

INGEGNERIA



UNIVERSITÀ
DEGLI STUDI DI ROMA
'TOR VERGATA'

DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

DEPARTMENT OF
INDUSTRIAL ENGINEERING

<http://ingegneriaindustriale.uniroma2.it>

INDUSTRIAL ENGINEERING DEPARTMENT

INTRODUCTION

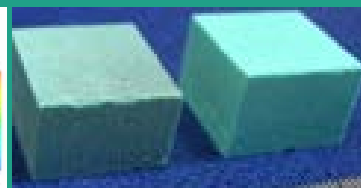
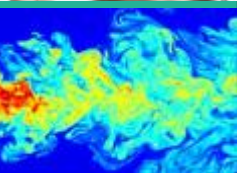
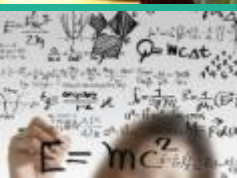
The Department of Industrial Engineering, formerly the Department of Mechanical Engineering, has been a core part of the University of Rome Tor Vergata since 1982. The mission of the Department is to promote and valorize education, culture, research and innovation on several subjects that fall within industrial fields. This makes the Department not only incubator for leading research, but also allows for close collaboration with industries.

The Industrial Engineering Department coordinates three Bachelor's programs in Mechanical Engineering, Energy Engineering and Engineering Sciences and two Master's programs in Mechanical Engineering and Energy Engineering. The Department organizes also a PhD program in Industrial Engineering and four International Master courses. With these programs the department provides education to approximately 500 students.

The research of the Department of Industrial Engineering is focused on several knowledge pillars as materials and mechanics, energy and flow, physics, systems dynamics and control, power technologies, space and security. Several research teams collaborate in a interdisciplinary manner by means of a theoretical-numerical approach and simulation, and experimental activities in many of the Department's laboratories.

Head of the Department

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INDUSTRIAL ENGINEERING DEPARTMENT

RESEARCH AREAS

Energy Systems and Fluid Machinery

Management Engineering

Materials and Manufacturing Technologies

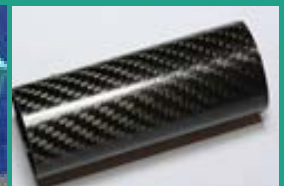
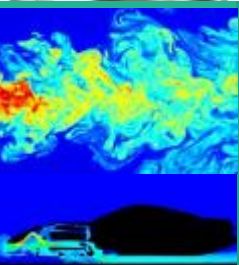
Materials Science

Metallurgy

Physics

Power Electronics

Thermofluid Dynamics

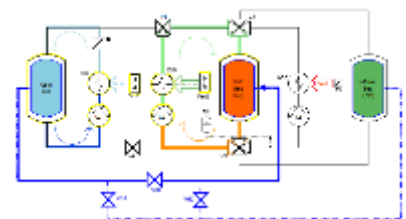
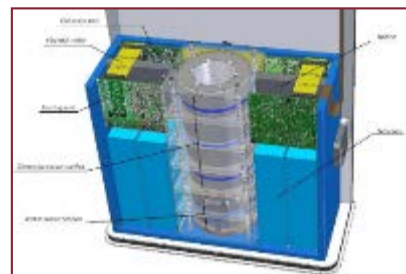
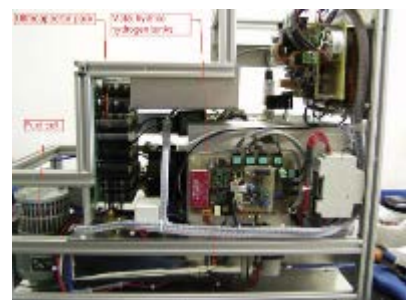
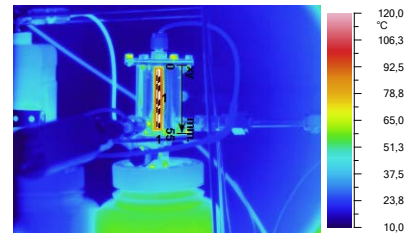


Energy Systems

Research Team

Research Topics

- Energy storage
 - Hydrogen storage
 - Electric Energy Storage Systems
 - Thermal Energy Storage
- Hydrogen-Based Energy Systems for Portable Equipment and Mobile Applications
- Energy Harvesting
- HVAC Systems for Electric Vehicles
- Waste Heat Recovery and Management
 - Advanced materials for water vapor adsorption



Contact

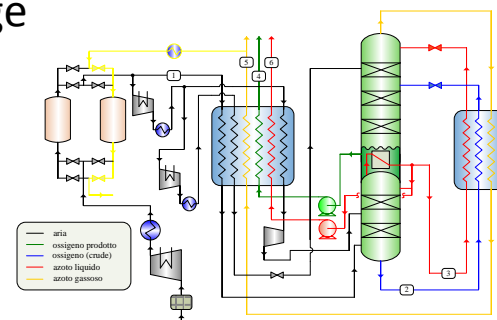
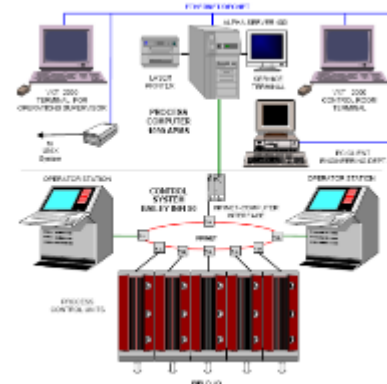
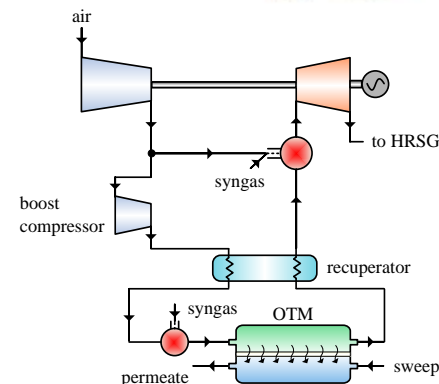
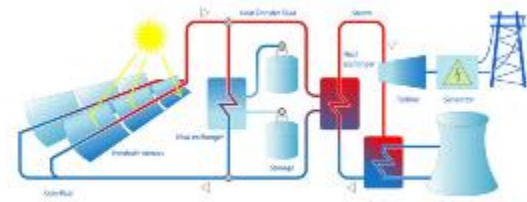
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Energy Conversion

Research Team

Research Topics

- CO₂ emissions abatement in advanced thermal power plants
 - exhaust gas treatment
 - oxy-combustion
 - fossil fuel decarbonization technologies
- Energy conversion based on renewable energy sources
 - biomass and biogas
 - concentrating solar power (CSP) technologies with thermal storage
- Cogeneration and trigeneration
- Power plant monitoring and diagnostic systems
- Metal hydride for hydrogen storage and thermodynamic cycles



Contact

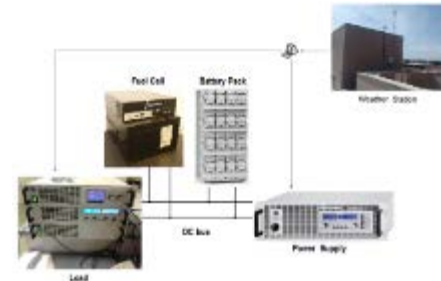
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Fluid Machinery

Research Team

Research Topics

- Hybrid Renewable Energy Systems for power generation from renewables
- Development of mission oriented optimal control strategies for fleets of hybrid or electric vehicles
- 3D combustion models for ultra-lean natural gas fueled internal combustion engines
- Spark-ignited and compression-ignited internal combustion engines with special regard to nanoparticle emission measurements
- Development of small size biomass power systems based on pyrolysis and gasification processes



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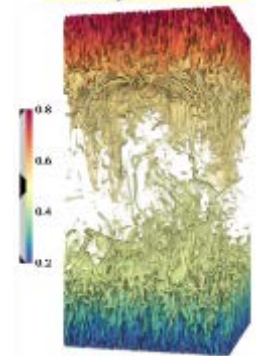
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Fluid Dynamics

Research Team

Research Topics

- High Performance Scientific Computing
 - Numerical Simulation of Turbulence
 - Turbulence Modeling
- Shear-driven Wall-bounded Turbulence
- Thermally driven Turbulence
- Complex geometry industrial flows
- Geophysical Flows
- Biofluid dynamics
 - Numerical Simulations
 - Laboratory Experiments
- Cardiovascular flows
- Multiphase flows



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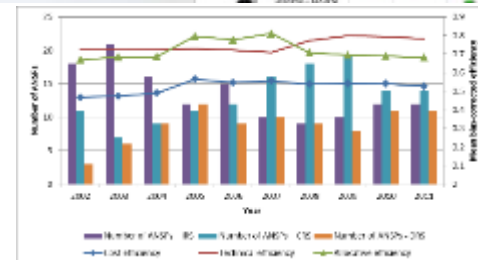
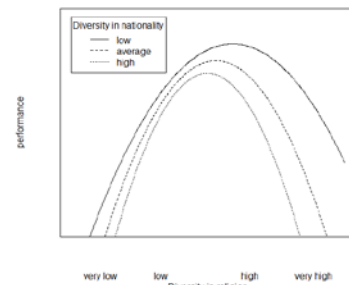
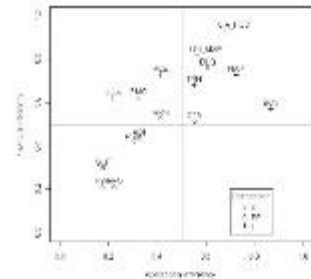
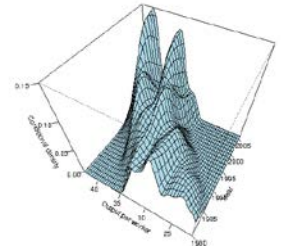
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Management Engineering Research Team

Research Topics

- Demand Forecasting and Distribution Optimization in retail
- Big Data and Data mining
- Multicultural diversity and performance of organizations
- Efficiency, productivity and economic growth
- Efficiency analysis in Hospitals
- Air transport
- Marketing and Neuro-Marketing



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Technologies and Manufacturing Systems

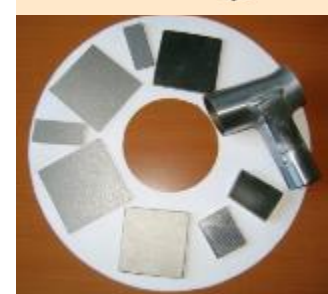
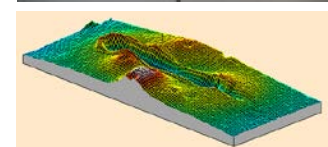
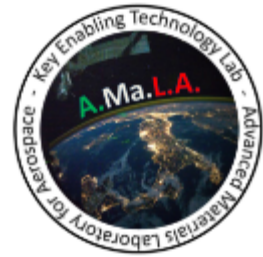
Research Team

TSL-IND

Research Topics

- Materials for space applications
- Composites and SMART materials
 - Shape memory foams and composites
 - Shielding materials
- Non-conventional processes and machining
- Polymer processing
- Manufacturing process simulation
- Metal and polymer foams
- Materials characterization
- Materials recycling technologies and circular economy
- Aesthetic technologies

LIPI



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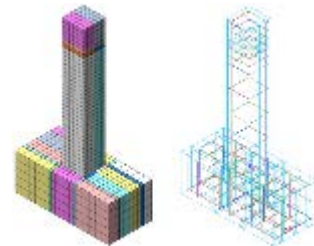
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Innovative Materials for Civil Structures

Research Team

Research Topics

- Innovative materials for tunnel segments
 - Fiber reinforced concrete
 - Glass fiber reinforced polymers
- Full-scale experimental tests on tunnel segments
- HPFRC (high performance fiber reinforced concrete) for Seismic Retrofitting
- Analytical models
- Numerical models



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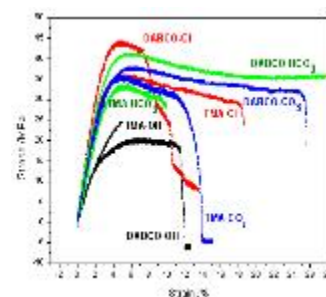
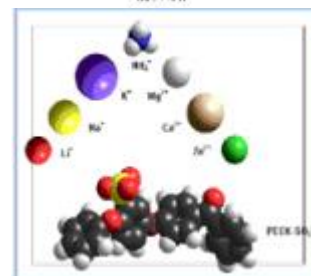
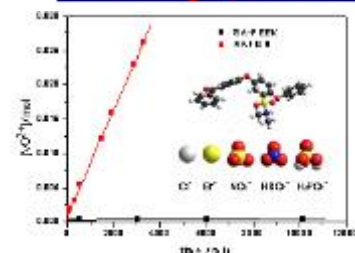
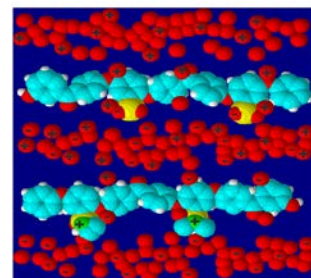
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International Associated Laboratory: IONOMER MATERIALS FOR ENERGY (LIME)

Research Topics

- Proton conducting ionomers
 - PEM fuel cells
 - Water electrolyzers
- Cation conducting ionomers
 - Rechargeable batteries in anhydrous state
 - Aqueous metal batteries
- Hydroxide conducting ionomers
 - Alkaline fuel cells
 - Water electrolyzers
- Anion conducting ionomers
 - Redox flow batteries
- Amphoteric ionomers
 - Redox flow batteries

Ionomer separators for electrochemical energy technologies are produced from the microscale (micro-batteries based on TiO_2 nanotubes) to the macroscale (redox flow batteries)



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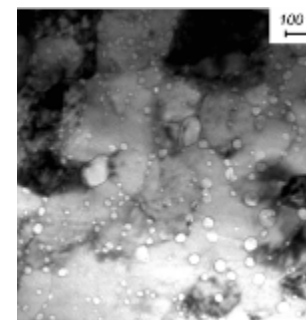
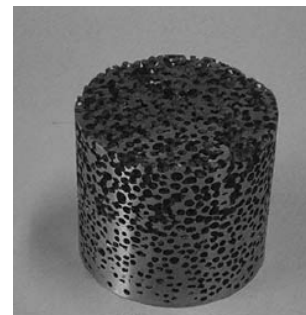
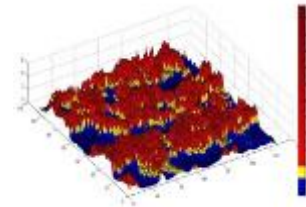


Metallurgy and Material Science

Research Team

Research Topics

- Metallic alloys for high temperature applications
 - Ni base superalloys and ODS steels
- Metal hydrides for hydrogen storage
- Materials for applications in future nuclear fusion reactors
- Solidification and foundry problems
- Metal Matrix Composites
- Precious metals (Au and Ag alloys)
- Metal foams
- Shape memory alloys
- Bulk and surface characterization of materials:
 - X-ray diffraction, electron microscopy, micro-chemical analysis EDS, XPS and AES, instrumented indentation, mechanical spectroscopy
- Laser and electron beam welding



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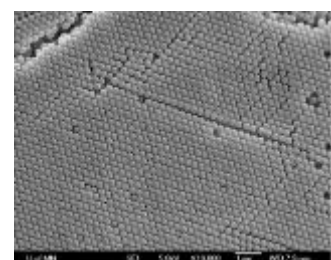
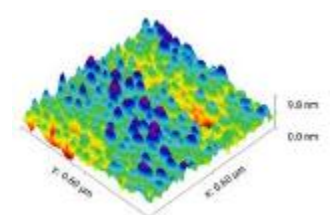
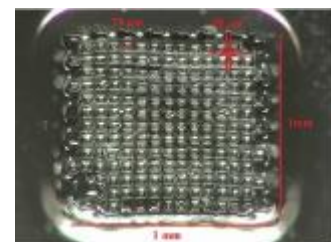
New Materials for Optoelectronics

Research Team

Nemo-IND

Research Topics

- Scaffold for Tissue Engineering
 - 3D-printing by 1-Photon Photopolymerization
 - 3D-printing by 2-Photon Photopolymerization
- Optical Sensing of VOC
- Optical Sensing of heavy metals in water
- Optimization of light harvesting in solar cells
- Silicon Photonics
- Photonic Crystals
- Ag and Au Nanoparticles
- UV-VIS-NIR Fluorescence Spectroscopy
- Spectroscopic Ellipsometry



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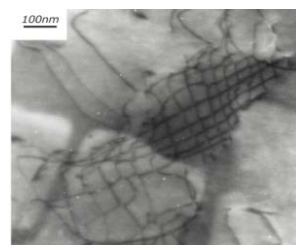
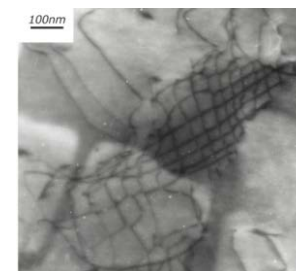
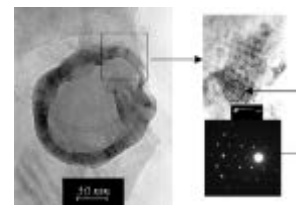
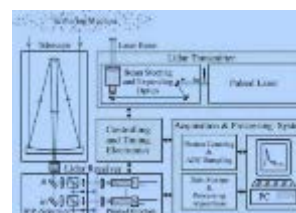
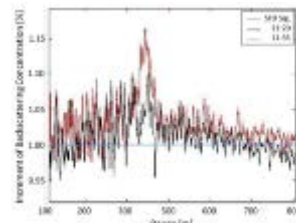
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Optical, Mechanical and Thermal Measurements

Research Team

Research Topics

- Development and application of LIDAR/DIAL systems for environmental/non environmental monitoring.
- In particular:
 - Range resolved pollutant detection
 - Surveillance of accidental gas and aerosol emission from plants
 - Early stage detection of forest fire
- Study of Lost Of Vacuum Accident (LOVA) in nuclear plants
- Study of the algal growth in Photo Bio-Reactor and Open Ponds to produce bio-fuel
- Biomaterials: mechanical characterization and measurements
- Nanomaterials



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Diagnostics on cultural heritage items

Research Topics

- Non destructive testing in cultural heritage
 - Ancient books
 - Paintings
 - Bronze statues
- Degradation in parchment and paper
- Recovery of
 - erased, faded and buried texts in books
 - drawings and pentimenti in illuminations and paintings
- Composition of ink, paint and metal alloy
- Hidden elements in bronze statues



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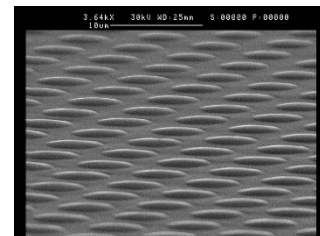
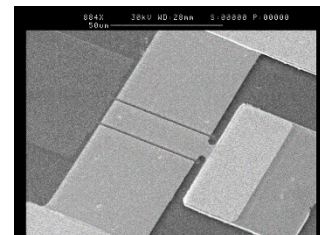
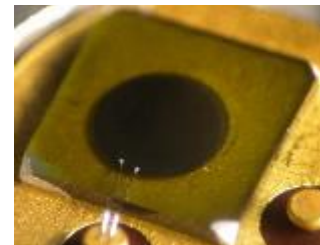
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CVD Diamond Devices

Research Team

Research Topics

- Single crystal diamond growth and characterization
- Diamond based device fabrication
 - Radiation therapy dosimeters
 - Hadron-therapy micro-dosimeters
 - In-vivo dosimetry
 - Neutron detectors
 - UV, V-UV, E-UV, Soft-X ray detectors
 - Field effect transistors for high frequency-high power application



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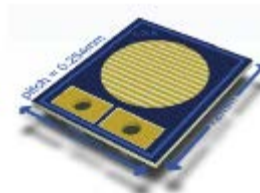
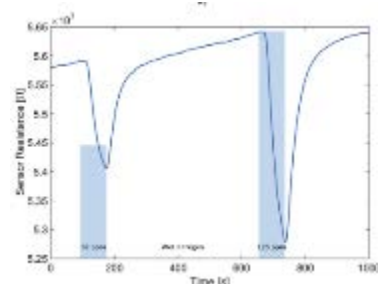
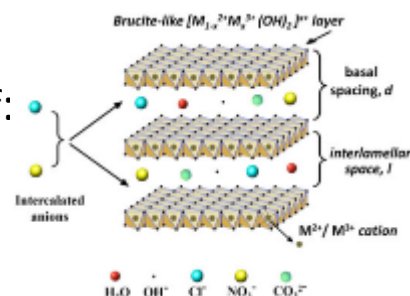
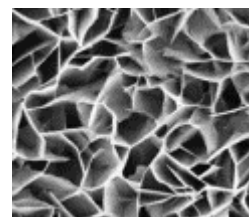
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Metal oxide – based nanostructured materials

Research Team

Research Topics

- Synthesis and characterization of Layered Double Hydroxides (LDH) nanostructured materials
- Synthesis and characterization of ZnO nanorods
- Application of nanomaterial in the field of:
 - Drug delivery
 - Gas sensors
 - Biosensors
 - Energy harvesting
 - Smart materials
 - Electrochemistry
- Structural characterization
- Tuning of nanomaterials morphology
- Electrical characterization



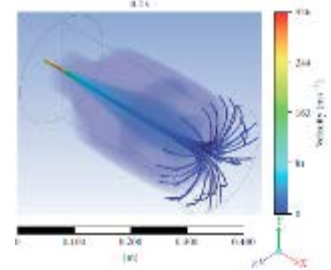
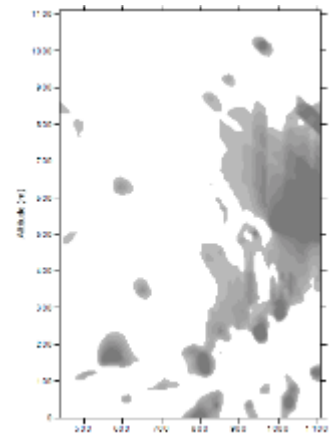
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Quantum Electronic and Plasma Physics Research Team

Research Topics

- Laser System for Environmental monitoring
 - Develop of Laser based on Lidar and Dial technologies
 - Pollutants monitoring
 - Chemical aggressive gas identification
 - Fire detection
 - Pollutants detection
- Nuclear Fusion
 - Safety and Security – STARDUST U project;
 - Big data analysis and data mining
- Numerical simulation of physics phenomena
- CBRNe Research



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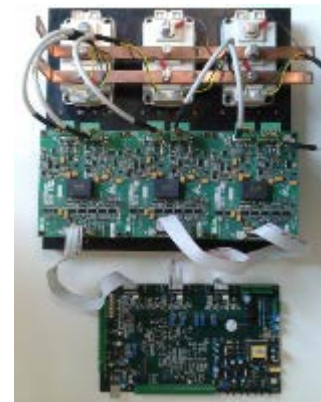
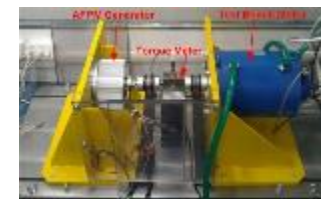
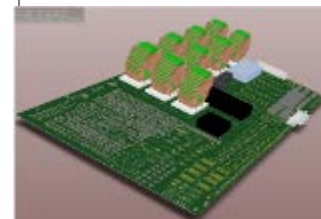
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Power Electronic Systems

Research Team

Research Topics

- Design and Control of Power Electronic Converters
- Static Uninterruptible Power Supplies
- Solid-State Transformers
- Distributed Energy Generation Systems
- Future Electricity Networks (Smart Grids and Microgrids)
- Electrical Drives



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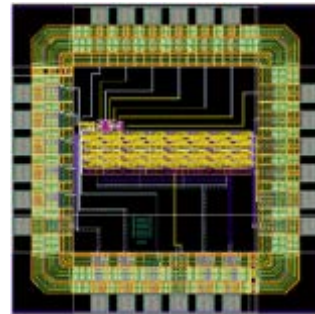
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Hardware Design for Signal Processing

Research Team

Research Topics

- Design of mixed-signal electronic systems
 - MCU or DSP
 - FPGA
- Design of analogue or mixed-signal ASIC
 - Artificial Neural Networks
 - Analogue VLSI Circuit implementation
 - Cellular Neural Networks
 - I&F Neuromorphic Neural Networks
 - Sport Engineering Technologies
 - Extraction of functional parameters for performance evaluation of high-level athletes
 - NA62 CERN Experiment – High Energy Physics
 - Design of the Trigger System for LKr Calorimeter



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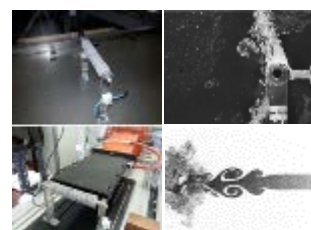
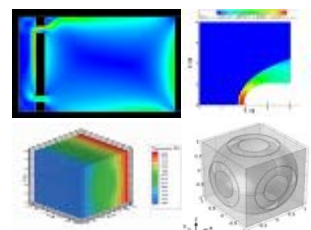
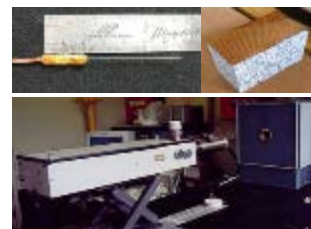
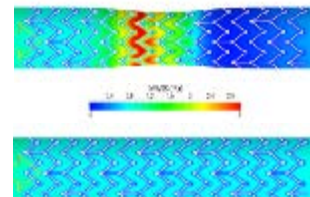
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Thermodynamics and Heat Transfer

Research Team

Research Topics

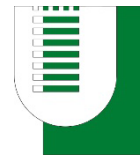
- Temperature and thermophysical properties of porous media, composite material, food, nano-fluids, flames.
- Thermo-fluid dynamics of buildings
- Thermo-fluid dynamics: passive and active techniques to enhance convective heat transfer
- Low enthalpy geothermal energy: heat transfer and thermo-fluid dynamics in soils.
- Metabolism and blood perfusion in human tissues.
- Assessment of the fluid dynamic performances of different configurations of self-expanding bar metal stents.



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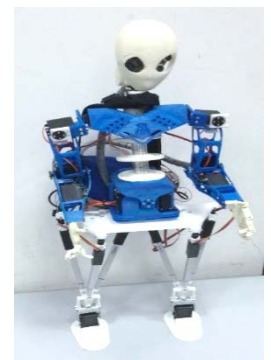
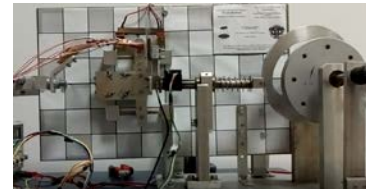
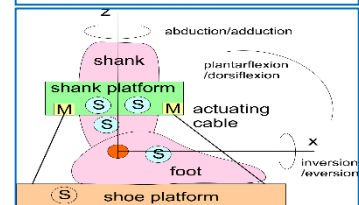
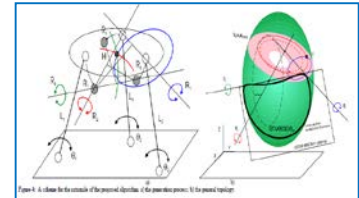
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Mechanics of Robots and Design of Service Robots

Research Topics

- Analysis of robot manipulation
- Kinematics and dynamics of robots
- Design of mechanisms for robots
- Design of service robots
- Design of medical devices
- Grasping, grippers and hands
- Experimental testing of robots
- Locomotion and legged mobile robots
- Parallel manipulators
- Exoskeleton mechanisms
- Design of humanoid robots
- History of mechanisms and machines



Contact

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- Department's Research Laboratories (area 1350 m²)
- Laboratories' auxiliary rooms (area 100 m²)

RESEARCH LABORATORIES:

- Industrial Thermofluid Dynamics
- Physics
 - Diagnostic unit and study of Cultural Heritage
- Fluid Machinery and Energy Conversion
- Metallurgy
- Electrical Systems for Energy
- Technologies and Manufacturing Systems
- Robot Mechatronics



LABORATORIES IN OTHER INSTITUTIONS:

- Engine Testing Laboratory
- Laboratory for Innovation of Production Processes (LIPI)
- Advanced Material Laboratory for Aerospace (AMALA)
- NEMO's Laboratory and Laser Etching Laboratory



SAE Competition Lab



INDUSTRIAL ENGINEERING DEPARTMENT

UNDERGRADUATE AND GRADUATE PROGRAMS

BACHELOR'S DEGREE IN MECHANICAL ENGINEERING

<http://ingegneriameccanica.uniroma2.it>

BACHELOR'S DEGREE IN ENERGY ENGINEERING

<http://www.energetica.uniroma2.it>

BACHELOR'S DEGREE IN ENGINEERING SCIENCES

engineering-sciences.uniroma2.it

MASTER'S DEGREE IN MECHANICAL ENGINEERING

<http://ingegneriameccanica.uniroma2.it>

MASTER'S DEGREE IN ENERGY ENGINEERING

<http://www.energetica.uniroma2.it>

PHD IN INDUSTRIAL ENGINEERING

<http://phdindustrialengineering.uniroma2.it>

INTERNATIONAL MASTER COURSES IN "PROTECTION AGAINST CHEMICAL, BIOLOGICAL, RADIOLOGICAL, NUCLEAR AND EXPLOSIVE (CBRNe) EVENTS" OF 1ST AND 2ND LEVEL

<http://www.mastercbrn.com>

MASTER COURSE IN "FUSION ENERGY - SCIENCE AND ENGINEERING" OF 2ND LEVEL

MASTER COURSE IN "ORGANIZATION AND DEVELOPMENT OF HUMAN CAPITAL IN THE INTERNATIONAL FIELD" (OSCUAI)

<http://www.mastercapitaleumano.it>

INTERNATIONAL MASTER COURSE IN "THERMOFLUID DYNAMICS" OF 2ND LEVEL





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