Politechnika Krakowska
im. Tadeusza Kościuszki

COURSE TITLE: Computational Fluid Dynamics (CFD)
Number of contact hours: 45
Duration: 1 semester (spring)
ECTS credits: 4

Programme description:

The goal of the course is to familiarize students with the basics of CFD. Students are to understand how numerical modeling programs for fluid and heat flow work. After completing the course, the student is expected to understand how geometries are divided into control volumes, how discretization is performed, and be able to interpret the results from the analyses performed. At a basic level, the student is expected to master one of the contemporary CFD software.

Learning Objectives: a) Understand the principles and applications of CFD. b) Master the steps to obtain the results of the modeled problem including: construction of geometry, division into control volumes, assignment of boundary and initial conditions, performing calculations, processing of results. c) Understand and apply the control volume method d) Student is able to assess the convergence of the calculations carried out and knows how to monitor the course of calculations. e) Become familiar with the basics of using commercial CFD calculation programs. f) Interpret results for engineering applications.
Course Outline:

1. Introduction to CFD: Basics, advantages, and limitations.
2. Governing Equations: Navier-Stokes, energy conservation.
3. Discretization Techniques: Control volume method, finite volume,
4. Grid Generation: Structured and unstructured meshes.
5. Solution Methods: Explicit, implicit, and iterative solvers.
6. Turbulence Modeling: RANS, LES, DNS methods.
7. Heat Transfer in CFD
8. Practical Applications

Course type: Project (45): Work on an engineering projects, making model, calculations, presentation and defense of the project

Literature:

1. Versteeg, H., & Malalasekera, W. (2007). An introduction to computational fluid dynamics: The finite volume method (2nd ed.). Prentice Hall.
2. Ferziger, J. H., & Peric, M. (2001). Computational methods for fluid dynamics (3rd ed.). Springer.

Assessment method: Defense of an individual project

Lecturer: Prof. Artur Cebula

Contact person: Artur Cebula (e-mail: artur.cebula@pk.edu.pl)