

**TOR VERGATA**  
UNIVERSITY OF ROME

PhD Programme in  
Industrial Engineering

a.a. 2024-25

<https://phdindustrialengineering.uniroma2.it/>

PhD Coordinator

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## DOCTORAL PROGRAMME

### General Presentation

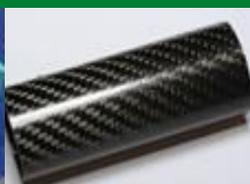
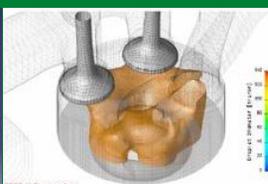
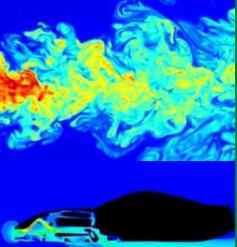
The PhD in Industrial Engineering of the Rome "Tor Vergata" University has made multidisciplinary approach and close relationships with national and international companies its distinctive character. The research topics present in the PhD program cover a wide range of applications, including but not limited to industrial design, new materials and technologies, energy and the environment, engineering applications for medicine and sports, sensors, robotics, diagnostics for cultural heritage and management. In the following pages, a brief summary of the research activities carried out in the framework of the programme is given.

### Main Objectives

The main goal of the PhD programme is to train graduate students to become "problem solvers". In order to do so, academic and specialist courses are given, as well as seminars, schools and guided research activities. The duration of this whole set of training activities is 3 years. It is intended to provide the students with quite a few skills in their specific area of interest, such as: theoretical knowledge, experimental abilities, technological expertise, methods for calculus, modelling and simulation. The outcome of the process, is to form proactive professionals able to "tune" their skills with the increasingly complex demands from the market, in search of constant and challenging technological innovations.

### Professional Opportunities

Beside the connection with Italian and international Universities and research Institutes, the PhD programme in Industrial Engineering is strongly related to and supported by public and private companies as well. They greatly appreciate the ability to deal with design, production and characterization in the field of technological applications. This is why quite often our PhD students find out career opportunities soon after their PhD final exam and the achievement of their Doctoral Degree.





## Multidisciplinary, International and Intersectoral

Meeting the needs of a changing labour market requires greater emphasis on the EU Triple-I recommendations on doctoral training: to be international, interdisciplinary and intersectoral. In order to fulfil such requirements, several research fields are covered by expertise of the members of both scientific and advisory panels of the PhD program. They belong to quite a few different scientific and disciplinary sectors, ranging from engineering to physics, involving chemistry, biology, medicine, management and law. In addition, carrying out study and research activities at external laboratories is strongly recommended in the PhD training program. Joint PhD paths with International Institutions, as well as Joint and Double PhD, Exchange and Erasmus+ programmes are supported by the "Tor Vergata" University PhD School. More specifically, well assessed cooperation and/or formal agreements are active between the PhD Programme in "Industrial Engineering" and the following Universities, Research Institutions and private companies (see below):

## Partner Universities and Research Institutions

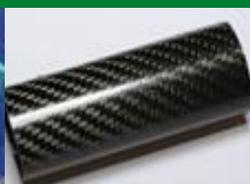
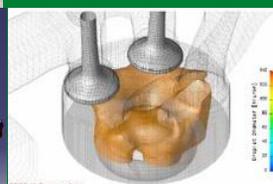
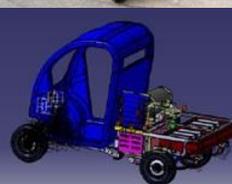
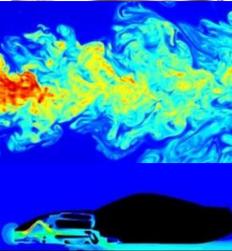
CNRS – Université de Poitiers (France)  
ENEI-BOLOGNA (Italy)  
ENEI-CASACCIA (Italy)  
ENEI-FRASCATI (Italy)  
INFN (Italy)  
Institut National des Sciences Appliquées (France)  
Universidad de Málaga (Spain)  
Max Planck Institute (Germany)  
National Institute of Materials Science (Japan)  
National Research Council (Italy)  
National Research Council (Russian Federation)  
Politehnica University Timișoara (Romania)

S. Mary's University (Canada)  
Technische Hochschule Wildau (Germany)  
Tokyo Institute of Technology (Japan)  
Universidade Fernando Pessoa (Portugal)  
Universita' Aix Marseille (France)  
Universitatea "Dunărea de Jos" din Galați (Romania)  
Université de Montpellier (France)  
University Of Applied Sciences Hes-So (Switzerland)  
University of Applied Sciences of Yverdon (Switzerland)  
University Of Twente (Netherlands)  
Wroclaw University of Science and Technology (Poland)  
Oklahoma State University (USA)

## Private Companies Supporting the Programme

CAPTIKS Srl  
IVECO SpA  
Probablin & Tefarm Srl  
Polo Rosso Srl  
Ansaldo Nucleare SpA  
SER TEC Srl  
FIS & DM Srl  
CALEF Consortium  
THPC Srl  
Vitrociset SpA  
CBRN GmbH

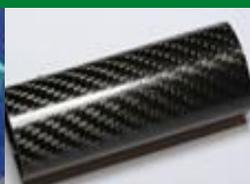
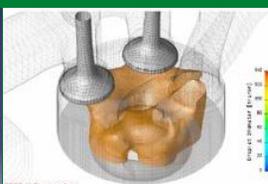
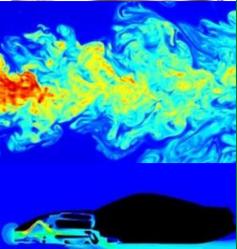
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Promedica Bioelectronics Srl  
ENPROJECT MEDICALI Srl  
DIESSE DIAGNOSTICS SENESE SpA  
TECNOGYM SpA  
Walter Tosto SpA  
OCEM Srl  
SENSORMEDICA  
DELTA Biologicals  
IMC Srl





## PHD SCIENTIFIC PANEL MEMBERS FROM ITALIAN UNIVERSITIES

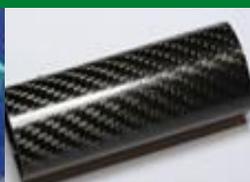
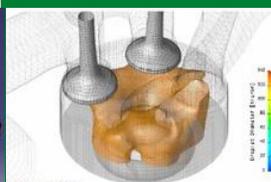
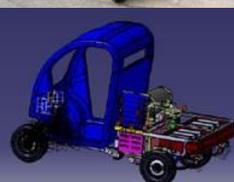
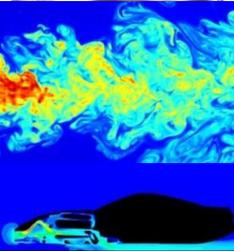
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CECCARELLI	Marco	VARONE	Alessandra
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GAMBINI	Marco		
GAUDIO	Pasqualino		
GELFUSA	Michela		
GLORIA	Antonio		
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MANNO	Michele		
MARINELLI	Marco		
MAZZONI	Stefano		
MERCURI	Fulvio		
MINIERI	Marilena		
MONTANARI	Roberto		
MULONE	Vincenzo		
NARDUCCI	Riccardo		
NASTASI	Benedetto		
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PIERI	Massimo		
PIZZOFERRATO	Roberto		
PROSPPOSITO	Paolo		





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BHAVANAM	Nagakishore	Acharya Nagarjuna University Guntur (India)
BODENSCHATZ	Eberhard	Max Plank Institute (Germany)
CARPITA	Mauro	University of Applied Sciences of Yeverdon (Switzerland)
DABAGOV	Sultan	INFN (Italy)
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GRASSO	Giacomo	ENEA-BOLOGNA (Italy)
KACIULIS	Saulius	National Research Council (Italy)
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LOVASZ	Erwin Christian	Politehnica University Timișoara (Romania)
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TARNAWSKY	Vlodek	S. Mary's University (Canada)
TESTANI	Claudio	CALEF Consortium (Italy)
VARLAMOV	Andrei	National Research Council (Russian Federation)

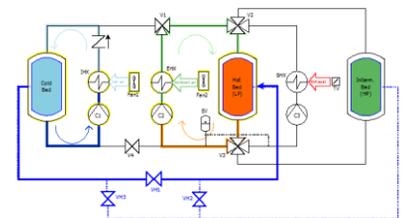
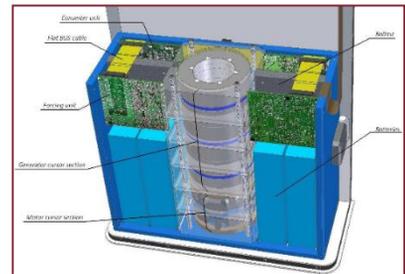
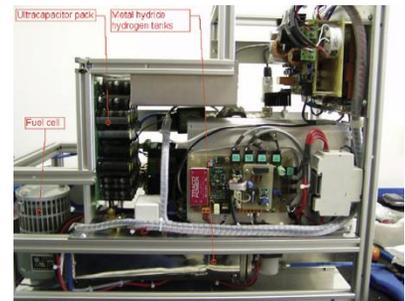
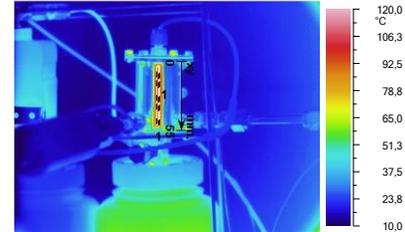




# Energy Systems

## 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



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# Sustainable and Clean Energy Research Group

## Research Topics

- Multi-Source Energy Systems for generation from renewables at high-penetration scenarios
- Hybrid/Electric vehicles and fleet optimal control strategies for the development of Sustainable Mobility
- Development of small size biomass power systems based on pyrolysis and anaerobic digestion processes
- Design of sustainable ultra-lean biomethane/biodiesel dual fueled internal combustion engines
- Implementation of resilient energy solutions for developing countries – rural and urban case studies

## Contacts

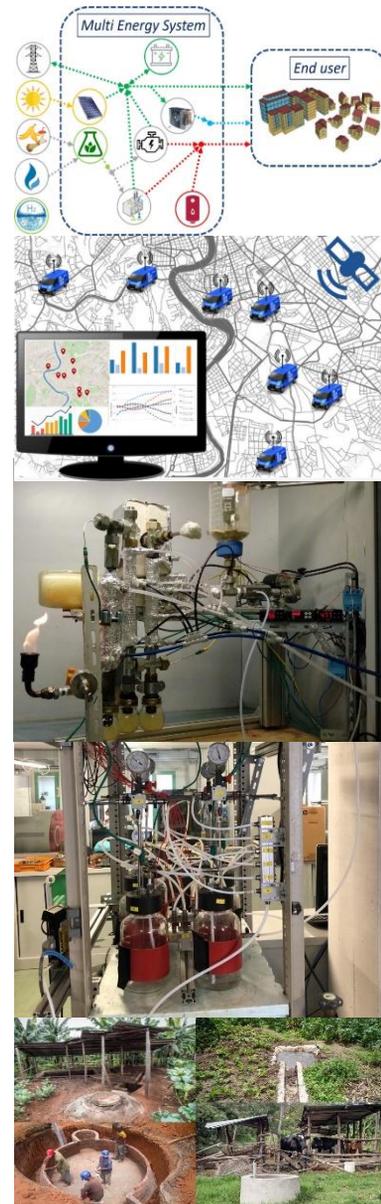


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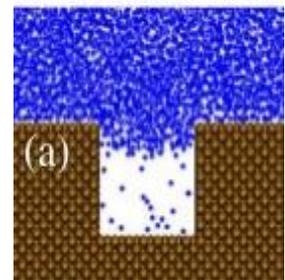
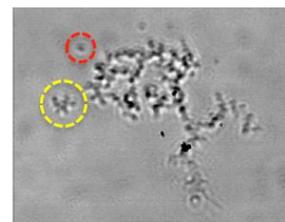
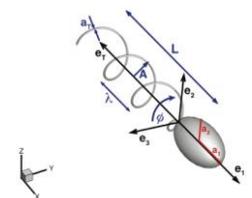
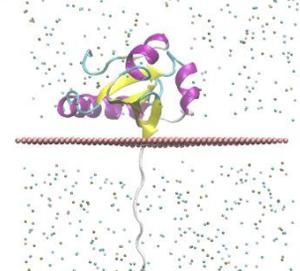
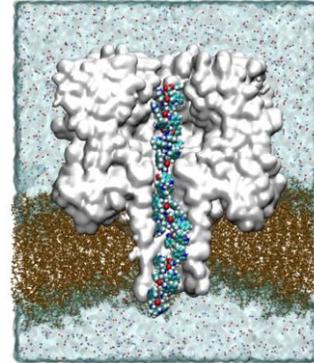




# Micro and Nanofluidics

## Research Topics

- Nanopore based single molecule sensors
- Nanofluidic devices for protein sequencing
- Electroosmosis
- Microswimmers
- Wetting on superhydrophobic surfaces
- Water slippage



### Contact

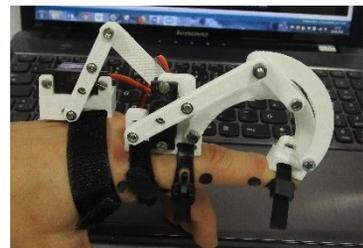
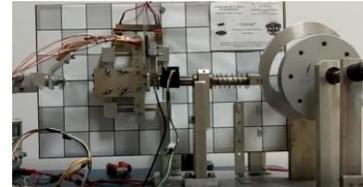
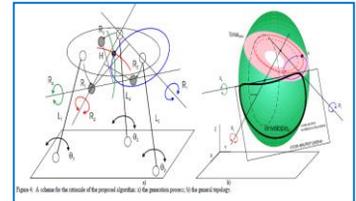
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# Robot Mechanics and Design of Service Robots

## 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



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# Technologies and Manufacturing Systems

## Research Topics

- Smart materials and structures
- Materials in space environment
- Space sustainability
- Non-conventional processes and machining
- Additive manufacturing
- Polymer processing
- Manufacturing process simulation
- Metal and polymer foams
- Material characterization
- Material recycling technologies and circular economy
- Aesthetic technologies



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# IONOMER MATERIALS FOR ENERGY (LIME)

## Research Topics

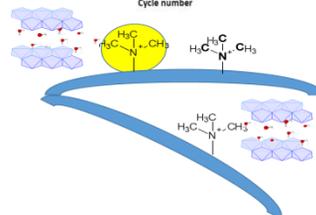
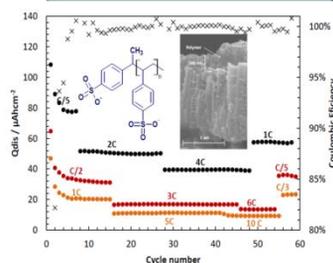
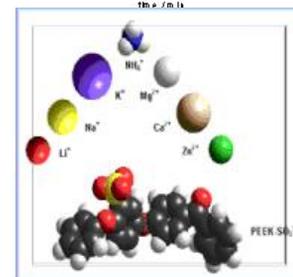
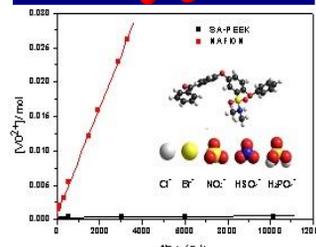
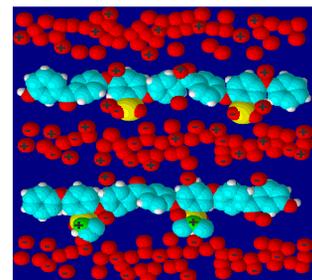
- Synthesis of ionomers
  - Post-polymerization modification
  - Direct copolymerization
  - Organic/inorganic nano-hybrids
- Ion exchange membranes for fuel cells
  - Proton exchange membranes
  - Anion exchange membranes
- Amphoteric ionomers
  - Stimuli-responsive polymers
- Thin film separators for Li microbatteries
  - Electrochemical deposition
- Solid electrolyte for redox flow batteries
- Inorganic solid electrolytes
  - Layered double hydroxides
  - Graphene quantum dots

*Synthesis, characterization, and application of solid state ionic materials from the microscale to the macroscale*



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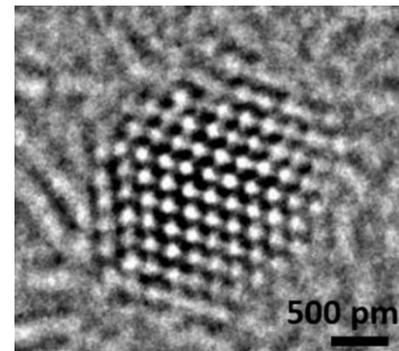
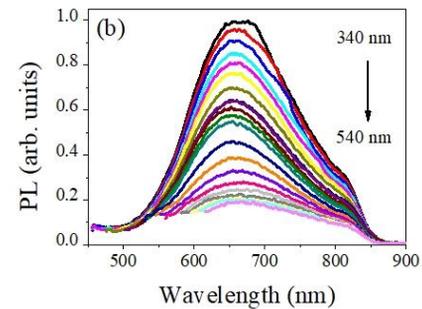
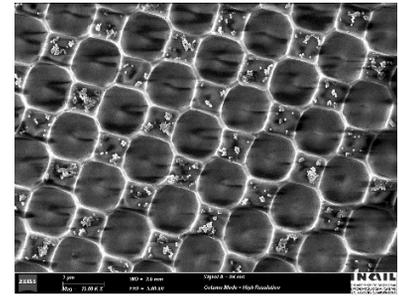


# New Materials for Optoelectronics (NeMO)

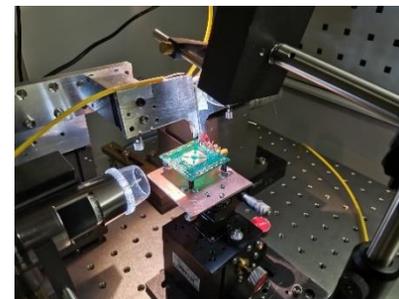
Webpage: [webnemo.uniroma2.it](http://webnemo.uniroma2.it)

## Research Topics

- Water filtration and optical sensing of heavy metal ions
- Photocatalytic degradation of organic pollutants through metal oxides
- Ag and Au Nanoparticles and Nanoclusters
- Silicon Photonics for ICT and Quantum Technologies
- Silicon Photonic Bio-Sensors



500  $\mu\text{m}$

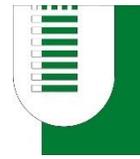


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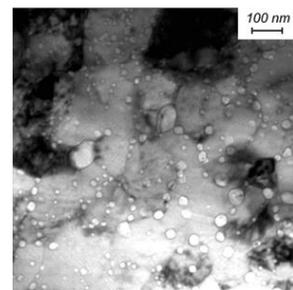
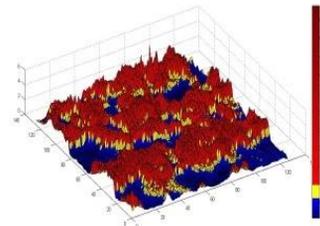
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# Metallurgy and Materials Science

## Research Topics

- Metallic alloys for high temperature applications
  - Ni base superalloys and ODS steels
- Materials for applications in future nuclear fusion reactors
- Stainless steels
- Laser and electron beam welding
- Metal Matrix Composites
- Biocompatible alloys (Mg and Co alloys)
- Metal foams
- Metal hydrides for hydrogen storage
- Additive manufacturing
- Bulk and surface materials characterization :
  - X-ray diffraction, Electron Microscopy, Micro-chemical analysis EDS, XPS and AES, Instrumented Indentation, Mechanical Spectroscopy



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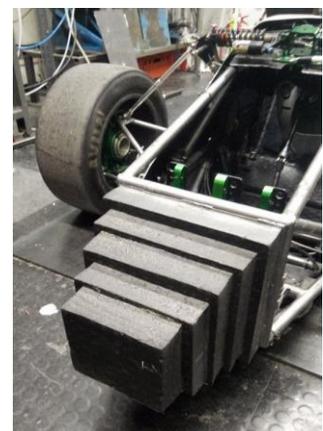
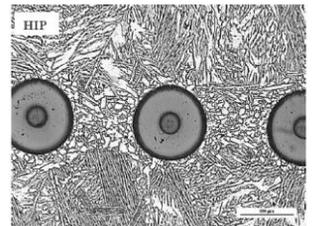
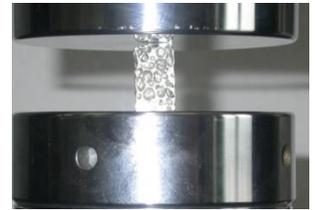
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# Metallurgy

## Research Topics

- Production and characterization of metal foams (Al, Pb, Fe)
- SMA (NiTi) for actuators and/or sensors (Solar sails)
- Innovative Materials (composites)
- Conventional and Unconventional weldings
- Honeycomb and AFS panels



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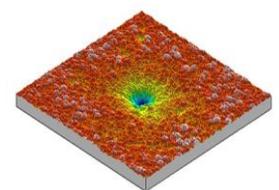
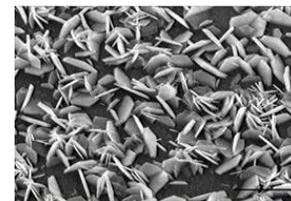
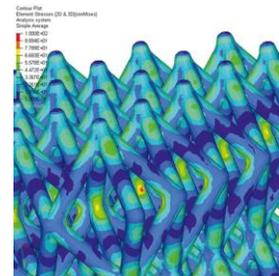
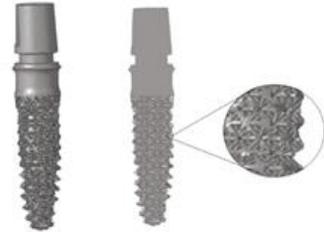




# Design and Materials

## Research Topics

- Advanced design for additive manufacturing of smart, sustainable and high-performance products
- Bioinspired/biomimetic design of additive manufactured devices for industrial and biomedical applications
- 3D solid, cellular, lattice or solid-lattice hybrid structures
- Computer - Aided Design (CAD), Modeling & Simulation, Mechanical & Thermal Measurements
- Tailoring of mass transport and mechanical properties of additive manufactured structures
- Hybrid design & nanomaterials synthesis
- Optimality criteria methods & generative design
- Layered Double Hydroxides synthesis, characterization, morphological analysis, growth mechanism investigation
- Materials of interest for fusion reactors (tungsten, ferritic steels)



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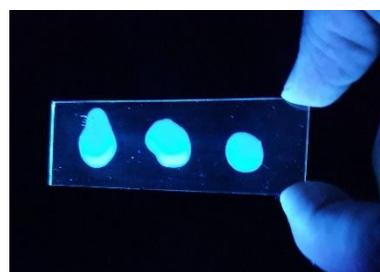
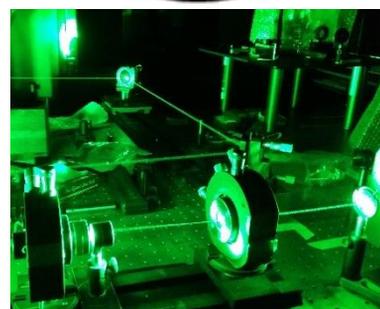
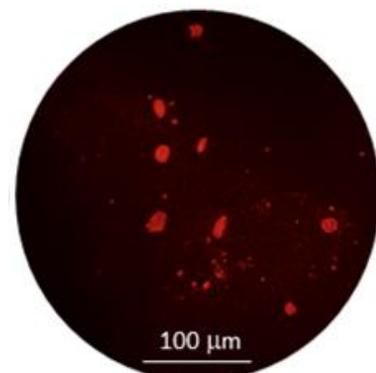
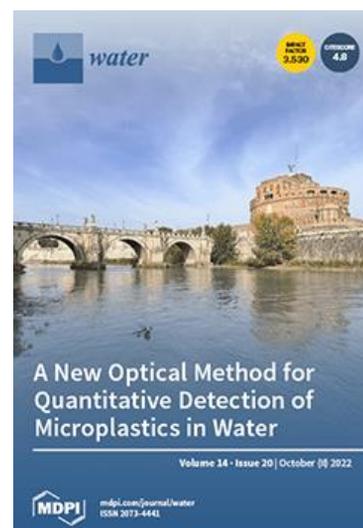
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# Optical Sensing and Nanomaterials

## Research Topics

- Detection of Microplastics in water through optical methods
- Carbon Nanomaterials for detection of Heavy Metals
- Functionalized Carbon Quantum Dots
- Water remediation through Layered Double Hydroxides
- New Lock-In techniques for revelation of optical signals



## Contacts

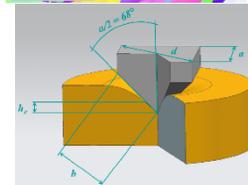
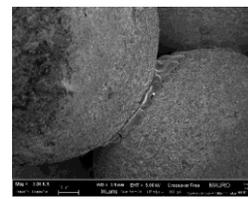
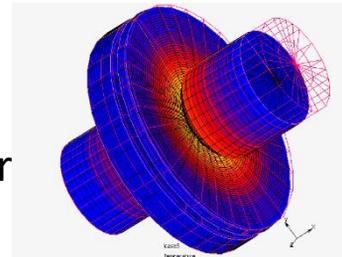
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# Modelling and Design of Materials and Processes

## Research Topics

- Materials and Process Multiphysics: experimental and modelling of manufacturing processes.
- Solid state capacitor discharge welding (SSCDW) of similar and dissimilar materials for automotive and aerospace applications
- Laser additive manufacturing of high added value products (for luxury and made in Italy industrial sectors)
- Laser metallurgical/product repair of manufacturing tools and aerospace parts
- Mechanical (nano, micro, macro) characterization of metals and alloys by means of instrumented indentation, test to enhance materials research and industrial manufacturing (experimental and modelling)



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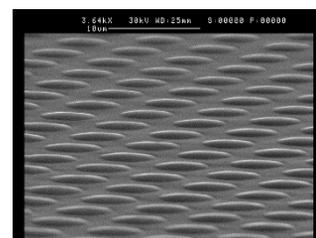
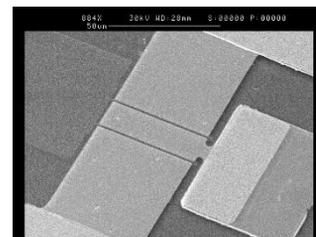
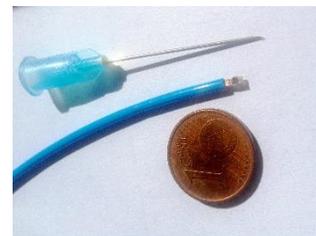
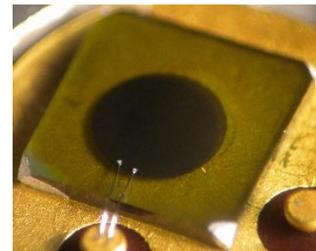


# Synthetic Diamond Devices

## Research Topics

- Single crystal diamond growth
- Transport properties of semiconductors
- Time-resolved Laser-induced Fluorescence
- Diamond based device fabrication
  - Radiation therapy dosimeters
  - Hadron-therapy micro-dosimeters
  - FLASH radiotherapy dosimetry
  - Field effect transistors for high-frequency/high-power application
  - Neutron detectors
  - UV, V-UV, E-UV, Soft-X ray detectors
  - Detectors for femtosecond laser application
  - Laser-generated plasma diagnostics
- Diagnostics for cultural heritage applications

Nearly as good as water



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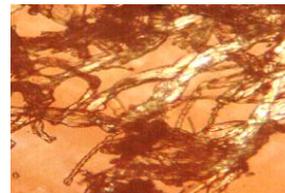


# Photothermal analysis

## Research Topics

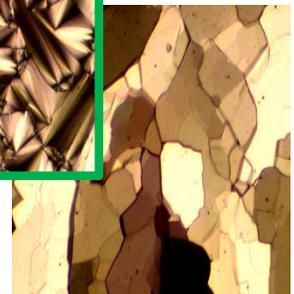
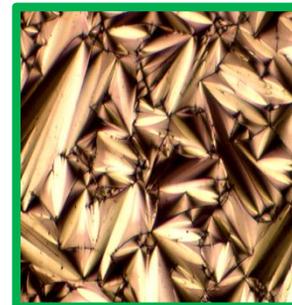
### Cultural heritage

- Bronzes, paintings, historical books: structure and composition
  - IR Thermography and Reflectography
  - Spectroscopy and colorimetric studies
  - Alloys and cast analysis
- Parchment deterioration: optothermal study
  - Hydrothermal denaturation method



### Liquid crystals

- Phase transitions, Optical and thermal properties
  - Photopyroelectric calorimetry
  - Texture analysis



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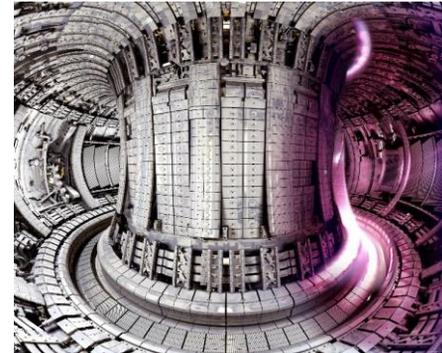




# Fusion Energy

## Research Topics

- Fusion reactor physics
  - Models of plasma transport in fusion experiments
  - Models of plasma off-normal events
  - Alpha particle collective effects
- Diagnostics for fusion reactors
  - Design of diagnostics in nuclear environment;
  - Qualification test for ITER diagnostic components
- System codes for fusion reactor design
- System studies on the integration of different energy technologies in the electric system



### Contact

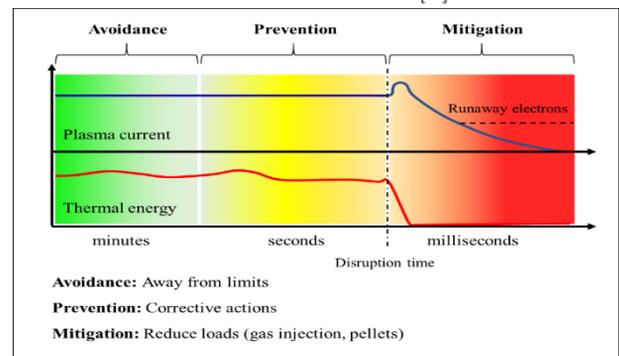
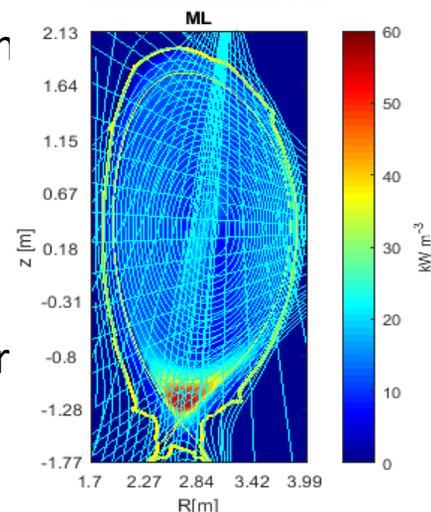
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# Diagnostics for Fusion Reactors

## Research Topics

- Measurements for identification and control of thermonuclear plasmas
- Tomography and other ill-posed inversion problems
- Anomaly detection for the prevention of accidents
- Advanced analysis methods for physics modelling, data mining and data driven theory
- Scaling of engineering parameters for the design of new power plants



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# Power Electronics and Drives

## Research Topics

- Power Supplies for Nuclear Fusion Reactors
- Multi-port Multi-level Converters
- Solid-State Transformers
- e-Mobility charging stations (G2V-V2G)
- Supercapacitor-based Power Supplies
- Electric Drives
- Interfacing Distributed Generation Systems to the (Smart) grid
- Model-based control design
- Hardware-in-the-loop real-time simulation



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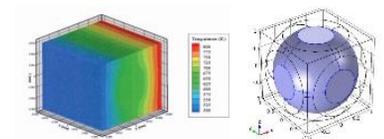
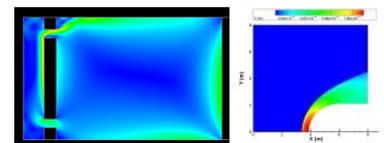
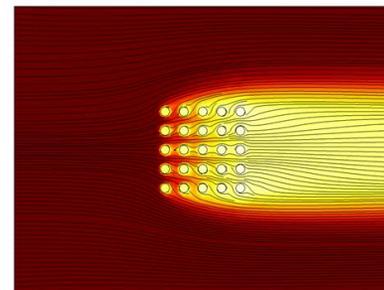
CENTER FOR POWER ELECTRONICS AND DRIVES



# Thermodynamics and Heat Transfer

## Research Topics

- Theoretical models for the evaluation of thermophysical properties of porous media, composite material...
- Experimental investigation of thermophysical properties of porous media, liquids, composite material, foods, nanofluids with thermal probe method, dual probe method, flash method...
- Heat transfer and thermo-fluid dynamics in terrestrial and extraterrestrial soils
- Thermo-fluid dynamics of buildings
- Free convection in porous materials
- Thermo-fluid dynamics: passive and active techniques to enhance convective heat transfer



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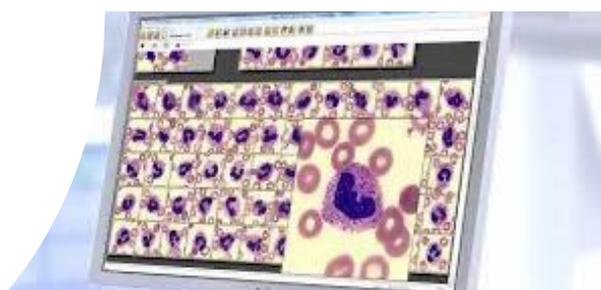
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# Emerging Technologies in Laboratory Medicine

## *Research Topics*

- Total Clinical Laboratory Automation
- Machine Learning Applications in Laboratory Medicine
- Digital Morphology
- Mass Spectrometry and NMR diagnostics
- Biosensors Diagnostics
- Emerging Technologies in Sport Sciences



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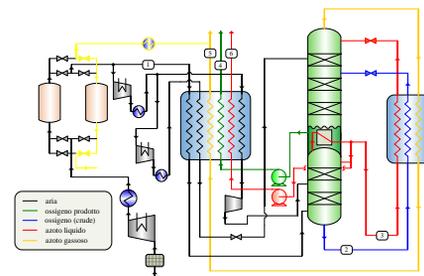


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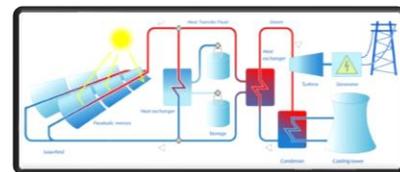
# Energy Conversion

## Research Topics



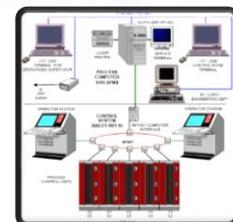
### Decarbonized Power Generation Solutions:

- Innovative **Polygeneration** Solutions & **Optimization Strategies**
- **CCS & CCU** for exhaust gas treatment & Decarbonized Processes;
- Oxy-Combustion for **Low-Emission Power Generation**;
- **CO2** Certification, Validation and **Trade**
- **Integration of Renewables Energy Resources**;
- **Biomass & Biogas** based power systems
- **Concentrated Solar Power (CSP)** equipped with advanced temperature thermal energy storage



### Power plant monitoring and diagnostic

- **Advanced modelling** techniques for real-time power plant control, monitoring and **optimal** operations based on **forecasting** approaches.



### Solutions for cleaner generation, storage and mobility

- **Innovative Storage Solutions:** Metal Hydride & Liquid Organic Hydrogen Carriers (LOHC)
- **Fuel Diversification: E-fuels** (e-methane, e-kerosene, e-methanol) produced by RES and Decarbonized Electricity



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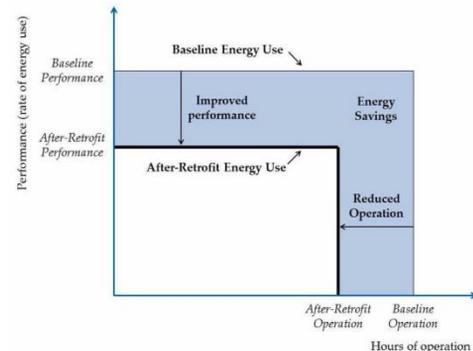
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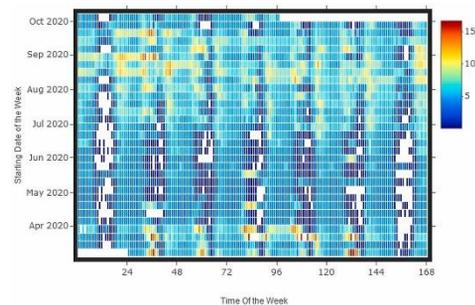
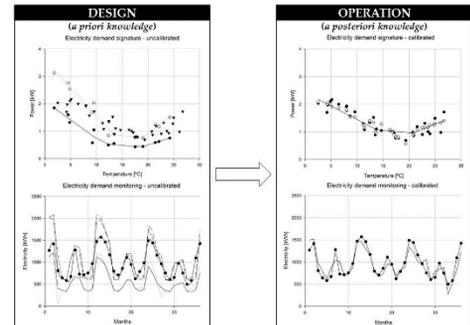
# Smart Energy Systems for the Built Environment

## Research Topics

- Smart Energy Systems Planning
  - From National to District scale
  - Renewable Energy Communities
- Open Data & Energy Analytics
  - Interpretable Data-driven Models
  - Energy Flexibility Enablers
- Sustainable Buildings
  - Rational Use of Energy
  - Energy Efficiency
- Electro-fuels in Energy Transition
  - Hydrogen and Low Carbon options
- Hybrid solutions for HVAC
  - Heat Pumps for HT, MT, LT users



Parametric Performance Analysis and Energy Model Calibration Workflow Integration



## Contact

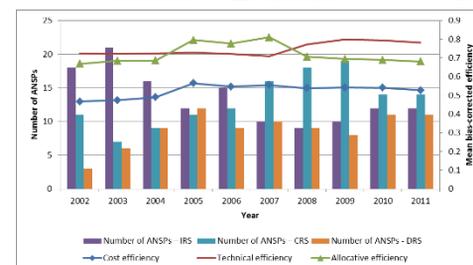
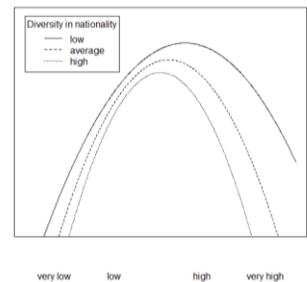
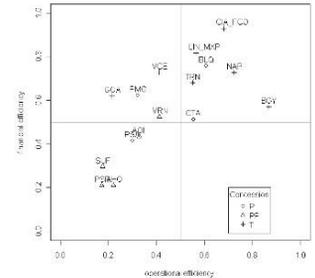
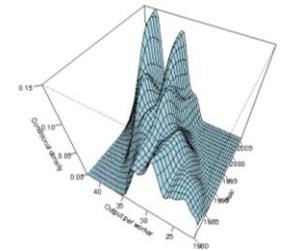
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# Management Engineering

## 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
- Energy efficiency



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# Corporation and Competition Law

## *Research Topics*

- Commercial Law
- Company and Corporation Law
- Competition and Antitrust Law
- Intellectual property Law



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# How to reach us

## BY AIRPLANE

### FROM “LEONARDO DA VINCI INTERNATIONAL AIRPORT”

No stop service “Leonardo Express Fiumicino Aeroporto – Roma Termini” (please check the section “By Train” from here to the University).

or

### FROM “CIAMPINO AIRPORT”

Take COTRAL and ATAC bus services to reach the Subway A line Anagnina station (please check the section “by Public Transport” from here to the University).

## BY TRAIN

### From Roma Termini Station:

Take the Subway A line to Anagnina station (please check the section “by public transport” from here to the University).

## BY PUBLIC TRANSPORT

### From Subway A line Anagnina station to Rectorate and Campus:

20 Express Bus



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