FLE - Fluids and Energy - S5-S6

FLUIDES ET ENERGIE - CONCEPTS ET APPLICATIONS

FLUIDS AND ENERGY - CONCEPTS AND APPLICATIONS

Lecturers: Pierre DUQUESNE, Ariane EMMANUELLI

| Lecturers : 22.0 | TC : 16.0 | PW : 4.0 | Autonomy : 8.0 | Study : 0.0 | Project : 0.0 | Language : MI

Objectives

This teaching component (AF) introduces the whole FLE (Fluids & Energy) teaching unit (UE) through a hands-on exploration of flow physics and presents next the key concepts of fluid mechanics and heat transfers

Keywords : Discovery of fluid mechanics, fundamental governing equations, simplifying frameworks

Programme

- Kinematics and fundamental laws
- Newtonian viscous fluid
- Reynolds number
- Flow regimes and flow features as a function of the Reynolds number
- Turbulent flows
- Energy, thermodynamics and compressible flows
- Vorticity and introduction to aerodynamics
- Heat transfer Mixtures

Learning outcomes

- Be able to describe the fundamental laws of fluid flows and heat transfers and their various levels of approximation.
- Be able to identify the main flow features and flow regimes.
- Be able to perform a dimensional analysis and an order of magnitude analysis for a boundary problem.
- Know the basics of continuous flux systems and head balances.

Independent study

Objectifs : Illustration of key concepts.
Training on report writing and result formatting.

Méhodes : 2 TD (2 x 2h) : Exercices
1 TP (2h) : Training document + 5-page laboratory report writing

Core texts

E. Guyon, J.-P. Hulin, L. Petit., *HYDRODYNAMIQUE PHYSIQUE.* , CNRS Editions, EDP Sciences., 2012
G. K. Batchelor *AN INTRODUCTION TO FLUID DYNAMICS.* , Cambridge University Press, 1967
C. Bailly & G. Comte-Bellot*TURBULENCE.*, Springer, 2015

Assessment

Final mark = 60% Knowledge + 40% Know-how
Knowledge = 100% final exam
Know-how = 100% continuous assessment

FLUIDES ET ENERGIE - MÉTHODES EXPÉRIMENTALES ET NUMÉRIQUES

FLUIDS AND ENERGY - EXPERIMENTAL AND NUMERICAL METHODS

Lecturers: Pierre DUQUESNE, Andrea MAFFIOLI, Didier DRAGNA

| Lecturers : 0.0 | TC : 0.0 | PW : 8.0 | Autonomy : 4.0 | Study : 6.0 | Project : 0.0 | Language : FR

Objectives

This teaching activity presents experimental and numerical methods in fluid mechanics, and the approach to be adopted for their practical implementation.

Keywords : Experimental protocal, Measurement techniques, Numerical simulation, Comparison model/experiment, Uncertainties

Programme

- Practical work on flow speed measurement in a jet
- Practical work on Bernoulli or Air treatment
- 4 BE sessions on a practical introduction to numerical simulation in fluid mechanics

Learning outcomes

- Know how to make use of experimental and numerical methods in fluid mechanics and energetics.
- Know how to design an experimental protocol to characterize a phenomenon.
- Know how to present the results of simulations or experiments.
- Know how to compare a model and measurements.

Independent study

Objectifs : Getting started with a numerical simulation software in fluid mechanics.
Exploitation of results from numerical simulation.

Méhodes : Use of the commercial software FLUENT.
Simulations performed under supervision during the three first BE and autonomously in the last BE.

Core texts

Assessment

Final mark = Know-how
Know-how mark = continuous assessment

FLUIDES ET ENERGIE - ETUDES THÉMATIQUES

FLUIDS AND ENERGY - PROJECT LABS

Lecturers: Pierre DUQUESNE, Alexis GIAUQUE, Michel GERON

| Lecturers : 0.0 | TC : 0.0 | PW : 9.0 | Autonomy : 7.0 | Study : 6.0 | Project : 0.0 | Language : FR

Objectives

This module aims at applying all the knowledge and know-how acquired throughout the whole "Fluid Mechanics and Energy" course. From the choice of a topic and the set-up of the relevant practical work sessions, to the presentation of the results, going through performing and interpreting the experiments, the students will have to illustrate a scientific theme (head losses, similarity, heat transfer, hydraulic networks, ...) in order to deliver both an oral presentation to fellow students and a written report.

Keywords : Experiments and numerical simulations. Team work and project mode

Programme

- Defining the project and setting-up of the practical work sessions
- Performing the experiments
- Post-processing and analysing the results
- Oral and written reporting

Learning outcomes

- Be able to identify key flow features and flow regimes
- Be able to perform a dimensional and an order of magnitude analysis
- Be able to apply fundamental tools on flow analysis : flux balance, head loss analysis
- Be able to apply experimental and numerical techniques

Independent study

Objectifs : Performing the measurements, post-processing and analysing the results

Méhodes : 1h during each practical work session.
2h devoted to post-processing and analysis.

Core texts

Assessment

The work carried out in FLEtc3 is evaluated by a note which is based on
• Oral synthesis: Noral.
• The project report: Nreport.