

## Faculty of Applied Sciences



### MECA2700 Fluid turbines.

[30h+15h exercises] 4 credits

This two-yearly course is taught in 2007-2008, 2009-2010,...

This course is taught in the 1st semester

Language: French

Level: Second cycle

#### Aims

Explain the fundamental principles of design and operation of axial and radial turbomachines (blowers, compressors and pumps). The two aspects of these lectures cover the analysis, in order to understand the flow field, and the design, in order to address their manufacturing.

#### Main themes

- Definition of compressibility.
- Various approximation levels in the description of a turbomachine.
- Analysis principle of an existing turbomachine.
- Design principles of a new turbomachine (dimensioning criteria, radial equilibrium, boundary layer control)
- Axial machines, radial machines

#### Content and teaching methods

Introduction : compressibility phenomena in the turbomachines and in the associated circuits. General equations describing the flow in a single stage machine. Degree of reaction, Losses and efficiency of a turbomachine.

- Dimensional analysis : non dimensional characteristic numbers, dimensioning criteria.
- Radial equilibrium, boundary layer development
- Axial turbomachines : theory based on the aerodynamic characteristics. Cascade flow. Correlations. Analysis and design by means of analytical methods, Euler and Navier Stokes equations. Analysis of inverse methods.
- Radial turbomachines : simplified theory and design criteria
- Cavitation phenomena

#### Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

- Background  
Fundamental background in fluid dynamics and thermodynamics.
- Organization  
One laboratory session and visits at the von Karman Institute, Rhode Saint Genèse
- Evaluation  
Oral open book exam, allowing an in depth evaluation of the skills of the student
- Lecture Notes  
Available from the lecturer at the beginning of the lectures.