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Special Issues on Response Surface Methodology

Editorial

Response surface methodology (RSM) plays a key role in process optimization with a variety of applications to diverse areas such as agriculture, chemical engineering, food science, manufacturing, and pharmaceutical development. *Quality Technology and Quantitative Management* presents two special issues on papers addressing the topic of RSM. We hope that these two issues, comprising nine articles each, will advance the field of RSM in many directions.

The first issue comprises an eclectic collection of articles. The first paper is by Philip Prescott and Norman Draper. It deals with the challenging and important topic of mixture experiments. Here the authors propose a new transformation of the coordinate system to help make data analysis more interpretable in highly constrained mixture experiments. The second paper is by Sourish Saha and André Khuri. The purpose of their paper is to compare designs for response surface models with a random block effect. They achieve this using quantiles of a scaled prediction variance. A paper by the authors Anu Abraham, Timothy Robinson, and Christine Anderson-Cook comprises the third article. These authors present a graphical approach for assessing optimal operating conditions in robust parameter design. The fourth article is by Gregory Piepel and Scott Cooley. In their paper they provide a procedure for backward reduction of terms in a Scheffé linear mixture model in a way that is appropriate for mixture experiment models. The fifth paper in this first issue is by Runze Li and Dennis Lin. The first step in many applications of RSM is typically the variable screening process. These two authors introduce a variable selection procedure based upon penalized least squares. Lynne Seymour and Xiangrong Yin's paper on estimating the dimensionality of a ridge in quadratic response surface models comprises the sixth article. Their approach can be helpful for exploring quadratic response surfaces with more than two factors. The seventh paper is by M. J. Álvarez, L. Ilzarbe, E. Viles, and M. Tanco. This paper provides an overview of how genetic algorithms can be used when RSM is applied and optimization is required. In the eighth article, Shaun Wulff and Timothy Robinson examine methods of evaluating uncertainty of regression coefficient estimates from response surface models with complex covariance structure. In the final, and ninth paper, of this first series of papers, Robin Nicolai and Rommert Dekker present a framework for seeking the optimal settings of a response surface in an automated fashion.

The second issue is also made up of articles addressing a variety of RSM topics. The first three papers in the second issue apply Bayesian methodology for response surface inference. The first article is by John Peterson, Guillermo Miró-Quesada, and Enrique del Castillo. The authors present a flexible Bayesian approach to multiple response surface optimization when using seemingly unrelated regressions models. The second paper, by Younan Chen and Keying Ye, use Bayesian methods to tackle the dual response model in the presence of partially replicated designs. The third paper is by Gregory Stockdale and Aili Cheng. These authors present two examples of applying multivariate posterior predictive distributions to construct "design spaces" and "reliable operating regions" useful

for pharmaceutical manufacturing. The fourth article in this second RSM issue is by Daniel Lepadatu, Abdessamad Kobi, Xavier Baguenard, and Luc Jaulin. It presents a new method which employs mechanical tolerancing, RSM, and interval computation for process optimization. A paper by S. Huda and F. Alqallaf makes up the fifth article in this second series. These authors present D-minimax optimal designs for estimating slopes on second-order response surfaces. The sixth paper is by Jiahong Li, Li Liang, Connie Borror, Christine Anderson-Cook, and Douglas Montgomery. This article provides graphical summary procedures to compare prediction variance performance in the case of central composite designs with 6 to 10 factors. In the seventh paper, Peter Chung, Heidi Goldfarb, Douglas Montgomery, and Connie Borror propose designs for mixture-process experiments involving continuous and categorical noise variables. Sung Park, Hyang Jung, and Rabindra Nath Das discuss the slope-rotatability of response surface models with correlated error in the eighth paper. The final paper in this second RSM series is by Xuan Lu, Dennis Lin, and Daxin Zhou. They present a new criterion for the construction of two-stage optimal designs.

We wish to thank the authors for their contributions that make up these two special issues. We also give our sincere appreciation to the anonymous referees who provided quality feedback for the manuscripts submitted. In particular, we would also like to thank the editors of *Quality Technology and Quantitative Management* for providing us with the opportunity to have these two special and important issues in response surface methodology.

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