Atomisation Two Phase flow

Course code: APF3 — ECTS Credits: 1.5

Department	: ET	**Lectures**	: 15h00
Lecturers	: FX Demoulin	**Tutorials**	:
Year of study	: 2nd year	**Laboratory sessions**	:
Semester	: 3rd semester	**Project**	:
Assessment method(s)	: 1 written test	**Home works**	:
Language of instruction	: English	**Total hours**	: 15h00
Type of courses	: Compulsory		

Objective: To give the students an overview of atomization phenomena which are involved during injection of fuel. Nowadays methods dedicated to spray and atomization will be explained from both experimental and numerical points of view. Finally a representative selection of injectors that can be encountered in real engine will be characterized to explain their typical range of application.

Prerequisites: Good knowledge of fluid mechanics

Content:

1. **Physical mechanisms**
   - Comprehension of atomization phenomena through different experimental results
   - Characteristic mechanisms and their associated dimensionless numbers: Re, We, Fr, Oh
   - Notion about linear instability to build a simple scenario of atomization from the liquid jet to the final droplet
2. **Methods**
   - Basic principle of experimental methods dedicated to spray: shadowgraphy, Mie scattering, LDV, PIV, PDPA
   - (Optional) advance technics: X-ray, Phemto laser
   - Basic principle of numerical methods for atomisation: RANS-Lagrangian based method with primary breakup model, secondary break-up model, collision modelling
   - Direct numerical method with interface capturing approach: VOF, Level Set
   - (Optional) advance numerical technics: ELSA, LES, numerical representation of discontinuity
3. **Injector applications**
   - Single hole injecto
   - Swirl injector
   - Air blast atomizer

Recommended reading:

Arthur Henry Lefebvre, *Atomization and Sprays*, Taylor & Francis Inc (1 December 1988)
G. Tryggvason, R. Scardovelli and S. Zaleski, *Direct Numerical Simulations of Gas-Liquid Multiphase Flows,* Cambridge University Press, 2011