

Faculty of Applied Sciences



MECA2780 Fluid compressors.

[30h+15h exercises] 4 credits

This course is taught in the 2nd semester

Teacher(s): Tony Arts
Language: French
Level: Second cycle

Aims

Explain the fundamental principles of design and operation of axial and radial turbomachines (turbines)

Main themes

The main focus of these lectures is directed towards axial steam and gas turbines. The description of radial gas turbines, as well as their operation, is of less importance. A short description of hydraulic machines ends the lectures.

Content and teaching methods

- Energetical study of the operation of a turbine stage. Flow field in stationary nozzles. Expansion in a converging-diverging nozzle. Flow field in rotating blade rows. Degree of reaction. Operation of action and reaction machines.
- Characteristic coefficients of the operation of a turbine stage. Velocity triangles. Determination of the aerodynamic angles of stationary and rotating blade rows. Various operation principles of a turbine stage. Efficiency of a turbine stage. Typical action and reaction stages. Curtis turbine.
- Flow field in a cascade : various blade design methods. Evaluation of the aerodynamic performance of a blade row.
- Determination of losses by experimental correlations. Secondary flows. Total-to-total efficiency of a turbine stage.
- Radial equilibrium principles in turbines. Equations and general solutions. Description of particular solutions (free vortex, #)
- General design principles of large power steam turbines. Exit stage.
- Industrial exploitation of steam turbines. Analysis of pressure and mass flow regimes. Heat and power production by steam turbines
- General description and manufacturing particularities of axial gas turbines.
- General description of radial turbines. Geometrical particularities. Characteristic coefficients. Loss analysis and efficiency.
- General description of hydraulic turbines. Overall operation characteristics.

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

- Background

Fundamental background in fluid dynamics (including gas dynamics) and thermodynamics (including the analysis of direct thermal cycles)

- Reference books

See the french version

- Evaluation

Oral open book exam, allowing an in depth evaluation of the skills of the student

Organization

Three visits to turbomachines companies are organized

- Lecture Notes

Available from the SICI and CD given by the lecturer

Other credits in programs

ELME22/E	Deuxième année du programme conduisant au grade d'ingénieur civil électro-mécanicien (énergie)	(4 credits)	Mandatory
ELME23/E	Troisième année du programme conduisant au grade d'ingénieur civil électro-mécanicien (énergie)	(4 credits)	
MECA22	Deuxième année du programme conduisant au grade d'ingénieur civil mécanicien	(4 credits)	