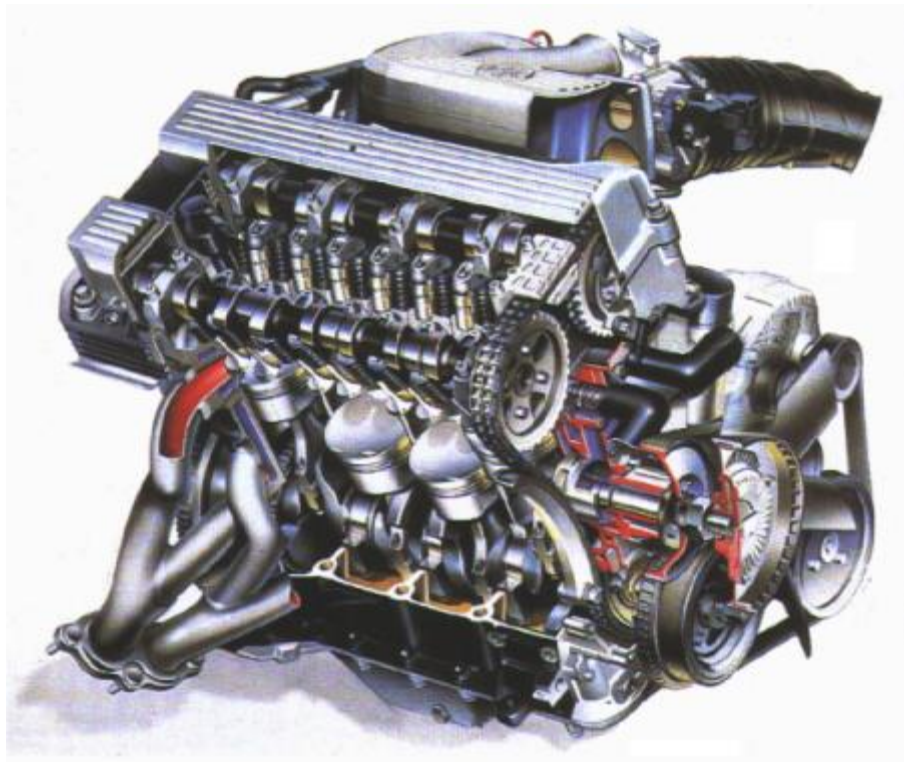




Laurea Magistrale: PSPA Internal Combustion Engines and Turbomachinery





LM: PSPA Internal combustion engines and turbomachinery *Courses and main learning objectives*

097599	B	ING-IND/08	INTERNAL COMBUSTION ENGINES A <i>Studenti da -- a -- - Docente Non Definito (erogato in EN)</i>	M	1	10.0	10.0
097600	B	ING-IND/08	TURBOMACHINERY A <i>Studenti da -- a -- - Docente Non Definito (erogato in EN)</i>	M	1	10.0	10.0
097601	B	ING-IND/09	POWER PRODUCTION FROM RENEWABLE ENERGY B <i>Studenti da -- a -- - Docente Non Definito (erogato in EN)</i>	M	1	6.0	6.0
091130	B	ING-IND/08	COMBUSTIONE E SICUREZZA B <i>Studenti da -- a -- - Docente Non Definito (erogato in IT)</i>	M	2	6.0	
091132	B	ING-IND/09	SISTEMI ENERGETICI AVANZATI B <i>Studenti da -- a -- - Docente Non Definito (erogato in IT)</i>	M	2	6.0	
097602	B	ING-IND/08	MODELING TECHNIQUES FOR FLUID MACHINES <i>Studenti da -- a -- - Docente Non Definito (erogato in EN)</i>	M	2	6.0	
083903	B	ING-IND/10	HEAT TRANSFER AND THERMAL ANALYSIS <i>Studenti da -- a -- - Docente Non Definito (erogato in EN)</i>	M	2	6.0	

+ further 12 CFU taken in a much larger group of courses – among them a new course

097657	B	ING-IND/08	DESIGN OF FLUID MACHINES FOR CLEAN POWER GENERATION B <i>Studenti da -- a -- - Docente Non Definito (erogato in EN)</i>	M	2	6.0
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In ICE, Turbomach. and other courses particular relevance is given to:

- Design techniques (→ Modeling techniques of FM)
- Fluid-dynamics and Thermodynamics of Fluid Machines
- Energetic and ecologic features
- Novel technologies (→ FM for clean power generation)

Expertise on:

**Design, optimization,
selection, management of
ICE & Turbomachinery for
Propulsive (land, marine, air)
and energetic applications**



LM: PSPA Internal combustion engines and turbomachinery *Graduation Thesis: Turbomachinery I*



EXPERIMENTAL RESEARCH: LABORATORIO DI FLUIDODINAMICA DELLE MACCHINE (LFM):

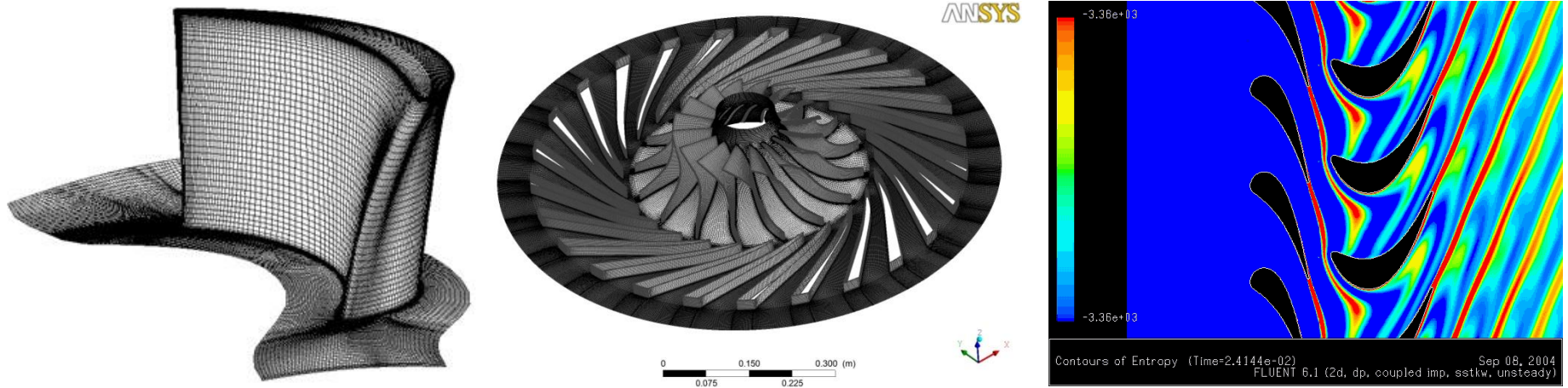
- 2 rigs for turbine and compressor testing (up to 800kW, 20000 rpm, multi-stage, D_{\max} 1 m)
- Flow measurement in turbomachinery with several techniques (pneumatic, optical, fast-response)
- Experimental determination of turbomachinery performance
- 2 transonic wind tunnels for detailed aerodynamic analyses of advanced blade profiles
- Wind tunnel for experimental analysis of supersonic flows of organic fluids

Main collaborations with companies: GE O&G (NP), Ansaldo En., Fincantieri, Turboden, Saipem

Thesis in collaboration with foreign Institutes: TU-DELFT, TU-GRAZ, VKI, J. Hopkins, DTU



LM: PSPA Internal combustion engines and turbomachinery *Graduation Thesis: Turbomachinery II*



TEORETICAL RESEARCH: CFD MODELING AND OPTIMIZATION

- Modeling of the 2D and 3D, steady and unsteady flow in turbomachinery with commercial (ANSYS-CFX, ANSYS-FLUENT) and in-house CFD solvers, including TU and real gas models
- Optimization and automatic design of turbomachinery blades by advanced techniques (evolutionary algorithms, adjoint-based gradient methods)

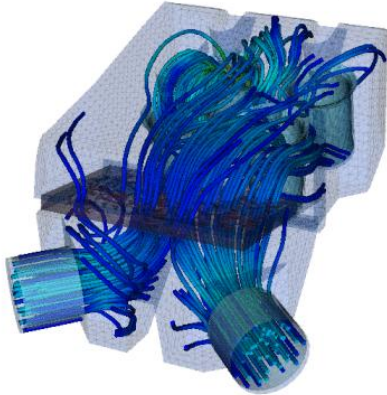
Main collaborations with companies: GE O&G (NP), EDF, IIT, FINCANTIERI

Thesis in collaboration with foreign Institutes: TU Delft, Rolls Royce (course of 'Modeling..' required)

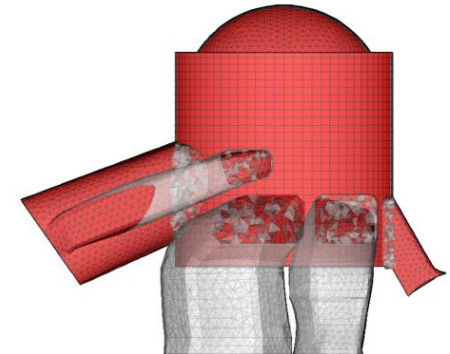
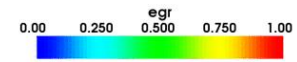


LM: PSPA Internal combustion engines and turbomachinery *Graduation Thesis: Internal Combustion Engines*

Pressure waves at intake: high-performance motorcycle ICE



Fluid change in two-stroke ICE



COMPUTATIONAL RESEARCH:

Flow and system modeling with in-house codes and OpenFOAM

Intake systems: Design of intake ducts, valve timing, fuel injection systems

Combustion processes: Combustion control with conventional and alternative (biodiesel, H_2); performance improvements (torque, power); reduction of fuel consumption

Environmental impact: Reduction/control of both noise and pollutant emissions

Main collaborations: CRF-FIAT, ENI, Husquarna

Thesis in collaboration with foreign Institutes: Chalmers, ETH-Zurigo, Imperial College, Valencia



LM: PSPA Internal combustion engines and turbomachinery *Employment opportunities*

Companies involved in the design, development, manufacturing and managing of:

- ICE for propulsion or power conversion
- Gas and steam turbines, compressors, fans, wind turbines, hydraulic turbines, pumps
- Components for energetic, pneumatic, and oil plants

Engineering companies – Electricity producers – Research centers

Data (partial) on the employment of alumni in the last 3 years:

- Enel, EDISON (managing and maintenance of power plants)
- ENI (installation, managing, and maintenance of Oil & Gas plants)
- FIAT e Magneti Marelli (also in Research centres)
- DUCATI , MV-AGUSTA (modeling and testing of MCI)
- GE O&G, Brembo
- Accenture, Bluethink (Consultants)
- Schlumberger, Foster & Wheeler (plant design and manufacturing)
- Astaldi (division of hydroelectric power plants - north and south America)
- Academic/research career both in Italy and in foreign Institutes in FM field

