



Design of Experiments

in chemical and related industries

COST-EFFICIENT RESEARCH

Research & Development: searching for new products and improving existing processes. This can be accomplished efficiently and optimally only in one way: the way of Experimental Design. Experimental Design, alias Design of Experiments (DOE) or Statistical Design of Experiments (SDE), not only guarantees reaching the preset goal, but on top costs a minimum number of experiments ... on condition that one takes into account the characteristics of the field of application. The optimal strategy of experimenting will be different in chemical industries as compared to for example the automotive industry. This explains the specific context of this course.

COURSE SET-UP

Four courses on DOE are offered: an introductory course (DOE-I: 4 days), a follow-up course (DOE-II: 1.5 days), a course on Principal Properties Design (0.5 day) and a Mixture Design course (1 day). DOE-I is limited to standard designs for continuous variables.

Categorical variables (e.g. type of solvent or type of reactor) and generating and evaluating optimal designs will be discussed in DOE-II.

The Principal Properties Design course deals with how solving / circumventing the problem of multi-level categorical variables.

Designs for problems where the sum of constituents is constant will be discussed in the fourth course.

DOE-I PRACTICAL

Each course day will be held from 9 am to about 5 pm. The course dates and fees are listed on the attached application form. The course fee includes handouts and lunches.

To apply, send us back the application form, or apply on-line, at least 20 days before the start of the course .



DOE-I

COURSE SET-UP

During the first three days the topics listed below will be theoretically treated, and illustrated with exercises. Day four is actually an Experimental Design "game": the participants go through all phases of a project: from problem analysis over choosing a design, up to analysing simulated data and reporting the results.

COURSE OBJECTIVE

At the end of the course the participants will be able to formalise a problem, find the appropriate design type and, except for complex problems, construct this design. The participants will also master the statistical analysis of standard designs for continuous variables.

INTENDED AUDIENCE AND PRIOR KNOWLEDGE

Those who want to acquire an "active" knowledge in setting up experiments according to Experimental Design theory, as well as people who want to understand both the Experimental Design principles and the results of the statistical analysis.

Participants to DOE-I are assumed to have a thorough understanding of some basic statistical techniques (normal probability plot, confidence intervals, hypothesis tests, Type I & Type II errors, power, ANOVA, regression). The 2-day course 'Applied Statistics – A primer' is ideally suited as a preparation to DOE-I.

The required prior knowledge can however also be obtained by private study. The course material consists of the handouts of the 'Applied Statistics – A primer' course, including problems and solutions. This selfstudy package can be ordered on-line or through the application form.

COURSE CONTENTS

Day 1 - 3

- One Variable At a Time versus Experimental Design
- The concept of interacting variables
- Replication, 2-level blocking variables and randomisation
- 2-level designs: Full Factorial, Fractional Factorial, Minimum-Run designs, Foldover designs, Confounding, Resolution
- Multi-level Response-Surface-Model designs
- Power-analysis: which is the smallest significant effect I can find, how many experiments will it cost to find an effect of a particular size
- Analysing the results with Analysis of Variance
- Residual analysis and graphical validation
- Visualisation of the results
- Response transformation
- Multi-response optimisation

Day 4

- Experimental Design game