



MF2024

Robust and probabilistic design (6 credits)

Course PM

January 2021– March 2021

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Canvas activity: *MF2024 VT21-1 Robust and probabilistic design*

Background

Probabilistic design is an engineering design methodology aimed to produce high-quality products, by systematically studying the effects of variations in design parameters on product performance.

Robust design is a methodology for optimising this quality by making the performance of the product insensitive to variations in the manufacturing, material, operational, and environmental properties.

Objectives

A student after completed course shall be able to:

- ✓ describe the characteristic properties of various design characteristics in statistical terms,
- ✓ assess the confidence interval of the assessed reliability of a technical system,
- ✓ find the type of probability distribution for a given set of data,
- ✓ describe the purpose for, the methodology of, and the output from Design of Experiments,
- ✓ define a testplan for a set of physical and numerical experiments,
- ✓ describe the purpose and steps for performing a Monte-Carlo simulation.
- ✓ use Monte Carlo simulations to analyse how the uncertainties in a models input variables affects the results from the model;
- ✓ describe the purpose of Robust design and how it relates to optimization approaches,
- ✓ use the Robust design methodology to minimize the sensitivity of a technical response parameter to variations in a set of component design parameters,
- ✓ use the Robust design methodology to minimize the sensitivity of a technical response parameter to variations i a set of technical interaction parameters,

Main content

- Engineering statistics; distributions, normal, exponential, Weibull, confidence intervals
- Design of experiments: physical and simulation experiments, suspended or censored tests Probabilistic design; Monte-Carlo simulation of performance variations caused by variations in design (manufacturing tolerances, material properties, geometric configuration), and environmental parameters (humidity, electromagnetic fields, temperature, dust)
- Robust design; minimizing performance variation due to variation in design parameters, human properties and environmental conditions
 - 12 lectures
 - Five exercises
 - A written examination

Examination and grading

Exercises, grade scale: pass/fail, 3.0 credits.

Written examination, grade scale: A, B, C, D, E, FX, F, 3.0 credits.

Course literature

1 Bryan Dodson, Patrick Hammett, Rene Klerx , Probabilistic Design for Optimization and Robustness for Engineers , Wiley 2014.

2. Handouts

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