60828 - Computational fluid models for engineering application

Syllabus Information

Academic Year:	2018/19
Subject:	60828 - Computational fluid models for engineering application
Faculty / School:	110 -
Degree:	532 - Master's in Industrial Engineering
ECTS:	6.0
Year:	2
Semester:	Second semester
Subject Type:	Optional
Module:	---

General information

Aims of the course

The subject and its expected results meet the following approaches and objectives:

Computational Fluid Mechanics (CFD) is an inherently interdisciplinary branch of science that has a very wide range of applications. Fluid Mechanics uses numerical methods and algorithms to solve and analyze problems that involve realistic fluid flows. Sectors such as aviation, space, automotive, medicine and the environment are just some of the industries that have in common fluid flows.

Context and importance of this course in the degree

The module on Models and flow simulation is part of the block of optional sibjects. This is a subject of 6 credits ETCS taught in the second semester of the second year. Equipped with numerical techniques of this subject, and with a good previous training in Fluid Mechanics, students will be prepared to understand and address more sophisticated design challenges in CFD utility in Industrial Engineering.

Recommendations to take this course

It is advisable to have studied and understood the subject Fluid Engineering of the first course. There are concepts of this subject used extensively. It is desirable that students adopt a system of ongoing study and frequently using tutorials with the teacher to resolve any doubts that surely will arise in the learning of the subject.

Learning goals

Competences

To pass the course, the students will be more competent at:

Applying the most suitable numerical methods for various problems of interest in Fluid Mechanics.
Interpreting the results generated by a computer model of a fluid problem.
Knowing the basics of modeling incompressible and compressible flows of practical interest.
Applying the knowledge gained to flow analysis and facilities in the industry.

Learning goals

The student should demonstrate the following results:

Meet the most suitable numerical methods for various problems of interest in Fluid Mechanics
Be able to interpret the results generated by a computer model of a fluid problem
Know the basics of modeling of incompressible and compressible flows of practical interest
Be able to apply the knowledge gained to flow analysis and facilities in the industry.

Importance of learning goals

There has been considerable growth in development and application of CFD in all aspects of fluid dynamics. CFD has become a standard modeling tool widely used in industry. As a result there is considerable demand for specialists in the subject that is not covered in sufficient detail at the undergraduate level. This subject is looking to lay the foundations for an industrial or research career in the rapidly growing field of computational fluid dynamics. It provides a solid foundation for the student to be able to apply CFD methods as a tool for design, analysis and engineering applications. With a strong emphasis on understanding and applying the underlying methods, enthusiastic students can write their own CFD codes during the course.

Assessment (1st and 2nd call)

Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate the achievement of the learning outcome through the following evaluation activities

I: Group work. Reports generated from various computer cases raised in the practical and and computational exercises will be evaluated. They may be carried out in groups of two. (fifty%)
II: Presentation and discussion of individual work (50%)
Students who choose not to perform the progressive evaluation will be evaluated by a single global test at the end of the course, consisting of a theoretical and practical examination to be performed on the date indicated by the academic calendar of the School of Engineering and Architecture.

Methodology, learning tasks, syllabus and resources

Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as

- Lectures, given to the entire group, in which the teacher will explain the theoretical contents, illustrated with relevant cases. These sessions will familiarize students with some advanced simulation tools.
- Computer sessions, which are recommended for a better understanding of the course contents because they deal with real-elements described in lectures.
- Tutorials, which can be related to any topic of the course.

Learning tasks

The course includes the following learning tasks:

- **Lectures** (45 hours). Four weekly hours.
- **Computer lab sessions** (12 hours). 4 sessions of 3 hours each with groups of two students.
- **Autonomous work and study** (93 hours). Time for the study of theory, case solving, and preparation of materials.
- **Tutorials**. The teacher will communicate their office hours.

Syllabus

The course will address the following topics:

- Topic 0. Introduction
- Topic 1. Governing equations and their properties in relation to CFD
- Topic 2. Discretization of the equations and meshes schemes
- Topic 3. Incompressible viscous flow models with and without turbulence
- Topic 4. Models for free surface flow: hydraulic processes and environmental interest
- Topic 5. Models for compressible flow: pressure gas installations and models of interest in aeronautics
- Topic 6. Cases of interest in the industry

Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

At the beginning of each course the key dates and schedule will be published at the center's website http://eina.unizar.es Also students will have at the beginning of course dates and locations of the necessary examinations to pass this subject. Teaching material will be uploaded at the moodle2 platform and this will be the essential mechanism of communication with students.

Bibliography and recommended resources