Professional Software for Fluid Mechanics

ECTS: 6 ECTS

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UNIVERSITY WHERE THE COORDINATOR IS: USC

HAVE YOU GIVEN PERMISSION TO RECORD YOUR CLASSES? No

SUBJECT CONTENTS

[1] Review of models of Fluid Mechanics .

[2] Description of the package.

-Ansys Workbench

-Pre-process: creation of geometry with Design Modeler and mesh generation with Meshing .

-Simulation ("solver") using the graphical user interface for defining the problem to be solved: model selection, input, boundary and initial conditions, etc.

-Post-process: visualization and analysis of results.

-Introduction to UDF's.

[3] Numerical Methods.

-Analysis of numerical methods used in Fluent. Finite volume method.

[4] Resolution of various problems of fluid mechanics.

-Incompressible inviscid fluids:

-Outer flow through a cylinder and a sphere.

-Incompressible viscous fluids:

-Flows with low Reynolds number: Couette and Poisseuille flows, on an incline plane, Hagen-Poisseuille in conduit, etc.

-Flows with moderate Reynolds number: a study of boundary layers.

-Flows with number of moderate/high Reynolds: destabilization of laminar solutions.

-Flows with high Reynolds numbers: modeling of turbulent flows.

-Compressible viscous flows:

-Thermal convection phenomena: Boussinesq approximation.

-Reactive flows.

-Thermal radiation.

-Multiphase flows.

-Turbomachinery.

METHODOLOGY

- Lectures: 10 hours. Mathematical models that we will manage and the numerical methods used in their resolution.

- Practical sessions: 50 hours. Will be carried out in a computer room. Students will learn to use the appropriate software associated with such methods. The teacher will give generic guidelines so that each student can do their work. Also, the teacher will address the issues raised by the students and will monitor the work of these.

LANGUAGE USED IN CLASS: Spanish

IS IT COMPULSORY TO ATTEND CLASS? In the university where the teacher is.

BIBLIOGRAPHY

1. Ansys Fluent Theory Guide.
2. Ansys Fluent User Guide.
3. Bermúdez. Mathematical methods in Fluid Mechanics. Universidad de Santiago de Compostela, 2002.
4. M. Griebel, T. Dornseifer, T Neunhoeffer. Numerical simulation in Fluid Dynamics. A practical introduction. SIAM, 1998.
5. J.H. Ferziger, M. Perić. Computational methods for Fluid Dynamics. Springer-Verlag, 1997.
6. C.A.J. Fletcher. Computational techniques for Fluid Dynamics. Volume I and II. Springer-Verlag, 1988.
7. M.E. Gurtin. An introduction to Continuum Mechanics. Academic Press, 1981.
8. Hirsch. Numerical computation of internal and external flows. Volume I and II. John Wiley & Sons, 1991.
9. Mohammadi, O. Pironneau. Analysis of the K-Epsilon turbulence model. John Wiley & Sons, Masson, 1994.
10. S.V. Patankar. Numerical heat transfer and fluid flow. Hemisphere, Washington, D.C., 1980.

11. H.K. Versteeg, W. Malalasekera. An introduction to Computational Fluid Dynamics. The finite volume method. Prentice Hall, 1995.

SKILLS

Basic:

CG1: To have knowledge that provide a basis or opportunity for originality in developing and / or applying ideas, often within a research context, knowing how to translate industrial needs in terms of R & D in the field of mathematics Industrial.

CG4: To have the ability to communicate the findings to specialist and non-specialist audiences in a clear and unambiguous way.

Specific:

CE4: To be able to select a set of numerical techniques, languages and tools, appropriate to solve a mathematical model.

CE5: To be able to validate and interpret the results, comparing them with visualizations, experimental measurements and functional requirements of the physical engineering system.

Numerical specialization:

CS1: To know, be able to select or use how to handle most suitable professional software tools (both commercial and free) for the simulation of processes in the industrial and business sector.

CS2: To adapt, modify and implement software tools for numerical simulation.

WILL YOU BE USING A VIRTUAL PLATFORM? No.

WILL YOU BE USING ANY SPECIFIC SOFTWARE? No.

CRITERIA FOR THE 1ST ASSESSMENT OPPORTUNITY

Tasks to be evaluated:

- Class attendance is mandatory. It will help teach-student relations.

- Individual Exercises: exercises that the teacher will propose along the course.

- Exam: The exam will consist on a simulated case study.

Score	
Tasks maximum	
Exam	3
Personal work	7
Total	10

CRITERIA FOR THE 2ND ASSESSMENT OPPORTUNITY

Same as for the 1st assessment opportunity.