

MECHANICAL ENGINEERING DEPARTMENTAL SEMINAR

Friday, April 16, 2004

1:30pm – 2:30pm

2233 GG BROWN

Professor John E. Dennis, Jr.
Rice University

“Optimization Using Surrogates for Engineering Design”

Abstract:

This talk will outline the surrogate management framework, which is presently built on the filter generalized pattern search (GPS) method for general nonlinear programming without derivatives. This line of research was motivated by industrial applications indeed, by a question I was asked by Paul Frank of Boeing Phantom Works. His group was often asked for help in dealing with very expensive low dimensional design problems from all around the company. Everyone there was dissatisfied with the common practice of substituting inexpensive surrogates for the expensive “true” objective and constraint functions in the optimal design formulation. We had been asked the same basic question some time before by Sandia Labs engineers who were designing a shipping container for nuclear waste. When Paul asked the question this time, the ideas behind the surrogate management framework based on a GPS meta-algorithm occurred to us, and we hope to demonstrate in this talk just how simple that answer is.

The surrogate management framework is unreasonably effective in practice, where most of the applications are extended valued and certainly non-differentiable. This has forced me to begin to learn some non-smooth analysis, which in turn has led to mesh adaptive direct search (MADS), a replacement for the GPS infrastructure algorithm.

Bio:

John E. Dennis, Jr. is Noah Harding Professor Emeritus and Research Professor in the Department of Computational and Applied Mathematics at Rice University. During the past decade he has spent a substantial amount of his time working with the Mathematics and Engineering Analysis Group at Boeing Information Support Services. He has held faculty positions at the University of Utah (Department of Mathematics, 1966-68), Cornell University (Department of Computer Science and Graduate Faculty of Applied Mathematics and Operations Research, 1969-1979), and Rice University (Department of Mathematical Sciences, Department of Computer Science, and Department of Computational and Applied Mathematics, since 1979), where he has also served as Chair of the Departments. He has held several center directorships, additional adjunct faculty and research appointments worldwide, and offices in professional organizations, including serving as Chair of the Mathematical Programming Society (MPS) and the Optimization Activity Group of the Society for Industrial and Applied Mathematics (SIAM). Among other editorial positions, he is the founder and former editor-in-chief of the SIAM Journal on Optimization and the MPS/SIAM Book Series on Optimization. His primary research focuses on practical methods for optimization, particularly for nonlinear engineering systems. His algorithm research has been published widely in several journals, and he has co-authored a textbook (with R.B. Schnabel) that is now published as one of the SIAM *Classics in Applied Mathematics*.