

# SEMTE

# seminar

## Current Advances in Engineering Design-Decision Making

School for Engineering of Matter, Transport and Energy

### abstract

In the design of any product or system, fulfillment of the end-user requirements is critical. To accomplish this, engineers make many technical and non-technical decisions, termed *design-decisions*. Successful realization of a product or a system depends on how good these decisions are. It is a challenge, however, to accurately model the preferences of the end-users, to understand how these preferences may conflict and how one can automate the search for optimal design-decisions on a computer. Furthermore, the presence of uncertainty only makes these decisions harder. This presentation describes recent advancements made by the presenter and his coworkers that alleviate some of these challenges. Recent findings in optimization algorithms, limitations of Pareto fronts, guidelines for selecting utility functions and reliability engineering theory will be presented. In particular, new findings in reliability engineering and their implications on decision making will be presented in detail. A system representation using a block diagram is a critical element of reliability analysis. A linear algebra method to encode the block diagram and its use to determine system failure will be presented. This will be followed by a discussion of an algorithm to solve the inverse problem of identifying the system block diagram using limited available information on system failures. Parallels will be drawn between a reliability block diagram and a decision making situation. We will discuss how the evaluation of different design alternatives by a decision maker is equivalent to evaluating a 'decision' block diagram. We will show that block diagrams can be made consistent with normative decision analysis providing therefore, a new decision making tool. We will conclude with the implications of our findings and future directions in the design-decision making field.

### Dr. Vijitashwa Pandey

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### biosketch

Dr. Vijitashwa Pandey received his PhD from the University of Illinois at Urbana-Champaign. He is an active researcher in mechanical engineering, particularly the areas of design optimization, decision based design, reliability engineering and sustainability. He has authored two textbooks in the design-decision making area. His work has also appeared in many peer-reviewed journal and conference publications, two of which received best paper awards at the ASME design conference. He is a strong proponent of interdisciplinary and sustainable efforts in mechanical engineering design.



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