Applied and Computational Mathematics and Statistics Colloquium

Min Yang

Department of Statistics
University of Missouri-Columbia

will give a lecture entitled:

On the de la Garza Phenomenon: A New Approach of Studying Optimal Design for Nonlinear Models

Friday, January 28th, 2011
4:00 PM
Location: 129 Hayes-Healy Center

Abstract:

Designing experiments is an integral part of the scientific process, both for discovery and verification. Resources are almost always scarce, and judicious use of the limited resources is essential. Identifying efficient and optimal designs for data collection is therefore paramount.

There is a vast literature on identifying good designs for a wide variety of linear models, but the problem is much more difficult and not nearly as well understood for nonlinear models. Nonlinear models are however very important in applications, and include the broad class of generalized linear models. The usefulness and popularity of these models has spurred a large literature on data analysis, but research on design selection has not kept pace and has proven to be quite difficult.

One crucial step in deriving optimal design is to determine the number of support points needed. Current tools handle this on a case-by-case basis. Each combination of model, optimality criterion and objective requires its own proof. The celebrated de la Garza phenomenon states that under a polynomial regression model, any optimal design can be based on a design with minimum number of support points. Does this conclusion also hold for nonlinear models? If the answer is yes, it would significantly simplify deriving optimal design, analytically or numerically.

In this talk, we will introduce a new approach of studying optimal designs. Using this new approach, it can be easily shown that the de la Garza phenomenon exists for many commonly studied nonlinear models, such as the Emax model, exponential model, three- and four-parameter log-linear models, Emax-PK1 model, as well as many classical polynomial regression models. The proposed approach unifies and extends many well-known results in the optimal design literature. It has four advantages over current tools: (i) it can be applied to many forms of nonlinear models; to continuous or discrete data; to data with homogeneous or nonhomogeneous errors; (ii) it can be applied to any design region; (iii) it can be applied to multiple-stage optimal design and (iv) it can be easily implemented.