BASICS OF CHEMICAL ENGINEERING 1 FIELD_10 ECTS

Introducing

Description

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Fluid mechanics

Introducing

Description

From the complete Navier Stokes model, we develop the usual restricted models of incompressible flows such as: Stokes (creeping flow), Euler (inertial flow without viscosity), Prandtl (laminar boundary layer) and Reynolds (turbulent flow). We describe and apply the following usual basics of fluid mechanics: Euler's theorem, Bernoulli's theorem, perfect fluid, irrotational flow, fluid wall interaction (dynamic and thermal boundary layer), drag coefficient. Turbulence is studied through the notion of turbulent viscosity, the universal logarithmic law profile, the k-epsilon model and the different scales of turbulence.

Objectives

To learn the basics of fluid mechanics modeling in order to understand the operation and to size the laboratory devices and the industrial installations involving flows.
1. To understand and apply global mass and momentum balances on a control domain
1. To understand the mechanical energy balance and apply Bernoulli's theorem
2. To master the concepts of dynamic and thermal boundary layers and use the associated transfer coefficients
3. To write a force balance on an inclusion by choosing the appropriate drag law
4. To write and to use the universal velocity profile in turbulent flow
5. To estimate the characteristic spatial and temporal scales of turbulence in reactors

Necessary prerequisites

I2BEMT10 : Mathématiques

I2BEBT10 : Bases de transfert

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Physical chemistry

Introducing

Description

The program includes:
Definitions and properties of interfaces (liquid-gas, liquid-liquid, solid-liquid).
Measurement and role of surface tensions.
Capillarity and related laws (Jurin, Young-Laplace).
Wettability and contact angle.
Adhesion work and Young-Dupré laws.
Surfactants: structure, classification, micelles, applications.
Intermolecular and colloidal forces (Van der Waals, electrostatic, hydrophobic).
Colloidal stabilization/destabilization (DLVO theory, polymers, flocculation).
Applications: emulsions, foams, detergents.

Objectives

The course aims to provide an understanding of the physical chemistry of surfaces and colloids: surface tension and energy, capillarity, wettability, adhesion, the role of surfactants, molecular interactions, and applications to colloids, emulsions, foams, and detergents.

Necessary prerequisites

Fundamentals of thermodynamics and physical chemistry.

Basic knowledge of molecular kinetics and intermolecular interactions.
General understanding of solution chemistry (solubility, polarity, pH).

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Practical info

Location(s)

Toulouse

Dispersed systems

Introducing

Description

- Basic concepts:
 - Motion of particles, drops and bubbles in a fluid (various separation regimes, spherical and non spherical particles, concentrated media)
 - fluid flow through a porous media (pressure drop, resistance)
 - hydrodynamics of packed towers
- Unit operations:
 - cake filtration
 - sedimentation
 - fluidisation
- Dimensional analysis

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
- basic concepts of unit operations associated with momentum transfer phenomena for dispersed systems (bubbles, drops, particles)
- basic concepts of fluid flow through a porous medium
- principle of dimensional analysis
- mass and energy balance

The student will be able to apply these concepts:
- to the design of different unit operations: sedimentation, filtration
- to the calculation of hydrodynamics of a packed tower, of a fluidised bed

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