Ten Lectures on Turbulence

Course Nr.:	2189904
Course Title:	Ten lectures on turbulence
Course Credits:	4
Lecture Starting Date:	October 24. 2024
Class Schedule:	Th. 15:45-17:15
Classroom:	Bulding: 10.81 Room 219.1
	Course Catalog
Language:	English

Instructor:	Dr. Ivan Otic
Email:	ivan.otic@kit.edu
Office Location:	Geb. 419; CN, ITES, Room 237
Office Hours:	Tu. 14:00-15:00 and by appointment

Course Description:

The course is aimed of giving the fundamentals of turbelence theory, modelling and simulation. Governing equations and statistical description of turbulence are introduced. Reynolds equations, Kolmogorov's theory and scales of turbulent flows are discussed. Homogeneous and isotropic turbulence. Turbulent free-shear flows and wall-bounded turbulent flows are discussed. Turbulence modelling approaches and simulation methods are introduced. At the completion of this course, students will be able to formulate an own turbulence model.

Prerequisites:

Undergraduate fluid mechanics, statistics and probability theory.

Course Objectives:

At the completion of this course, students

- are able to understand fundamentals of statistical fluid mechanics, turbulence theory and turbulence modelling.
- are able to derive RANS and LES transport equations
- get working knowledge of modelling techniques that can be used for solving engineering heat and mass transfer problems
- are able to formulate an own turbulence model.

Reference texts:

- Lecture notes
- Presentation slides

  Lecture material is available online.

Grading:

The final grade is based on performance in:
- Homework Problems
- Final Exam

Recommended Books:

- *Pope, S. B.: Turbulent Flows. Cambridge University Press, 2003.*
- *Hinze J. O.: Turbulence. McGraw-Hill, 1975.*

Tentative Course Outline:
The weekly coverage might change as it depends on the progress of the class.

	Content
1	• Introduction
2	• Turbulent transport of momentum and heat
3	• Statistical description of turbulence
4	• Scales of turbulent flows
5	• Homogeneous turbulent shear flows
6	• Free turbulent shear flows
7	• Wall-Bounded turbulent flows
8	• Turbulence Modelling
9	• Reynolds Averaged Navier-Stokes (RANS) Simulation Approach
10	• Large Eddy Simulation (LES) Approach