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# Project “Computer Experiments”

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Fallstudien II / Case Studies II

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## 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  $Y = \eta(\mathbf{X})$ .

- **Reliability Analysis:**

Density transformation maybe for higher dimension

*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 **a**ffect 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  $n_{\max} \leq 200$