Response Surface Methodology

BIOE 498/598 PJ

Spring 2021
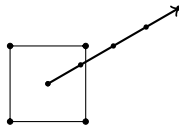
Last time: The method of steepest ascent

▶ Begin with a FF+CP design.
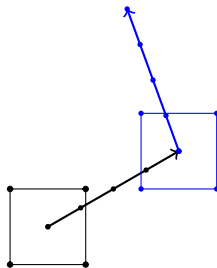
Last time: The method of steepest ascent

- Begin with a FF+CP design.
- Follow path of steepest ascent until the model breaks.

Last time: The method of steepest ascent

▶ Begin with a FF+CP design.

▶ Follow path of steepest ascent until the model breaks.

▶ New FF+CP; repeat steepest ascent.

Last time: The method of steepest ascent

▶ Begin with a FF+CP design.

▶ Follow path of steepest ascent until the model breaks.

▶ New FF+CP; repeat steepest ascent.

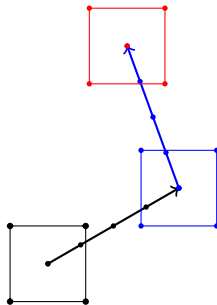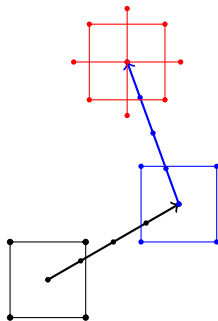▶ Stop when model detects lack of fit.

Last time: The method of steepest ascent

- ▶ Begin with a FF+CP design.
- ▶ Follow path of steepest ascent until the model breaks.
- ▶ New FF+CP; repeat steepest ascent.
- ▶ Stop when model detects lack of fit.
- ▶ **Today**: Fitting a model to a curved response surface.

Fitting models with curvature

► We need two things to model a curved response surface:
  1. A model that is flexible enough to curve.
  2. Data that can detect the curvature.

Fitting models with curvature

- ▶ We need two things to model a curved response surface:
  1. A model that is flexible enough to curve.
  2. Data that can detect the curvature.
- ▶ The optimal operating conditions correspond to a maximum in the response surface.
- ▶ We need models that can model maxima.

Fitting models with curvature

- We need two things to model a curved response surface:
  1. A model that is flexible enough to curve.
  2. Data that can detect the curvature.
- The optimal operating conditions correspond to a maximum in the response surface.
- We need models that can model maxima.
- FO + TWI models are curved, but are rarely bounded.

Fitting models with curvature

▶ We need two things to model a curved response surface:
  1. A model that is flexible enough to curve.
  2. Data that can detect the curvature.
▶ The optimal operating conditions correspond to a maximum in the response surface.
▶ We need models that can model maxima.
▶ FO + TWI models are curved, but are rarely bounded.

$$y = 20 + 3.6x_1 - 1.8x_2 - 0.6x_1x_2$$

Set $x_2 = 0$, then $y \to \infty$ as $x_1 \to \infty$.