Introduction to Fluid Mechanics

Component
École Nationale Supérieure d'Électrotechnique d'Électronique

In brief

Code ELP: N5EM03A

Presentation

Objectives

This course precedes the "continuum mechanics" course where the Navier-Stokes equations are derived and implemented in some academic situations presenting an accessible analytical solution. The purpose of this course is to provide a physical insight into some basic problems in fluid mechanics via dimensional analysis and analysis using orders of magnitude. It introduces dimensionless numbers and adimensionalization of an equation system. At the end of the course, students will be able to:

- to master the vocabulary used to classify the flows and physical phenomena observe.
- to produce a dimensional analysis of a physical problem.
- to make dimensionless an equation system for a physical problem.
- to explain the physical meaning of the different terms of the conservation equations and to use them to analyze with the hands a problem.

Description

1. Illustration of classical flows and discovery of vocabulary to describe the flows and physical phenomena observed.
2. Physical Analysis of Navier-Stokes Equations. The two viscosities. Transport mechanisms. Capillary effects.
3. Dimension and adimensionalization of the quantities and equations. Discussion on studies in similarities
4. The Pi / Vaschy Buckingham theorem and application for solving simple physical problems.
5. Law of scales and problem solving by manipulation of orders of magnitude.

Two sessions of TP.

TP1 in wind tunnel for implementation of the concepts of aerodynamic forces and coefficient of drag and lift. Study of similarity

Non-contractual information.
Last update on 18 December 2024

TP2: Reynolds experiment. Flow regime, laminar / turbulent, pressure drop. Taylor-Couette flow transitions.

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