INTRODUCTION

The Department of Civil and Mechanical Engineering (DICeM) consists of 53 members, distributed across 23 Scientific Disciplinary Sectors (SSD). Among them, 11 are full professors, 22 are associate professors, 16 are permanent researchers, and 4 are fixed-term researchers. The DICeM has 12 laboratories. The scientific fields of reference are: mechanical engineering, management, civil and environmental engineering, moreover they deal with basical subjects like physics and chemistry.

MISSION

The mission is to promote scientific research in all its forms and ensure the dissemination of relevant knowledges and technologies, pursuing excellence in research and teaching, activating interdisciplinary synergies. Collaborations with both administrations and public and private companies are intended to promote high-level education and the territory development. The DICeM also aims at qualified employment, for its graduates and employees. Further, it ensures the coordination and development of projects of excellence at national and international level. As part of the University of Cassino and Southern Lazio, DICeM pursues the following specific objectives: continuous improvement in its research services, guaranteeing effectiveness, efficiency, and satisfaction of all interested parties; the technology transfer towards the territory, also by encouraging constitution of university start-ups and spin-offs.

DEGREE COURSES

Degree in Civil and Environmental Engineering
Degree in Industrial Engineering (Cassino and Frosinone)
Master’s Degree in Civil Engineering
Master’s Degree in Environmental and Territorial Engineering
Master’s Degree in Management Engineering (Frosinone)
Master’s Degree in Mechanical Engineering
Master’s Degree in Mechanical Engineering (in English)
THE DiCeM’S RESEARCH

Full professors
Nicola Bonora
Giorgio Buonanno
Michela Cigola
Paolo Croce
Marco Dell’Isola
Giovanni de Marinis
Domenico Falcone
Giorgio Figliolini
Gustavo Fontana
Francesco Iacoviello
Michele Pansini
Luca Sorrentino
Giuseppe Spazzafumo
Luca Stabile
Jeffery Wyss
Marcello Zordan

Associate professors
Fausto Arpino
Mauro D’Apuzzo
Fabio De Felice
Gianfranco Dell’Agli
Vittorio Di Cocco
Giorgio Picco
Enzo Galloni
Rudy Gargano
Francesco Granata
Michele Grimaldi
Gianluca Iannitti
Maura Imbimbo
Giuseppe Modoni
Alessandra Perna
Wilma Polini
Andrew Ruggiero
Michele Saroli

 Permanent researchers
Laura Cantarella
Andrea Caporale
Massimo Cavacece
Arturo Gallozzi
Gaspere Giovinco
Gillo Giuliano
Marco Greco
Angelo Leopardi
Maria Cristina Mascolo
Erika Ottaviano
Carmine Elvezio Pagliarone
Alessandro Rasulo
Alessandro Silvestri
Domenico Speranza
Carla Tricarico
Sandro Turchetta

Fixed-term researchers
Gino Cortellessa
Gianpaolo Di Bona
Marco Race
Gabriel Testa

Lab technicians
Alberto Colantuono
Raffaele D’Alessio
Sebastiana Dal Vecchio
Antonio Di Mambro
Giovanni Erme
Mario Fionda
Lino Fuoco
Chiara Lanni
Daniele Pallone
Valentino Piacenti
Nicola Purificato
Adolfo Ranaldi
Aldo Russi
RESEARCH GROUPS

The DICeM has a consolidated experience in scientific research and technological development in the fields of Mechanical Engineering, Management, Civil and Environmental Engineering.

The research activity is divided into 13 research groups:

- **Structural Analysis and Design**
  coordinated by Maura Imbimbo

- **Documentation, Analysis, Survey and Technique of Architecture and Territory**
  coordinated by Michela Cigola

- **Geotecnica, Costruzioni di strade ferrovie ed aeroporti, Geologia applicata**
  coordinated by Paolo Croce

- **Gestione e sicurezza degli impianti industriali**
  coordinated by Domenico Falcone

- **Ingegneria delle Acque**
  coordinated by Giovanni De Marinis

- **Macchine e Impianti per l’Energia**
  coordinated by Gustavo Fontana

- **Materiali**
  coordinated by Michele Pansini

- **Metallurgia e Fisica**
  coordinated by Francesco Iacoviello

- **Misure Industriali**
  coordinated by Marco Dell’Isola

- **Progettazione Industriale**
  coordinated by Nicola Bonora

- **Robotica e Meccatronica**
  coordinated by Giorgio Figliolini

- **Tecnologie e sistemi di lavorazione**
  coordinated by Wilma Polini
STRUCTURAL ANALYSIS AND DESIGN

The research group covers topics concerning the mechanics of solids, materials and structures as well as theories and techniques aimed at either the structural conception and design of new buildings and to the verification and structural rehabilitation of existing ones.

The main studied topics are: statics, dynamics, stability of equilibrium, fracture mechanics, limit analysis, the effect of the actions on buildings, including the seismic action, the response of the structural systems in function of material, morphology and type, the interaction with the soil and the environment, the assessments of vulnerability, reliability, comfort, security and durability of structures; the experimentation, monitoring and survey of constructions; the structural identification and optimization, the structural intervention techniques applicable to existing and historic buildings and monuments.

The most recent studies conducted by the research group concern: mechanics of ancient and monumental masonry structures; mechanics of innovative materials for civil and industrial constructions with a special reference to the mechanics and micromechanics of composite materials; global response and ductility of masonry, reinforced concrete and composite reinforced structures; dynamic identification and damage detection of structures and health monitoring; structural response of reinforced concrete or prestressed elements or assemblage of elements; seismic risk; seismic vulnerability of buildings and bridges; structural optimization; high-rise buildings.
DOCUMENTATION, ANALYSIS, SURVEY AND TECHNIQUE OF ARCHITECTURE AND TERRITORY

DART research group are interested in the scientific and educational activity concerning the architecture, city and territory in general and in particular of Built Cultural Heritage.

The scientific-disciplinary contents of the members of the SSD ICAR / 17 refer to scientific foundations of drawing, 3d modeling, and virtual representation, its theories and its methods, both under an innovative and an historical point of view. Focus of the research activity is survey considered as an instrument of knowledge of architectural, urban and environmental reality and Built Cultural heritage. Drawing as a graphic, infographic and multimedia language is applied to the design process from the formation of the idea to its executive definition.

The scientific-disciplinary contents of the members of the SSD ICAR / 10 refer to the analysis of building organisms, in their constructive, functional, typological and formal aspects and in their hierarchies of systems, aimed at the themes of project feasibility and at optimal compliance of the works with the essential requirements. They involve the critical evaluation of traditional and innovative building techniques and their translation in terms of design and production procedures. They concern both the problems of new buildings at various dimensional scales, and conservation, recovery and restructuring of the existing ones.
The research group carries on several studies pertaining to Geotechnics, Engineering Geology and Infrastructures for Transportation. Geotechnical research focuses on basic and applied topics investigated by means of experimental and theoretical methods. Three main fields of investigation can be distinguished: application and development of laboratory techniques aimed at studying the mechanical and hydraulic properties of natural and improved soils; numerical analysis of static and seismic behaviour of main geotechnical works such as foundations, earth-retaining structures, dams and tunnels; geotechnical risk analysis of large areas with particular reference to seismic liquefaction and land subsidence.

Geological research concerns land and territory safeguard with respect to landslides, deep gravitational slope deformations, earthquake geology, erosion processes, subsidence, aquifer management and protection, hydrogeology, remote sensing, rock characterization, stone and natural building materials, geological-technical survey, geological exploration of the subsoil, thematic mapping, geology of urban areas, monitoring, prevention and mitigation of geological and geo-environmental risks, recovery of polluted sites, conservation of the environmental heritage.

The research in the field of Highway, Railways and Airports Engineering concerns the design, construction, maintenance and management of various transport infrastructures. The main research topics concern the functional and mechanical characterization of bituminous mixes, road safety and vulnerable users, transport asset management, assessment of environmental impact at project and network level, road information systems for management, quality and safety of construction sites.
MANAGEMENT AND SAFETY OF INDUSTRIAL PLANTS

The research group studies the methodologies and general criteria governing the planning, design, implementation and management of industrial plants (or production systems). The sector includes the following main strands: analysis and design of industrial plants, feasibility studies, location choice and the economic evaluation of the initiative; analysis and design of general plant services, including technical-economic optimization methods; analysis and design of production processes and technologies; analysis, ergonomic design and safety of production systems; management of production systems, including quality and maintenance management; logistics of industrial plants, including the management and handling of materials; automation of production systems, including cost-effectiveness analysis of integrated and flexible systems and industrial instrumentation for automatic process control.

Furthermore, the group brings together skills for the integration of design, economic organizational and management aspects, in the engineering field. We can identify two great thematic strands. The first strand is aimed at integrating design-oriented economic and managerial knowledge, highlighting the economic implications of projects, the relationships between design choices and business performance, the relationships between planning and implementation of the innovations, financing methods, the connection with the context in which the enterprise operates. The second strand deepens the different professionalities characterizing the management engineering, integrating, for each of them, the economic, organizational and technological skills. The following components of engineering culture coexist: design finalization, theory-based optics systems and control, emphasis on modeling and quantitative methods, integration between theoretical models and empirical verification.
In the field of Hydraulics and Hydraulic Engineering the group deals with the mechanics and motion of fluids and the planning, design and operation of hydraulic works. The topics concern river hydraulics, eco-hydraulics and solid transport and mud flow phenomena; works for the territory protection, systems for water supply resource, hydroelectric production plants, works for the collection, disposal and return of waste water.

In the field of Hydrology, aspects related to the water analysis cycle are deepened; water balance in river basins; interventions to satisfy water needs; analysis of hydrogeological catastrophes in terms of prevention, mitigation and defense; the effects of climate change.

The area of Coastal Engineering concerns coastal protection works, port infrastructure, offshore works and marine outfalls.

In the field of Sanitary and Environmental Engineering, the environmental impact and health risks are studied; the design, management of processes and plants for the water treatment and recovery, wastewater and sludge, and atmospheric emissions; integrated waste management; protection and rehabilitation of soil, water and air components; remediation of contaminated sediments; the production and enhancement of biogas and other biofuels.

The field of Geomatics is concerned with physical, geometric and spatial geodesy, topography, aerial and terrestrial photogrammetry, cartography, remote sensing, navigation and GIS systems. The contents concern the acquisition, processing, analysis of metric or thematic data relating to the surface of the Earth, and its architectural heritage.
MANAGEMENT ENGINEERING

The group conducts research, teaching and consulting activities in the areas of technical-economic analysis and economic and organizational disciplines.

The main research topics include:

- innovation management (with particular focus on Open Innovation);
- intellectual capital and intellectual property management and development;
- the impact of Big Data on organizational performances;
- project management (in particular in the megaprojects);
- industrial marketing.

The group has been involved in many national and international collaborations, with leading research groups, with local companies and with important Italian and foreign multinationals on the following topics:

- effective management of innovative practices in collaboration with external organizations;
- re-engineering of organizational processes (e.g. mapping and analysis of AS-IS processes, proposed TO-BE scenarios);
- implementation of effective management control mechanisms and systems (e.g., analytical accounting and management accounting);
- full cost estimate (essential for the cost structure of a company and its profits producing abilities);
- planning of industrial marketing activities (e.g. marketing planning and competitive analysis);
- management and enhancement of intellectual capital (e.g. skills mapping);
- start-ups’ and entrepreneurial support.
The research group studies the thermodynamic, fluid-dynamic, energy, technological and environmental problems of fluid machines, both at the level of the single component and at the level of systems and plants. The skills cover the design, management, diagnostics, control, environmental impact and testing aspects of engines and turbomachines. The sector also studies the inclusion of single components in stationary systems for electricity and heat generation, in land, marine and air propulsion systems, in industrial processes, as well as in the tertiary and residential sectors.

The group studies the energy conversion systems in the various forms: from fossil fuels to thermoelectric power plants, hydroelectric and nuclear power plants, cogeneration in the industrial, tertiary and residential sectors, technologies for the transformation of renewable energy, the use of geothermal energy, thermal and refrigeration plants, transport and energy storage processes, different various forms of direct energy conversion.

The thermodynamic, fluid-dynamic, technological, environmental, safety, diagnostic and control issues are examined in depth. The sector also studies the environmental impact of energy systems and the technologies aimed at its containment.
MATERIALS

The research group is oriented to the study of chemical and physical-chemical foundations of the different technology sectors, regarding particularly to those referring to materials, their properties and interaction with the environment, providing a summary of the common principles of the different phenomenologies and categories of substances.

The group also studies the globality of cultural and professional aspects related to science and technology of materials. More specifically, it includes the skills associated with structure and properties, design, production and transformation processes, use, analysis, characterization and quality control, corrosion and degradation, conservation, restoration and recycling, and their assembly or combinations, with an engineering, industrial and biomedical interest. Furthermore, the complex knowledge of materials for energy conversion, accumulation and conservation and environmental protection technologies is part of the sector.

METALLURGY AND PHYSICS

The research group studies the fundamentals and the realization of the manufacturing and transformation processes of metallic materials; raw materials and its related treatments, principles, processes, metallurgical plants; recycles and recoveries; forming processes; the chemical, physical, mechanical, technological properties of metals and alloys; the relative methods of study and control; the relationship between submicroscopic and microscopic structure and properties; the defectiveness; the transformations between phases, with particular attention to transformations in the solid state, the basis of the treatments able to modify the aforementioned properties, solid / liquid transformations, due to their relevance in foundry and welding, other transformations; the mechanisms of alteration / degradation of metallic materials and their interventions; the treatments (mechanical, thermal, thermochemical, thermomechanical and others, which involve mass and surface) for metallic materials in their future use; the characteristics of use and the parameters determining the behaviour of metallic materials; qualification and choice; the market; classification, designation, costs.
INDUSTRIAL MEASURES

The research group is interested in the scientific and educational-training activity in the field of Industrial Measures of Energy and Environment. The sector studies the fundamental and applicative aspects of applied thermodynamics, thermofluid dynamics, heat transmission, energetics, environmental physics, lighting and applied acoustics, with reference to technological problems in engineering, architecture, industrial design, land planning and agriculture areas.

Scientific and technical expertises are developed related to the thermodynamics of energy transformations, end-uses energy, energy saving, cogeneration and the use of renewable sources in industrial and civil fields, thermotechnics, refrigeration techniques and technologies, thermophysical properties of materials, thermo-fluid dynamics of confined environments, environmental conditioning for human well-being and conservation of manufactured products, they also work on passive technologies and plant systems for environmental control, energy and environmental planning actions on a territorial, urban and construction scale.

The techniques of measuring and adjusting thermofluid dynamic quantities characterizing thermodynamic transformations, thermal processes and environments are analyzed and developed. An integral part of the group’s experimental and applied research activities are the application of mechanical and thermo-fluid dynamic measurements in industrial and laboratory environments, with regard to pressure and temperature measurements, in contact and at distance, flow measurements in closed liquids and gases ducts, energy and energy vector metering, legal or regulatory metrology and related instrumentation.
MECHANICAL AND MACHINE DESIGN

The research group collects the design, construction and testing of machinery, structures and mechanical systems expertise.

The involved areas include:

- **Structural integrity and fracture mechanics.** Design by rules with the most accredited codes (R6, DNV-OS-F101, BS7910, API1104, ASME sect. VIII, EN 13445, etc.). Design by analysis with commercial FEM codes (MSC.MARC, ABAQUS, etc.). Development and use of damage mechanics models for ductile rupture.

- **Advanced materials.** Characterization and design of composite materials and structures. Support manufacturers in the implementation of Damage Tolerance design procedures and product qualification. Mechanical behavior of both metallic and polymeric materials obtained by Additive Manufacturing techniques.

- **Impact dynamics.** Study, simulation and experimental assessment of high velocity impact related phenomena. Characterization and modeling of constitutive behavior of materials under extreme conditions (large strain, high strain rate, high temperature, high pressure).

- **High temperature.** Modeling of materials behavior at high temperature (creep, creep-fatigue and thermo-mechanical fatigue). Proprietary computational models (based on short duration test data incorporating damage/microstructure evolution) for the prediction of component creep life assessment.
The research group studies the cultural, scientific and professional aspects of mechanical systems, machines, their components and structures, using the methods of theoretical, applied and experimental mechanics.

The typology of the mechanical systems considered is quite general: driving and operating machines, mechanical devices, mechanisms, transmissions and drives, automatic machines and robots, vehicles, transport and lifting systems, energy production systems, biomechanical systems, micro / nano components and systems.

The group develops theoretical and experimental methods for the analysis of mechanical behaviour, synthesis and functional design of mechanical machines and systems through the study of kinematics, statics, linear and non-linear dynamics, interactions with the environment and between material surfaces, automation control and identification. The group meets the design and development needs of innovative systems and components by studying vibratory, vibro-acoustic and tribological phaenomena, the control of mechanical systems, mechatronics, fluid-structure interactions, monitoring, diagnostics and prognostics of mechanical systems, fluid automation and robotics, fluidics and microfluidics, eco-compatible systems and renewable energies as well as problems concerning pneumatic, hydraulic, electric actuation systems based on non-conventional technologies.

Interrelations are implemented with the methods of the field of drawing and industrial engineering, of the machines’ design and construction, fluid dynamics, bioengineering, motor sciences, orthopaedic and prosthetic surgery, rehabilitation and analysis of machines of historical interest.
TECHNOLOGIES AND MANUFACTURING SYSTEMS

The research group develops research, training and technology transfer activities in the field of manufacturing technologies on metal and non-metallic materials, tolerancing and mechanical measurements.

The group plans and develops research activities on metals and non-metallic materials manufacturing technologies, studies models to predict interferences during the assembly process and develops procedures to control the micro and macro geometry of mechanical parts in order to reduce time and costs to introduce new products on the market, and at the same time to increase their quality.

The studied manufacturing processes are related to process monitoring and optimization, cutting strategy analysis, sheet metal forming analysis and optimization, tube forming process analysis and optimization.

Composite and ornamental stone processes are studied too. As regards composites, the technologies of robotic filament winding, the tape placement and the light RTM are investigated. Regarding ornamental stones, the machining through diamond tools, the abrasive water jet (AWJ) and the laser technology are studied.

T tolerancing is investigated too by focusing on the development of methods to assign the geometric tolerances to the components of an assembly, to solve the chains of tolerances for assembly purposes, to inspect the geometric tolerances on the manufactured parts through a coordinate measuring machine.
LABORATORIES

DART - Laboratory of Documentation, Analysis, Survey and Technique of Architecture
LABMAT - Materials Laboratory
www.unicas.it/siti/laboratori/labmat-laboratorio-materiali.aspx
LAGESII - Industrial Plant Management and Safety Laboratory
LaMeFl - Laboratory of Metallurgy and Physics
LAMI - Laboratory of Industrial Measures - mechanical section
www.unicas.it/siti/laboratori/lami-laboratorio-di-misure-industriali.aspx
LAMIEN - Laboratory of Machines and Energy Plants
LARM - Laboratory of Robotics and Mechatronics
LIA - Water Engineering Laboratory
LAPS - Structural Analysis and Design Laboratory
LaPI - Industrial Design Laboratory
www.unicas.it/siti/laboratori/lapi-laboratorio-di-progettazione-industriale.aspx
LaTeSLa - Laboratory of Technology and Processing Systems
LaGS - Geotechnical and Roads Laboratory
PATENTS / SPIN-OFF

For the complete list of patent information, refer to the IRIS catalogue.

https://iris.unicas.it

DICeM researchers are involved in the following academic spin-offs:

TECHDYN ENGINEERING

The purpose of the academic spin-off company Techdyn Engineering is to create true added value for customers in the field of materials and component operating at the extremes. This is achieved by providing an integrated approach on critical assets of customers and linking advanced modelling to dedicated testing, numerical simulation and analysis. Techdyn Engineering competences focus on structural integrity assessment under high strain rate, elevated temperature, high pressure and aggressive environment.

A.G.S. L.T.D.

(Advanced Geotechnical Solutions)

http://www.ageosol.com

The AGS academic spin-off Company operates in the geotechnical engineering, proposing to combine scientific progress and entrepreneurial innovation to develop and place on market products of high technological content such as IT tools for the analysis of experimental data, numerical models for verification, of design solutions, analysis tools for land management, development of new techniques and survey tools.
## COMPETITIVE PROJECTS

Europeans projects funded in 2015-2019

<table>
<thead>
<tr>
<th>Financing start</th>
<th>Acronym</th>
<th>Title</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>ABWET</td>
<td>Advanced Biological Waste-to-Energy Technologies</td>
<td>H2020</td>
</tr>
<tr>
<td>2015</td>
<td>HIT</td>
<td>Metrology for Humidity at High Temperatures and Transient Conditions</td>
<td>H2020 EMPIR</td>
</tr>
<tr>
<td>2015</td>
<td>TERRE</td>
<td>Training Engineers and Researchers to Rethink geotechnical Engineering for a low carbon future</td>
<td>H2020</td>
</tr>
<tr>
<td>2016</td>
<td>LIQUEFACT</td>
<td>Assessment and mitigation of liquefaction potential across Europe: a holistic approach to protect structures / infrastructures for improved resilience to earthquake-induced liquefaction disasters</td>
<td>H2020</td>
</tr>
<tr>
<td>2017</td>
<td>AEROMET</td>
<td>Aerosol metrology for atmospheric science and air quality</td>
<td>H2020 EMPIR</td>
</tr>
<tr>
<td>2018</td>
<td>GeoRes</td>
<td>Geomaterials: from Waste to Resource</td>
<td>H2020</td>
</tr>
<tr>
<td>2018</td>
<td>RE-BUILT</td>
<td>Rehabilitation of the Built Environment in the Context of Smart City and Sustainable Development Concepts for Knowledge Transfer and Lifelong Learning</td>
<td>Erasmus Plus</td>
</tr>
</tbody>
</table>
PhD COURSES

The PhD course in Methods, Models and Technologies for Engineering aims to train professional roles with a high technical-scientific profile on topics of basic and applied research of interest to the Engineering. Through a balanced mix of different training tools (courses and seminars provided at headquarters and at other schools, research carried out with advanced means of investigation, participation in joint activities with researchers from other locations, comparison with the college members) the courses aim to train capable researchers able to set and autonomously manage technological innovation processes that are not rigidly framed in restricted scientific fields. The training course includes a cultural path common to all students, and a specific part chosen by the candidate on his specific research area.

For this purpose, the course is divided into the following curricula, each one gathers specific scientific competences of the Academic Board:
- C1: Civil and Environmental Engineering
- C2: Information Engineering
- C3: Electrical Engineering
- C4: Mechanical and Management Engineering
- C5: Environments and technologies for physical activity and health

The Departments hosting the PhD course have recognized national and international scientific competences, resources (deriving from research projects, conventions, etc.), equipment and laboratories that guarantee a credible and effective development of the Course.
LIBRARIES

The Center for Library Services of the Engineering area handles the acquisition, cataloging and use of the library and documentary heritage of the Department of Electrical and Information Engineering and of the Department of Civil and Mechanical Engineering, as well as of the Frosinone headquarters.

CONTACTS

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