EPFL

PHYS-442   **Modeling and design of experiments**

Fuerbringer Jean-Marie

Cursus	Sem.	Type
Ing.-phys	MA2, MA4	Opt.
Physicien	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Oral
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
TP	2 weekly
Number of positions	

Summary

In the academic or industrial world, to optimize a system, it is necessary to establish strategies for the experimental approach. The DOE allows you to choose the best set of measurement points to minimize the variance of the results. The concepts learned are applicable in all areas.

Content

- Fundamentals of DOE theory
- Multilineal regression
- Greaco-Latin squares
- Placket-Burman designs
- Factorial and fractional factorial designs
- Surface response designs
- Mixture designs

Keywords

Design of experiments, ANOVA, Least square fit, Statistics, Multilineal regression, variance minimization

Learning Prerequisites

Recommended courses

Statistics, metrology

Important concepts to start the course

Basic statistical conceps suc as average, variance, statistical distributions, Calculus, linear algebra matriciel, Matlab or Python fundamentals, coding fundamentals

Learning Outcomes

By the end of the course, the student must be able to:

- Propose an empirical model in function of the experimental objective
- Analyze an experimental situation and identify the critical elements from a statistical point of view
- Establish a design of experiments in relation with the candidate models and the experimental constraints

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Use a work methodology appropriate to the task.
- Demonstrate the capacity for critical thinking
- Use both general and domain specific IT resources and tools

Teaching methods

Theoretical presentation, cases calculation and analysis

Expected student activities

- Synthesized the theoretical presentation in personal summary with concept maps
- Solve exercise problems

Assessment methods

Oral exam concisting in solving and analyzing a case

Resources

Bibliography

- Box, G.E.P.; Hunter, J.S.; Hunter, W.G. Statistics for Experimenters; Wiley Series in Probability and Mathematical Statistics, John Wyleyand Son, 1978.
- Montgomery, D.C. Design and analysis of experiments, 7th edition ed.; John Wyley and Son, 2009.
- Davison A.C.; Statistical model, Cambridge University Press in June 2003.
- Ryan Th.; Modern Experimental Design, John Wyley and Son, 2007.

Ressources en bibliothèque

- Modern Experimental Design
- Statistics for Experimenters, An introduction to design, data analysis and model building
- Design and analysis of experiments
- Statistical model

Moodle Link

- http://moodle.epfl.ch