



Co-funded by the Horizon 2020 programme of the European Union

Module 2: Fluids and fluid-structure interaction

Lecturers: Fernando Varas Mérida and Jose Luis Ferrin Gonzalez

Syllabus: The final module provides a presentation of the main models in fluid mechanics, including those regarding coupling with structures. After a presentation of a general framework and the discussion of some relevant non-dimensional numbers, the main limit models (for newtonian fluids) are derived. Some of these models will then be discussed. In particular, the module will cover the study of potential flows, laminar isothermal flows, turbulent isothermal flows, heat transfer problems and fluid-structure models. Some of these models will be solved using a CFD software.

Teaching hours/lecture: 10 h

Contents:

| # Lecture | Schedule | Lecturer | Content |
|-----------|-----------------------------|-----------------------|--|
| 1 | June 25, 12:30-14:00 (1,5h) | Fernando Varas Mérida | Lecture 1: General and limit models in Fluid Mechanics <ul style="list-style-type: none">- a general model for newtonian fluids- non-dimensional numbers- limit models and some examples |
| 2 | June 26, 9:00-10:30 (1,5h) | Fernando Varas Mérida | Lecture 2: Ideal flows <ul style="list-style-type: none">- Bernoulli equation- vorticity dynamics- potential flows |
| 3 | June 26, 10:30-12:00 (1,5h) | Fernando Varas Mérida | Lecture 3: Viscous, laminar flows <ul style="list-style-type: none">- viscosity effects and some simple flows- a note on boundary layers- stability of laminar flows (and transition to turbulence) |
| 4 | June 27, 9:00-10:30 (1,5h) | Fernando Varas Mérida | Lecture 4: Turbulent flows <ul style="list-style-type: none">- nature of turbulent flows- limits of direct numerical simulation- overview of turbulence models Some ideas on fluid-structure interaction <ul style="list-style-type: none">- coupling fluid and structural models- some applications: aeroelasticity and acoustics |





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| 5 | June 27, 10:30-11:30 (1h) | Fernando Varas Mérida | Lecture 5: Heat transfer problems <ul style="list-style-type: none">- buoyancy and Boussinesq approximation- natural and forced convection- turbulent flows with heat transfer |
| 6 | June 28, 12:30-14:00 (1,5h) | Jose Luis Ferrin Gonzalez | Lecture 6: Computation Fluid Dynamics <ul style="list-style-type: none">- introducing ANSYS Fluent- numerical solution of an incompressible laminar flow |
| 7 | June 29, 9:00-10:30 (1,5h) | Jose Luis Ferrin Gonzalez | Lecture 7: Computation Fluid Dynamics (continued) <ul style="list-style-type: none">- solving a flow with heat transfer |



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