

Statistical Modelling and Design of Experiments

Objectives

Statistical experimental design allows experimenters to get the maximum of relevant information with a minimum experimental effort. Most often the problems that practitioners face can be framed by the two questions: which are the most important factors of the system (model identification) and what is the best settings of the factors (prediction). Students will learn the fundamental concepts of factor, bias, interaction, confounding, how to construct fractional factorial designs and how to optimize a response surface. The methodology of robust engineering design (Taguchi method) used in modern quality improvement will also be taught. Although this course is an applied statistics course with many real examples, it provides insights in fundamental statistical modelling issues.

Contents

1. What is statistical experimental design
2. Full Factorial Designs with Factors at Two-Level
Factors, interaction
Analysis with normal and half-normal plot
3. Fractional Factorial Designs with Factors at Two-Level
Construction
Confounding of effects
Analysis
4. Special Issues
Design resolution
Blocking
Other screening designs
5. Modelling
Advantage of orthogonal designs
Model comparison
Test of lack-of-fit
6. Optimization techniques
Simplex
Evop
Steepest ascent
7. Response Surface Analysis
Central composite designs
Other designs
Canonical analysis
8. Special Issues
Simultaneous optimization of many responses
Analysis of transformation
9. Robust Engineering Design
Control and noise factors
Taguchi method
Parameter design optimization

Evaluation

According curriculum 2009-2010 :

- ES : 2-hour final written test during the last week of the semester
- *Reexamination session (September) : 2h written test*

Textbooks

- Box G.E.P., Hunter W. and Hunter S.J., *Statistics for Experimenters: Design, Innovation, and Discovery*, 2nd Edition, Wiley (2005).
- Myers R.H. and Montgomery D.C., *Response Surface Methodology: Process and Product Optimization Using Designed Experiments*, Wiley (1995).
- Wu C.F.J, Hamada M., *Experiments: Planning, Analysis, and Parameter Design Optimization*, Wiley (2000).

Characteristics

- 3 ECTS credits
- Compulsory course for master in statistics
- Spring Semester
- Course : 2 hours
- Prerequisite : Linear Regression

Teaching team

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Exercises