OPTION 3

Process control & optimization	5 credits	75h
Reactor Design & Flow Assurance	5 credits	52h

Process control & optimization

ECTS
5 credits

Component
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Number of hours
75h

Presentation

Description

Programme (detailed contents):

* Process control and regulation (classical control, advanced control)
* Modelling and simulation of dynamic systems
* Single-objective optimization
* Applied optimization (multi-objective, evolutionary algorithms, advanced optimization)

Organisation:

* Big pictures + Jigsaw
* Lectures
* Tutorials
* Project

During the project, the following tasks will be pursued:

* WWTP Modelling via Matlab
* WWTP single-objective optimization via Golden number method
* Regulation of WWTP in the dynamic regime via Simulink
* A serious game on process control
* Optimization of coupled WWTP-cogeneration (renewable energy production)

All above-mentioned items are provided in English. I5PECS11 is an English training unit (EMINSA project 2016).

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

1. how to proceed for the simulation and regulation of dynamic systems via:

a) An open programming platform (Matlab)

b) A multi-domain dynamic system analyzer (Simulink)

2. how to formulate and solve an optimization problem (single-objective or multi-objective) through suited methods (derivative-based or evolutionary)

The student will be able to:

3. compare different methods for the regulation and optimization of a dynamic industrial case study (Waste Water Treatment Plant – WWTP)

Pre-requisites

Analysis and computing

Modelling and numerical solution for fluid mechanics

Heterogeneous reactor engineering

The whole chemical engineering course

Useful info

Place

Toulouse

Reactor Design & Flow Assurance

ECTS
5 credits

Component
INSTITUT NATIONAL DES SCIENCES APPLIQUEES TOULOUSE

Number of hours
52h

Presentation

Description

Program (detailed contents):

Development of conservation equations for mass, momentum, species transport and energy by phase-averaging to describe locally multiphase systems.

Establishment and modelling of 3D, 2D, 1D and 0D multiphase systems.

Flow regimes in multiphase system (bubble column, airlift, gas-liquid transport, liquid-liquid flows...)

Closure relations (isolated, diluted, dense swarm), coupling and interactions between entities (population balance and exchange term).

Deep use of existing simulation tool in function of the physical scales, limited phenomena and coupling effects (Excel, Matlab, Ansys, Comsol). Tools benchmarking.

Organisation:

* Face to face lectures
* Academic and tutorials exercises of engineering (agitated and aerated tank, ozonation tower, airlift bioreactor, crystallisation column, multiphase transport in pipe and micro-reactor, liquid-liquid settler...). Cookbooks with recipes and tutorials.
* Industrial and numerical work project with partnership and evolving in an engineer training period. Serious games on a virtual industrial reactor.
* Practical works on instrumented pilot scale (multiphase process with coupling: oxidation in an airlift, agitated tank...)
* Invited conferences of industrial partners

Objectives

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Pre-requisites

Modelling and numerical solution for fluid mechanics

Thermal transfer and reactors

Basic concepts for OPU

Technology and design of OPU

Processes simulation and analysis

Useful info

Place

Toulouse