Information Science and Technology Seminar Speaker Series

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"Statistical Methods for Degradation Data with Dynamic Covariates and an Application to Outdoor Weathering Prediction"

Monday, August 13, 2012
10:30 - 11:30 AM
TA-3, Bldg. 40, Room N125 (Moon Room)

Abstract: Degradation data provide a useful resource for obtaining reliability information for high reliability products and systems. In addition to product/system degradation measurements, it is common nowadays to dynamically record product/system usage and as well as other environmental variables such as load, temperature and humidity, which we refer to as dynamic covariate information. In this paper, we introduce a class of models for analyzing degradation data with dynamic covariate information. We use general path models with individual random effects to describe degradation paths and parametric models to describe the covariate process. Physically motivated models are proposed to estimate the effects of dynamic covariates on the degradation process. The unknown parameters in the degradation data model and covariate process model are estimated by using maximum likelihood. We also describe algorithms for computing the estimate of the lifetime distribution induced by the proposed degradation path model. The proposed methods are illustrated with an application for predicting the life of organic paints and coatings in a complicated dynamic environment (i.e., changing UV spectrum and intensity, temperature, and humidity).

Key Words: Covariate process, Environmental conditions, Lifetime prediction, Organic coatings, System health monitoring, Usage history.

This is joint work with Yili Hong from Virginia Tech.

Biography: William Meeker is Professor of Statistics and Distinguished Professor of Liberal Arts and Sciences at Iowa State University. He is a Fellow of the American Statistical Association (ASA) and the American Society for Quality (ASQ) and a past Editor of *Technometrics*. He is co-author of the books *Statistical Methods for Reliability Data* with Luis Escobar (1998), and *Statistical Intervals* with Gerald Hahn (1991), 11 book chapters, and of numerous publications in the engineering and statistical literature. He has won the ASQ Youden prize five times and the ASQ Wilcoxon Prize three times. He was recognized by the ASA with their Best Practical Application Award in 2001 and by the ASQ Statistics Division's with their W.G. Hunter Award in 2003. In 2007 he was awarded the ASQ Shewhart medal. He has done research and consulted extensively on problems in reliability data analysis, warranty analysis, accelerated testing, nondestructive evaluation, and statistical computing.

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