seminar

SEMTE

A Modern System Design Architecture Incorporating Decision Analysis

School for Engineering of Matter, Transport and Energy

abstract

The increased complexity of large-scale systems has exposed weaknesses in the current system design architecture of requirements-based design. These weaknesses involve restrictions that requirements place on the design space, as well as limits on the communication of a design's value, among others. This presentation first explores a proposed system design architecture that incorporates the principles of Value-Driven Design, Multidisciplinary Design Optimization, Decision Analysis, and the social sciences. The ways in which the proposed architecture addresses the concerns of the current system design architecture is discussed, with appropriate design examples to highlight the architecture's benefits.

A primary discipline on which the new architecture is constructed is Decision Analysis. The act of decision-making is apparent throughout all stages of the design process as well as the product's usage. A macro-view of the role of Decision Analysis in the proposed architecture is discussed, followed by a micro-view of a Decision Analysis tool that can be used in current and proposed system design architectures. The performance of the product after production can be greatly impacted by the decisions of the end-users. An airplane may be limited in its turning radius due to the pilot's preferences. A building's evacuation time may be impacted by the information available to the evacuees. End-user decision models capture the choices being made by the final users of the products through normative Decision Analysis. In this presentation, work will be presented that demonstrates how product performance and robustness can be improved by incorporating end-user decision making in the early stages of large-scale complex engineered product design. Also discussed is the ability to manipulate end-user decisions through mechanism design to improve product performance.

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biosketch

Dr. Bryan Mesmer is a Postdoctoral Research Associate in the Department of Aerospace Engineering at Iowa State University. He completed his Ph.D. in August 2012 at the State University of New York at Buffalo in Mechanical Engineering. Also at the University at Buffalo, he completed his M.S. in Mechanical Engineering (2010) and a dual B.S. in Mechanical and Aerospace Engineering (2007). His work has focused on improving the design process, particularly for large-scale complex systems. Research topics include: system design architecture; interactions in systems and design; incorporation of end-user models and simulations in design; and integration of new system and design processes in government and industry practice.

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