November 25, 2024

Series 9: Response surface

1 A few manipulations with response surface designs

Objective

The objective of this exercise is to train the different analyses available for the response surface approach. It is also the opportunity to compare the performance of the different designs.

A the level of Matlab the following specific functions are potentially of interest: *doehlert(), ccdesign(), bbdesign(), x2fx(), corrcov(), normplot(), fitlm(), anova(), eig(), slice(), clim(), patch(), isosurface()*.

Routine *mesure3.m* simulates an experiment with 3 factors in an experimental space with 3 dimensions defined by $x_1, x_2, x_3 \in [-1.5, 1.5]$. The objective is to determine an empirical model with the results of a set of experiments. In this purpose:

a) Simulate experiments with 3^3, composite, Doehlert's and Box-Behnken's designs, replicating measurements (the routine simulates a measurement uncertainty),

b) Infer the coefficients of a quadratic model for each design and select a model according to the significant effects,

c) Perform a canonical analysis,

d) Compare the results in terms of accuracy and number of experiments,

e) Select 20 random points in the domain, perform the measurement for these points and compare them to the predictions of the different models

f) Using the *slice.m* routine, perform cross-sections of the domain to view the results of the canonical analysis of one of the models,

g) Using the *isosurface.m* routine, create a 3D graph with several isosurfaces to visualize the results of the canonical analysis of one of the models.