THE PHYSICS AND MODELLING OF FREE SURFACE FLOWS

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| Lecturers : 0.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 0.0 | Project : 0.0 | Language : AN

Objectives

The objective of this course is to present the different types of free surface flows (bubbles, drops, steady and unsteady flows in a channel), the physical processes that determine the flow and the ways in which the flow can be modelled, both analytically and numerically. Many of the topics introduced in this course are explored further, and in more detail, in courses in the 3rd year.

Keywords : Free surface, surface tension, capillary effects, Bernoulli equation, Weber, Froude, waves, solitons, Saint Venant, SPH

Programme

Introduction to free surface flows: the situations in which they occur, general features of free surface flows, the physical processes that are involved, and the associated characteristic length and time scales
Bubbles and drops: surface tension effects and associated boundary conditions, relevant dimensionless numbers and associated flow regimes, bubble and drop dynamics, interfacial effects
Open channel flows: relevant dimensionless numbers and associated flow regimes, rapidly-varying and slowly varying steady flows, unsteady flows – surge waves, flood waves, solitons and periodic gravity waves

Learning outcomes

- For a given situation, students will be able to identify the relevant dimensionless numbers and the flow regimes associated with them
- For a given situation, students will be able to write the relevant equations that govern the flow, and the associated boundary conditions.
- Students should be able to compute the major characteristics (depth and velocity) of the free surface flow in an open channel.
- Students should be able to identify the most suitable numerical model, and define the necessary data for the boundary conditions.

Independent study

Objectifs :

Méhodes :

Core texts

Clift, R., Grace, J.R. & Weber, M.E., *BUBBLES, DROPS AND PARTICLES*, Academic Press, 1978
Dean, R.G. & Dalrymple, R.A. *WATER WAVE MECHANICS FOR ENGINEERS AND SCIENTISTS*, World Scientific Publishing, 1991

Assessment

Final exam (2h): 40%
Lab reports : 60%