CHEMICAL ENGINEERING FIELD_12 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

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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Heat Transfer

Introducing

Description

Common Section :
The student should be able, for plan, cylindrical, and spherical systems in steady-state conditions, with or without heat generation, to:
-Establish and solve the energy balance equations in steady-state conditions to calculate heat fluxes and characterize temperature gradients,
-Calculate heat fluxes, thicknesses of materials composing walls, pipes, spherical tanks in steady-state conditions,
-Calculate temperatures at interfaces.

Section GP3E:
The student should be able to:
-Explain the different heat fluxes
-Establish energy balances on reactive or non-reactive systems
-Integrate differential equations to determine temperature profiles and assess heat fluxes
-Know how to transmit a given amount of heat between two systems
-Know how to limit heat losses through a surface
-Study cases applicable to processes.

Section GB:
The student should be able to:
-Choose a technology and configuration of heat exchanger according to its uses
-Calculate heat exchange between fluids within a heat exchanger based on steady-state configurations
-Calculate the efficiency of a heat exchanger based on steady-state configurations
-Size the heat exchange surface of a heat exchanger according to its steady-state configuration
-Calculate the performance of heat exchangers based on flow rates and inlet and outlet temperatures of fluids
-Solve, in transitional regime, the energy balance equations on a perfectly stirred tank to calculate heating and cooling times according to the implemented technologies (coil, double-wall, external heat exchanger) with or without thermal loss

Objectives

Common Section :
At the end of this common teaching section, the student should have understood and be able to explain (main concepts):
-The general equation of energy conservation,
-The different modes of heat transfer and the associated laws into the phenomena of conduction (Fourier's law) and forced and natural convection (Newton's law),
-The expressions for heat flux by conduction and convection and temperature profiles within different systems in steady-state conditions (simple and composite walls, cylindrical and spherical layers, simple and composite).

Section GP3E:
At the end of this common teaching section, the student should have understood and be able to explain (main concepts):
-Heat transfer in solids with and without heat production in steady-state
-Heat transfer in solids with and without heat production in transitional regime
-Heat transfer by radiation

Section GB:
At the end of this teaching section, the student should have understood and be able to explain (main concepts):

-Different technologies of heat exchangers (tubular, plate, coil, double-wall) implemented industrially
-Principles and operating theories of heat exchangers
-Sizing of heat exchangers

Necessary prerequisites

-Thermodynamics
-Differential Equations and Partial Differential Equations

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INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Hydraulic engineering

ECTS

Hourly volume
39h

Introducing

Description

Macroscopic mass, momentum and energy balances
Fluid rheology
application of energy balances (Bernoulli) ducted and free flows
Linear and singular pressure losses
Turbomachinery: Pumps and turbines
Hydraulic networks
Extension to total energy balance (EC thermodynamics)

Objectives

dimension a complete plant (processes, plants, hydropower turbine) from the hydraulic point of view

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