Computational fluid dynamics

Academic Year: (2022 / 2023) **Review date: 09-05-2022**

Department assigned to the subject: Thermal and Fluids Engineering Department

Coordinating teacher: IGLESIAS ESTRADE, MARIA IMMACULADA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Basic knowledge in Fluid Mechanics.

OBJECTIVES

This subject is intended for students to acquire, on a reasonable level,
-Knowledge and understanding of the fundamental concepts and basic techniques of Computational Fluid Mechanics (CFD).
-Ability to develop their own code for simulating simple flows.
-Ability to choose a mathematical model suitable for numerical simulation of industrial flows of interest, with possible application to design problems.
-Ability to use the commercial CFD software chosen for the subject and to read and understand the program guide.
-Awareness of the need to (and ability to) critically verify, validate and interpret results obtained from a CFD simulation.
-Ability to collaborate as a team and effectively present the results of the work carried out.

DESCRIPTION OF CONTENTS: PROGRAMME

- Introduction to CFD.
- The basic equations of fluid mechanics.
- Levels of approximation.
- Mathematical nature of the equations and their boundary conditions.
- Discretization techniques.
- Numerical mesh generation.
- Finite difference method for model equations.
- Finite difference and finite volume method for the Navier-Stokes equations.
- Turbulence modeling.
- Applications: programming a finite differences code to solve a simple problem, and using a commercial code (ANSYS FLUENT) to solve a real-life industrial problem.

LEARNING ACTIVITIES AND METHODOLOGY

The development of the course includes lectures where the theoretical concepts are exposed, combined with practical application classes in a computer room.

ASSESSMENT SYSTEM

- Final exam (30%)
- Attendance and participation in class (10%)
- Programming of a finite differences code to solve a simple flow problem (30%)
- Implementation of a problem of industrial interest in a general purpose commercial CFD code (30%)

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- Hirsch, C. Numerical Computation of Internal and External Flows (Second Edition) , Elsevier, 2007

ADDITIONAL BIBLIOGRAPHY

- null ANSYS FLUENT Theory Guide, ANSYS.

- null ANSYS FLUENT User's guide, ANSYS.

BASIC ELECTRONIC RESOURCES

- Hirsch, C. . Numerical Computation of Internal and External Flows (Second Edition) : http://www.sciencedirect.com/science/book/9780750665940#ancPR4