FSG3130 Uncertainty Analysis 5.0 credits

Osäkerhetsanalys

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for FSG3130 valid from Spring 2014

Grading scale

G

Education cycle

Third cycle

Specific prerequisites

A master degree in a mechanics related area is recommended.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The student will be able to discuss general issues regarding mainly experimental uncertainties relevant for measurements with special focus to fluid dynamic systems, the difference between systematic and random errors (bias and uncertainty), confidence intervals, calibra-

tion errors, error propagation in data reduction equations, regression analysis etc. There will also be a discussion about how to determine the uncertainty propagation by using Monte Carlo analysis. The uncertainty analysis will be exemplified through discussion of various real-life experiments (and to some extent simulations). Although many of the examples are taking from the fluid dynamics field, the discussion of the uncertainty analysis is general and can be applied to many other scientific fields. After completing this course the student should be able to:

- distinguish between random and systematic (uncertainty and bias) error.
- understand basic statistical concepts and the meaning of confidence intervals.
- calculate uncertainty in a measured variable based on the Taylor series method.
- perform a Monte-Carlo based uncertainty analysis.
- evaluate how long time a variable need to be sampled in order to obtain a certain accuracy in the measured/simulated statistics.
- handle outliers in a reliable and systematic way.
- design, debug and execute an experiment.
- understand the difference between validation and verification of simulations, and how validation can be performed.
- do an accurate regression analysis.

Course contents

1. Experimentation, Errors and Uncertainty
2. Errors and Uncertainties in a Measured Variable
3. Uncertainty in a Result Determined from Multiple Variables
4. General Uncertainty Analysis. Planning an Experiment and Application in validation
5. Detailed Uncertainty Analysis: Designing, Debugging, and Executing an Experiment
6. Validation of Simulations
7. Data Analysis, Regression, and Reporting of Results

Disposition

The lecture part of the course is given in a compressed time scale with approximately 20h of lectures during 1-2 weeks.

Course literature

H.W. Coleman & W. Glenn Steele: Experimentation, validation, and Uncertainty Analysis for Engineers

(3rd Edition), Wiley

Examination

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

The following items have to be approved in order to obtain a pass on the course:

- Compulsory and active attendance during at least 80% of the lecture time
- Successful completion of homework assignment within given time frame

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.