

Project “Computer Experiments”

Fallstudien II / Case Studies II

Prof. Dr. Katja Ickstadt

Dr. Henrike Weinert

Yassine Talleb

Carmen van Meegen

WS 2025/26

November 11, 2025

Guiding Questions

- **Analysis of Computer Experiments**
What could be possible research questions?
- **Design of Computer Experiments**
How to select “optimal” design points for evaluating the computer model?
- **Surrogate Modeling**
What is a suitable choice for a surrogate model?

Analysis of Computer Experiments

What could be possible research questions?

- **Uncertainty Analysis:**

How does uncertainty in the inputs induce uncertainty in the output?

→ Approximation of the uncertainty distribution of $Y = \eta(\mathbf{X})$.

Density transformation maybe for
higher dimension

- **Reliability Analysis:**

What is the probability that the structure will fail?

→ Estimation of the failure probability

$$p_f = P(g(\mathbf{X}) < 0) = \int_{\mathcal{X}} \mathbf{1}_{\{g(\mathbf{x}) < 0\}} f_{\mathbf{X}}(\mathbf{x}) d\mathbf{x}.$$

- **Sensitivity Analysis:**

How do changes in model inputs influence the output?

→ Identification and quantification of the effects of input parameters.

Analysis of Computer Experiments

What could be possible research questions?

- **Model Accuracy:**

How accurately does the surrogate model approximate the computer model?

→ Validation of the predictive capabilities of the surrogate model.

- **Design Choice:**

How does the design [effect](#) the performance of the surrogate model?

→ Determination of the impact of the design on the surrogate model.

Design of Computer Experiments

How to select “optimal” design points for evaluating the computer model?

- Simplifying assumptions:
 - Homogeneously distributed material parameters across the membrane
 - Stochastically independenten material parameters
- Limited budget for computer model runs $n_{\max} \leq 200$