

Fall 2014 **Statistics 578**
Response Surface Methodology

Instructor: John Borkowski 2-263 Wilson Hall Phone: 994-4606

Text: *Response Surface Methodology: Process Optimization Using Designed Experiments.* by Raymond H. Myers, Douglas C. Montgomery, and Christine-Anderson Cook (2009). Wiley.

Location: Wilson 1-134, M W F 2:10 - 3:00.

Tentative Office Hours:

Monday 1:00 - 2:00, Tuesday 11:00 - 12:00, Wednesday 12:00 - 1:00, and by appointment

Useful Background Information

- Taylor Series, Useful Matrix Theory Results
- Least Squares Estimations and Hypothesis Tests in Linear Regression Models (Sections 2.7-2.8 of Chapter 2)

Introduction to Response Surface Methodology (RSM) (Chapter 1)

- Fundamentals and Goals of RSM.
- Approximating Functions.

Empirical Model Building (Sections 2.7-2.8 of Chapter 2)

- Checking for Lack of Fit
- Checking for Collinearity Problems

2^k Factorial Designs (Chapter 3)

- The General 2^k Design
- In Two, Four, ... , 2^p Blocks
- Discussion of Confounding

2^{k-p} Fractional-Factorial Designs (Chapter 4)

- One-Half ($p=1$) and One-Quarter ($p=2$) Designs
- The General 2^{k-p} Design
- Designs of Resolution III, IV, V

The Method of Steepest Ascent (Descent) (Sections 5.1-5.3 of Chapter 5)

The Analysis of Response Surfaces (Sections 6.1-6.4 of Chapter 6)

- The Second-Order Response Surface
- Canonical Analysis and Ridge Analysis
- Properties of Results Based on a Fitted Model

Experimental Designs for Fitting Response Surface Models (Chapter 7)

- The Design Region and Model Inadequacy.
- Orthogonal Designs for Fitting First-Order Models
- Designs for Fitting Second-Order Models
 - Central Composite
 - Box-Behnken Designs
 - Discussion of Rotatability
 - Equiradial Designs
 - Orthogonal Blocking

Other Experimental Designs for Fitting Response Surface Models (Chapter 8)

- Optimality Criterion for Comparing Designs
- Computer Generated (algorithmic) Designs
- Blocking in Response Surface Designs

Introduction to Experiments with Mixtures (Sections 11.1-11.2 of Chapter 11, Sections 12.1 of Chapter 12)

- Simple Lattice and Simplex Centroid Designs
- Scheffe Models
- Constraints and Mixture Experiments
- Extreme Vertices and Computer-Generated Designs

Grading

1. Two 75-point Takehome Exams
2. Final 30-point reading project. This will involve reading and answering questions about two published research articles.
3. Approximately 120 points in homework.