A Pilot Program on Teaching Engineering Design Using Probabilistic Approaches

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Abstract

Engineering design represents a process of decision making under conditions of uncertainty and risk, but today's undergraduate engineering curricula rarely include any principles of decision theory. Even though value or utility theory are crucial components of the decision making process, these subjects are typically heavily underrepresented in engineering curricula and often treated incorrectly by the engineering community at large. Probability theory, which establishes the basic mathematical tools needed for the proper assessment of uncertainty and risk, is often not put into learning-enhancing context such as engineering design. This situation calls for a revolutionary shift in design education where practical examples of real design cases are used to illustrate the application of sound scientific principles.

This paper describes our progress in a pilot program that aims to prompt a strategic initiative for the development, implementation and assessment of stochastic modeling and simulation based approaches in engineering design education at Stevens Institute of Technology (SIT). In preparation for a feasibility study in two courses taken in the junior year by mechanical engineers, we have constructed a series of design scenarios in which to implement stochastic methods. Lecture materials, MATLAB analysis modules and student assignments have been prepared. The aforementioned will be introduced into the two courses as a pilot in the Fall 2004. Upon successful completion of this pilot project, this approach will be implemented into the capstone design sequence in the mechanical engineering department. Furthermore, the propagation of the approach to the entire engineering curriculum at SIT through a major revision of the entire curriculum will be considered.