MSE-213

Probability and statistics for materials science

Jotzu Gregor

Cursus	Sem.	Type
Materials Science and Engineering	BA3	Obl.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The course establishes the concepts of statistical analysis, probability theory, and data analysis. This includes standard statistical tests, correlation analysis and experimental design. It introduces computational statistical methods to analyse large data sets.

Content

- Basic statistics and probability theory. Introduction to concepts of uncertainty, random variables, probability distributions, with examples from materials science.
- Statistical hypothesis testing. Formulating a hypothesis and testing it on data sets in the presence of statistical uncertainty. Identifying the most appropriate method for realistic problems.
- Assessing the limitations of statistics. Developing the skill to interpret a given statistical analysis, and to critically assess the validity of its assumptions and conclusion. Critical evaluation of examples of general relevance.
- Computational analysis in Python. A use-focussed introduction to the basic aspects of data analysis, visualisation and fitting using Python. Application to realistic small and large data sets.

Keywords

Statistics, Probabilty, Data Analysis, Python, Experimental Design

Learning Outcomes

By the end of the course, the student must be able to:

- Analyze small data sets manually and large data sets computationally
- Examine the assumptions and conclusions of a statistical analysis.
- Contextualise random variables, probability distributions, the central limit theorem and the law of big numbers.
- Apply the least squares, ANOVA, student test, and related methods.
- Assess / Evaluate Python code for analysing, fitting and visualising data.

Transversal skills

- Demonstrate the capacity for critical thinking
- Access and evaluate appropriate sources of information.
- Use both general and domain specific IT resources and tools
- Take account of the social and human dimensions of the engineering profession.

Teaching methods

Lectures combined with exercises to solve computational examples.

Expected student activities

Attendance of lectures and solving exercises on the computer. A laptop computer will be required for this course.

Assessment methods

Written exam

Resources

Moodle Link

- https://go.epfl.ch/MSE-213