**COLLOQUIUM**

Department of Computer Science and Engineering

University of South Carolina

### **Computational Enhancements to Bayesian Design of Experiments Using Gaussian Processes**

**Brian Williams**, Los Alamos National Laboratory

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# Abstract

Bayesian design of experiments is a methodology for incorporating prior information into the design phase of an experiment. Unfortunately, the typical Bayesian approach to designing experiments is both numerically and analytically intractable without additional assumptions or approximations. In this paper we discuss how Gaussian processes can be used to help alleviate the numerical issues associated with Bayesian design of experiments. We provide examples drawn from accelerated life testing and probabilistic calibration of model parameters and compare our results with large sample methods. **Brian Williams** has been a Technical Staff Member at the Los Alamos National Laboratory (LANL) since 2003. He is a member of the Statistical Sciences Group. Previously he was associate statistician at the RAND Corporation (2000-2003). He is contributing to the development and implementation of statistical methods for the design and analysis of computer experiments, focusing on the technical areas of sequential optimization, global sensitivity analysis, calibration, predictive maturity assessment and rare event inference for computer models. He is currently working on the development of technology for efficient Bayesian experimental design and implementation of uncertainty quantification methods supporting applications in nondestructive assay. Dr. Williams coauthored a 2003 book entitled The Design and Analysis of Computer Experiments with Thomas J. Santner and William I. Notz of The Ohio State University. In 2015, he was elected Fellow of the American Statistical Association for fundamental methodological contributions to the statistical design of experiments involving computer simulators and the analysis of data from such experiments including uncertainty quantification, for excellence in leadership of uncertainty quantification in critical federal programs, for excellence in collaborative research, and for service to the American Statistical Association. His research interests include experimental design, computer experiments, Bayesian inference, spatial statistics, statistical computing, and uncertainty quantification. He holds the Ph.D. in statistics from The Ohio State University.