Engineering as well as a Ph.D. in Design and Computation from the School of Architecture and Planning at MIT.

Furthermore, Anas has been part of several research and multidisciplinary design teams. At MIT he worked with the Design Lab and the Smart Cities Group at the Media Lab and currently at the Strategic Engineering Group at the ESD. He has also collaborated on research projects with the Advanced Technology and Research Group at Ove Arup in London as well as with FA Consultants, a Design and Engineering firm in Saudi Arabia, where he is currently a Senior Executive. In addition, Anas is a licensed architect with several built projects within the GCC region.