Industrial & Systems Engineering
Seminar Announcement

Combined Optimization of Redundancy Allocation and Maintenance Planning for Systems Exposed to an Uncertain Environment

David Coit, PhD
Department of Industrial and Systems Engineering
Rutgers University

Abstract: Cost effective design and maintenance planning can be achieved by combining the respective decision making processes. A modeling approach is presented to optimally and simultaneously design the configuration of a multi-component system and determine a maintenance plan with uncertain future stress exposure. Traditionally, analytical models for system design and maintenance planning have been applied sequentially; however, this is potentially inefficient. This new model provides an integrated approach to make decisions considering the lifecycle cost of the system. Specifically considering the influence of uncertain future usage stresses on component and system reliability, the integrated redundancy allocation and maintenance planning problem is formulated as a two-stage stochastic programming model with recourse. The first stage decision variables determine the selection of component types and the number of components to be used in the system, and these decisions must be made before the uncertainty is revealed. The second-stage variables, involving a recourse function, are the preventive maintenance plan, which defines optimal maintenance times for planned replacement of components under distinct usage scenarios. The model is then extended to a four-stage optimization model to accommodate sequences of decisions over time with random future usage scenarios. In the third-stage, once the system is fielded and data is collected and analyzed to update model parameters and coefficient estimates, adaptive preventive maintenance optimization is performed. In the fourth stage, a cost saving strategy is implemented to decide whether the current system design or a new or revised system design can provide sufficient cost saving to justify design changes. The comparisons of the proposed integrated approach to traditional sequential method show advantages of the proposed model in cost saving.

Bio: *David W. Coit* is a Professor in the Department of Industrial & Systems Engineering at Rutgers University, Piscataway, NJ, USA. His current teaching and research involves system reliability modeling and optimization, and energy systems optimization. His research has been funded by National Science Foundation (NSF), U.S. Army, U.S. Navy, industry, and power utilities. He has over 95 published journal papers and over 90 peer-reviewed conference papers. He has been awarded several NSF grants, including a CAREER grant from NSF to develop new reliability optimization algorithms considering uncertainty. He was also the recipient of the P. K. McElroy award, Alain O. Plait award and Willian A. J. Golomski award for best papers and tutorials at the Reliability and Maintainability Symposium (RAMS). He also has over ten years of experience working for IIT Research Institute (IITRI), Rome NY. He received a BS degree in mechanical engineering from Cornell University, an MBA from Rensselaer Polytechnic Institute, and MS and PhD in industrial engineering from the University of Pittsburgh. He is an Associate Editor for IISE Transactions and a Department Editor for Journal of Risk and Reliability, and he is a member of IIE and INFORMS.

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