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21 specialisations in years 2 and 3

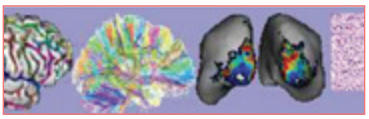
engineering training tailored to company needs

MANUFACTURING

- Aeronautics
- Embedded Control and Power Grids
- Mechanical Engineering for Materials and Manufacturing Processes
- Product Engineering
- Robotics
- Industrial Engineering

DIGITAL ECONOMY

- Computer Science
- Data Analysis and Applications in Signal and Image Processing
- Mathematics and Applications
- Modelling and Simulation in Mechanics
- Virtual Reality

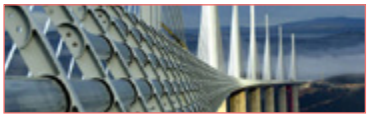


HEALTH

- Digital Sciences for Life Sciences and Healthcare

ENERGY, OCEAN

- Energy Production and Management
- Ocean: Hydrodynamics and Marine Engineering
- Propulsion and Transport



GEOMATIC, CIVIL & ENVIRONMENTAL ENGINEERING

- Civil Engineering
- Engineering Science for Housing and Urban Environment
- Digital City

PROJECT SPECIALISATIONS

- Carbon Neutrality
- Scientific Challenge 2024

RESEARCH PROGRAMME

- Doctorate (open to third year students only)

2ND AND 3RD YEAR SPECIALISATION

AERONAUTICS

With civilian air traffic set to double between 2030 and 2040, aeronautics faces numerous challenges ahead:

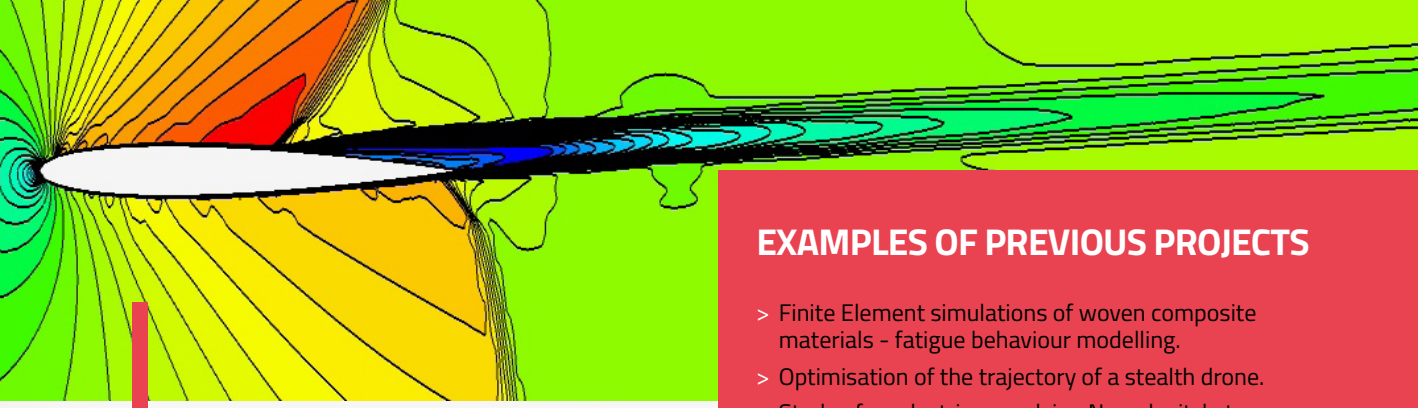
- Technological challenges posed by the need to reduce aircraft consumption: development in aircraft aerodynamics, engine improvements and new lighter, more resistant materials.

- Workforce challenges associated with the specific training requirements in new aeronautical techniques.

The aeronautics specialisation thus incorporates courses in aerodynamics, composite materials and structural calculations.

COURSE CONTENT

- Gas dynamics
- Introduction to numerical computation
- Flight dynamics
- Aircraft design and construction
- Computational aerodynamics
- Aircraft propulsion
- Turbulence modelling
- Inviscid aerodynamics
- Aeroacoustics
- Structural dynamics
- Passive safety of aerodynamic structures
- Aircraft structure modelling
- Project (80 hours)



INDUSTRY SECTORS

> Aircraft construction (Airbus, Eurocopter, BAE Systems, Stelia Aerospace, Dassault Aviation, Saab Aerospace).
> Engine/Component manufacturers (Safran/SNECMA, Turboméca, RollsRoyce, Techspace Aero, DAHER, GKN, Sagem).
> Research and development (ONERA, Cnes, DLR).
> Simulation (Thalès, Altran, Dassault Systems).
> Logistics (Airports).
> Servicing/Maintenance.

CAREER PROSPECTS

> research
> engines
> materials/structures
> production
> design
> flight testing
> simulation
> trade/finance

TEACHING STAFF

HEAD OF SPECIALISATION:

Guy Capdeville

LECTURERS:

I. Calmet, L. Gornet, P. Rozycki, H. Oudin, L. Perret, P. Cosson, B. Conan, Ph. Blot (Industrie), L. Paté (SNECMA)

CONTACT:
guy.capdeville@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Finite Element simulations of woven composite materials - fatigue behaviour modelling.
> Optimisation of the trajectory of a stealth drone.
> Study of an electric propulsion Nenadovitch-type biplane.
> Design of a tri-blade propeller made of composite materials for a passenger aircraft.
> Overall optimization of the aerodynamic performance of a wing profile.
> Aerodynamic design of a drone
> Control of the boundary layer separation in the vicinity of a wing
> Aerodynamic study of a radio-controlled FSJ glider

EXAMPLES OF PREVIOUS INTERNSHIPS

> Digital study of the impact of birds on turbo reactors (Safran)
> Characterisation and production of ceramic matrix composites (Polytechnique Montréal)
> Management and quality of the subcontracting at the Airbus plant in Hamburg (AIRBUS-Hamburg).
> A350 XWB Airtake Calculation Analysis (Airbus)
> Implementation of Java code to model a nozzle (Safran)
> Study and calculations of helicopter blade joints (Airbus)
> Evaluation and implementation of uncertainty propagation methods, for a robust aerodynamic design of turbomachines (ONERA)
> Technical study of airport logistics (Airbus)

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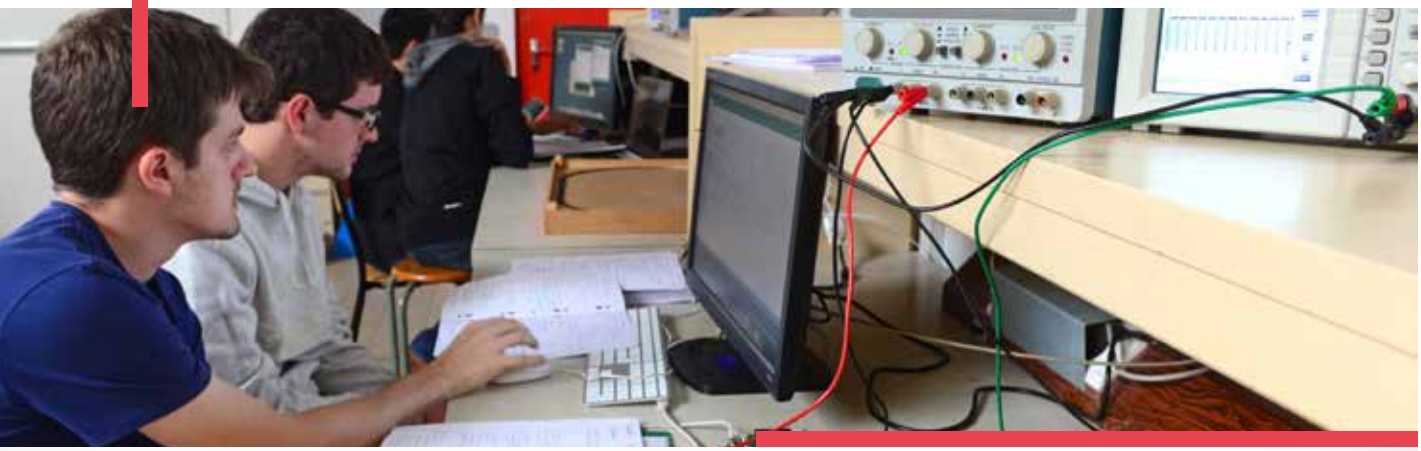

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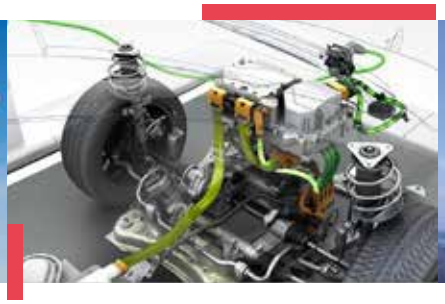
2ND AND 3RD YEAR SPECIALISATION

EMBEDDED CONTROL AND POWER GRIDS

"From system specification to embedded software"

Master a range of design and implementation tools for control laws and embedded software solutions; and acquire a global perspective of the development chain for a control system.



COURSE CONTENT

- Embedded systems software
- Modelling and verification of embedded systems
- Discrete time implementation of control laws
- Systems identification and signal filtering
- Control methodology of linear systems
- Advanced control of non-linear systems
- Interconnected systems
- Real-Time Operating Kernel
- Synchronous automation and supervision
- Simulation of dynamical systems
- Analysis and control of power systems
- Advanced control of linear systems
- Projects

INDUSTRY SECTORS

- Automobile
- Aeronautics
- Energy
- Electricity Transport
- Offshore sector
- Space Industry
- Biomechanics
- Health

CAREER PROSPECTS

- R&D engineer (studies, development, design, methodology...)
- Platform architect and embedded applications
- Embedded software developer
- Operations and maintenance engineer (power grids, power generation etc)
- Testing / validation / integration
- Project manager
- Management

TEACHING STAFF

HEAD OF SPECIALISATION:

Mohamed Hamida

LECTURERS:

Pierre Molinaro, Olivier-Henri Roux, Franck Plestan, Jean-Luc Béchennec, Guy Lebret, Bogdan Marinescu, Saïd Moussaoui, Sébastien Bourguignon, Malek Ghanes

EXTERNAL SPEAKERS:

Siemens Amesim, Airbus, National Instrument, Opal-RT

CONTACT:

mohamed.hamida@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

- Analysis of the dynamics of an electrical generator coupled to a power grid (RTE Chair).
- Steering of the sails of a hybrid diesel/sail boat (linked to the contract between STX and the IRCCyN laboratory).
- Control of a pico brewery with an Arduino microcontroller and a smartphone.
- Construction of a mini Segway vehicle controlled by an Arduino microcontroller.
- Production of a ROV (Remote Operated Vehicle).
- Production of a connected greenhouse
- Control methodology for Saildrone
- Study of a WIFI module
- Managing electric vehicle charging (in collaboration with Renault).
- Aerial video tracking system (in collaboration with Thales).

EXAMPLES OF PREVIOUS INTERNSHIPS

- Study on embedded Ethernet switches on telecommunications microprocessors for avionics software (Airbus)
- Hybrid powertrain simulation (PSA)
- Development of a 2D/3D HMI plugin for Matlab/ Simulink (MBDA)
- Determination of the flight altitude of an aircraft (MBDA)
- Study on electric vehicle charging (Renault Technocentre)
- Avionics Architecture Optimisation (ATR).
- Robust control law for the transmission of mobile articulated machines (Secom Engineering)
- Extension of Cyber Security surveillance probes to embedded systems (Thales Air Systems)
- Integration of renewable energies on the network with the Linky meter (EDF R&D)

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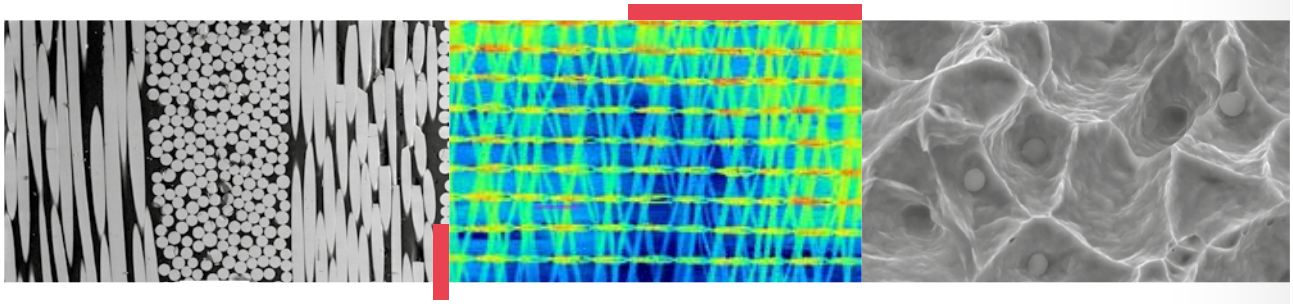
2ND AND 3RD YEAR SPECIALISATION

MECHANICAL ENGINEERING FOR MATERIALS AND MANUFACTURING PROCESSES

Training engineers in the mechanics of materials with expertise in manufacturing processes. Students will get to grips with complex design or manufacturing problems in their entirety. Innovation is the key issue at stake: the need to develop and produce new products combining materials and processes that can be industrialised profitably on a large-scale whilst respecting the environment.



COURSE CONTENT

MATERIALS AND MECHANICS:

- Materials selection in mechanical design
- Finite Element Method
- Structural mechanics

PHYSICS AND MECHANICS OF STRUCTURAL MATERIALS:

- Experimental methods in materials science
- Non-linear continuum mechanics
- Physical and mechanical metallurgy
- Polymers and composites
- Fatigue and fracture of materials

PROCESSES:

- Metal forming and processing
- Polymer processing
- Composite processing

- Conferences and company visits
- Project

INDUSTRY SECTORS

- Aeronautics
- Automotive
- Naval
- Nuclear, oil and gas industries
- Production of raw materials (iron and steel, glass, etc)

CAREER PROSPECTS

- Engineering consultant, methods engineer, R&D, test and process engineers
- Career progression towards expert or management roles.

TEACHING STAFF

HEAD OF SPECIALISATION:

Erwan Verron

LECTURERS:

Emmanuelle Abisset-Chavanne, Anaïs Barasinski, Christophe Binetruy, Christian Burtin, Sébastien Comas-Cardona, Nicolas Chevaugeon, Michel Coret, Bertrand Huneau, Jean-Michel Lebrun, Grégory Legrain, Adrien Leygue, Hervé Oudin, Guillaume Racineux, Erwan Verron

EXTERNAL SPEAKERS:

Michelin, Safran, Saint Gobain, Faurecia, etc.

CONTACT :
erwan.verron@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

- Additive Manufacturing and Composites: Specifications and Limitations
- Evolution of the microstructure of a composite during the infusion process: characterization by X-ray microtomography
- Exploratory study on the concept of "Data Driven Computational Mechanics"
- Influence of thermo-oxidative ageing on the mechanical properties of a rubber
- Should I stay or should I go? When a crack stops then spreads
- Magnetic pulse spot welding of metal alloys
- Instrumentation for the manufacture of composite parts

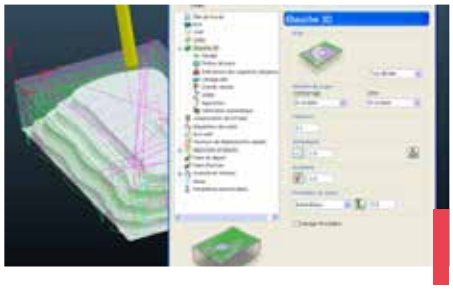
EXAMPLES OF PREVIOUS INTERNSHIPS

- Multi-physics materials optimization, Airbus Group Innovations (Toulouse, France)
- Compensation of microstructure effect during ultrasonic residual stress measurement, Veqter (Bristol, UK)
- Simulation of composite forming, DCNS (Lorient, France)
- Non-linear mechanical behaviour characterization of the ITER Vacuum vessel materials under multi-physics loading conditions, ITER (Cadarache, France)
- Implementation, qualification and validation of a fire test machine for composite materials Hexcel composites (Lyon, France)
- Reuse of waste plastic fibres from discarded fishing nets as shrinkage cracking prevention of cement-based specimen, DTU (Copenhagen, Denmark)
- Study of the weldability of a new superalloy
- Aubert & Duval (Clermont-Ferrand, France) / TWI (Cambridge UK)
- Dynamic Recrystallization and its Relationship to Hot-Ductility of Continuously Cast Micro-Alloyed Steel, TU Wien (Vienna, Austria)

2ND AND 3RD YEAR SPECIALISATION

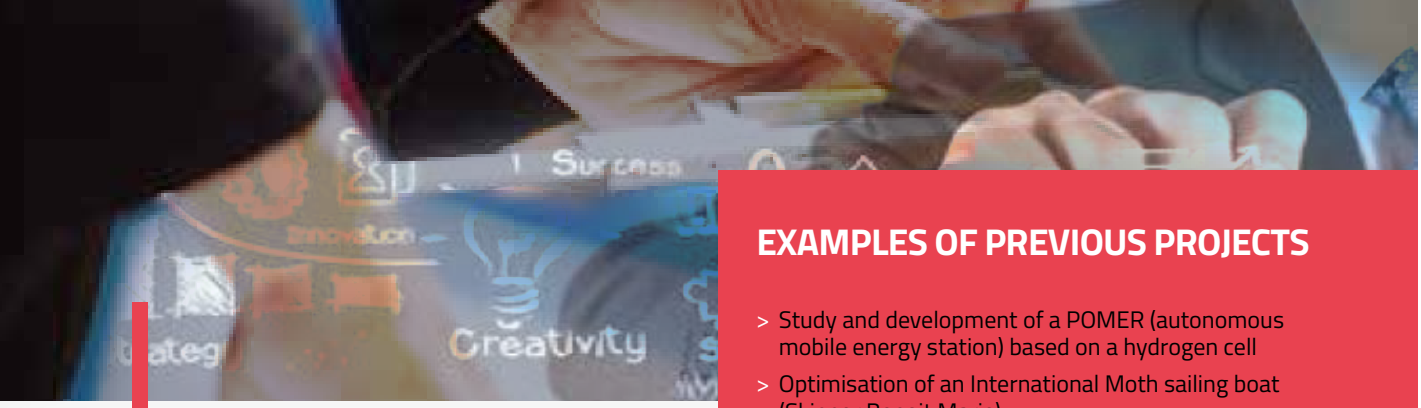
PRODUCT ENGINEERING

Providing students with a complete picture of the design/industrialisation process of a manufactured product. They will acquire technological and scientific skills to understand the product development and industrialisation processes at all stages of the product lifecycle.



COURSE CONTENT

- People, product and organizations
- Design of experiments
- Product modelling and development
- Product use
- Product design
- Materials and processes
- Marketing
- Production compliance and stability
- Advanced design
- Industrial design
- Costing, purchasing, and pricing
- Rapid manufacturing
- Project



INDUSTRY SECTORS

- Automotive
- Aeronautics
- Transport
- Construction
- Machines and equipment
- Consultancy
- Food processing
- Retail industry
- Textile and clothing

CAREER PROSPECTS

- Research and development engineer
- Product manager
- Quality engineer
- Industrial project manager
- Project manager for a design project, new product or service

TEACHING STAFF

HEAD OF SPECIALISATION:

Matthieu Rauch

LECTURERS:

Raphaël Chenouard, Jérôme Friant, Jean-Yves Hascoët, Olivier Legoff, Catherine Michel, Christian Le Gonidec, Jean-François Petiot, Emilie Poirson, Matthieu Rauch, Hervé Thomas

EXTERNAL SPEAKERS:

ENSAM, Audencia Business School,
École de Design de Nantes Atlantique
CHU, Faurecia, Stelia Aérospace, L'Oréal

CONTACT:
matthieu.rauch@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

- Study and development of a POMER (autonomous mobile energy station) based on a hydrogen cell
- Optimisation of an International Moth sailing boat (Skipper Benoit Marie)
- Development of a recycling system (Veolia)

EXAMPLES OF PREVIOUS INTERNSHIPS

- Companies: Desoutter, PSA, Faurecia, Stelia Aerospace, Labinal, Manitou, Porsche, L'Oréal, Coca-Cola, Michelin, Groupe Atlantic etc.
- Positions: quality engineer, assistant product manager, research and development engineer (mechanism design), industrial production, line improvement etc

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2ND AND 3RD YEAR SPECIALISATION

ROBOTICS

The robotics specialisation trains multidisciplinary engineers (modelling, design, programming) capable of understanding robotic systems (manipulator, parallel, walking, flying, submarine, etc.) and how they work. The course is focused on innovation and high technology.

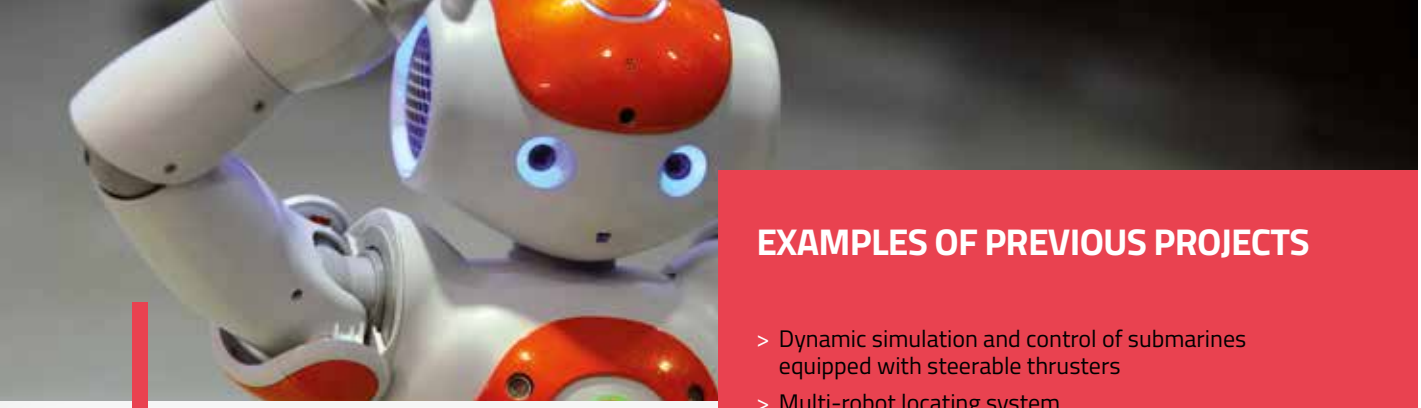
This is innovative training for the high-tech sectors of industrial robotics and / or production, transport (autonomous vehicles), and health (medical robots).

Students are trained in the design and development of complex mechanical systems. These future engineers who are oriented towards R&D and may or may not become integration engineers, can lead teams of specialists in robotics, mechatronics or real-time simulation.

Courses are strongly linked to the undertaking of projects, supported by the research teams at Centrale Nantes.

COURSE CONTENT

- Advanced programming
- Robot design
- Non linear control and observation
- Manipulator robot modelling
- Vision for robotics
- Intelligent vehicle and transport
- MiddleWare
- Modelling and control of unmanned systems (aerial/submarine)
- Non conventional robots
- Robot control
- Motion synthesis
- Project



INDUSTRY SECTORS

> Transport (automotive, aerospace, aeronautics, shipping)
> Food processing, agriculture
> Healthcare
> Arts and culture

In addition to the sectors traditionally open to robotics engineers, this specialisation offers opportunities in the growing sectors of autonomous driving, aeronautics and medical robotics

CAREER PROSPECTS

> R&D engineer
> Production engineer
> Operations engineer

TEACHING STAFF

HEAD OF SPECIALISATION:
Abdelhamid Chriette

CENTRALE NANTES LECTURERS:
Abdelhamid Chriette, Gaëtan Garcia, Olivier Kermorgant, Guy Lebret, Philippe Martinet, Pierre Molinaro, Franck Plestan, Sophie Sakka.

CNRS:
Sébastien Briot (CNRS)
Stéphane Caro (CNRS)
Franck Mars (CNRS)
Isabelle Milleville (CNRS)

CONTACT:
adbelhamid.chriette@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Dynamic simulation and control of submarines equipped with steerable thrusters
> Multi-robot locating system.
> "Barman" Robot: Use the Baxter robot to serve drinks, as a demo.
> Pioneer P3-AT Robot: Follow a predefined path.
> ROS: piloting laws for parrot drones

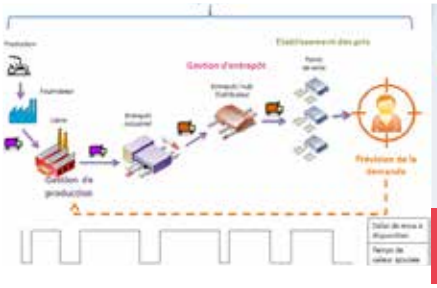
EXAMPLES OF PREVIOUS INTERNSHIPS

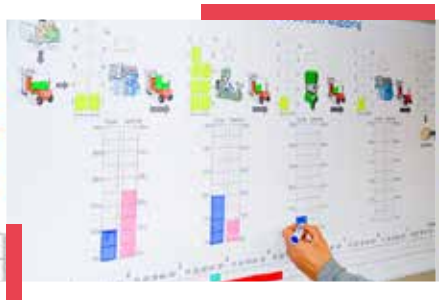
> Development, optimization and security of robotic applications at the Nantes plant (Airbus SAS Operations)
> Vision-guided navigation in dynamic environments (LAAS-Toulouse)
> Definition and development of a library for innovative industrial robots (Sitia)
> Strategies for moving a mobile robot in a constrained space (Stanley Robotics)
> Correlation studies between flight trajectories and sensor errors of an inertial sensor unit (French Ministry of Defence)

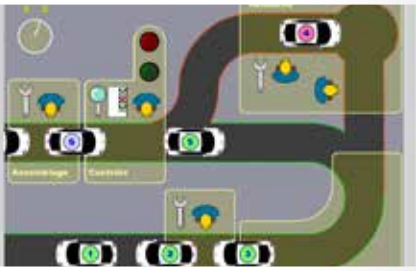
2ND AND 3RD YEAR SPECIALISATION

INDUSTRIAL ENGINEERING

Gain the capacity to understand a company and its organisation from an overall perspective (extended enterprise, information system, process, quality and standards etc), and acquire the tools and methods for optimal management (decision making, production management, supply chain, change management etc.)

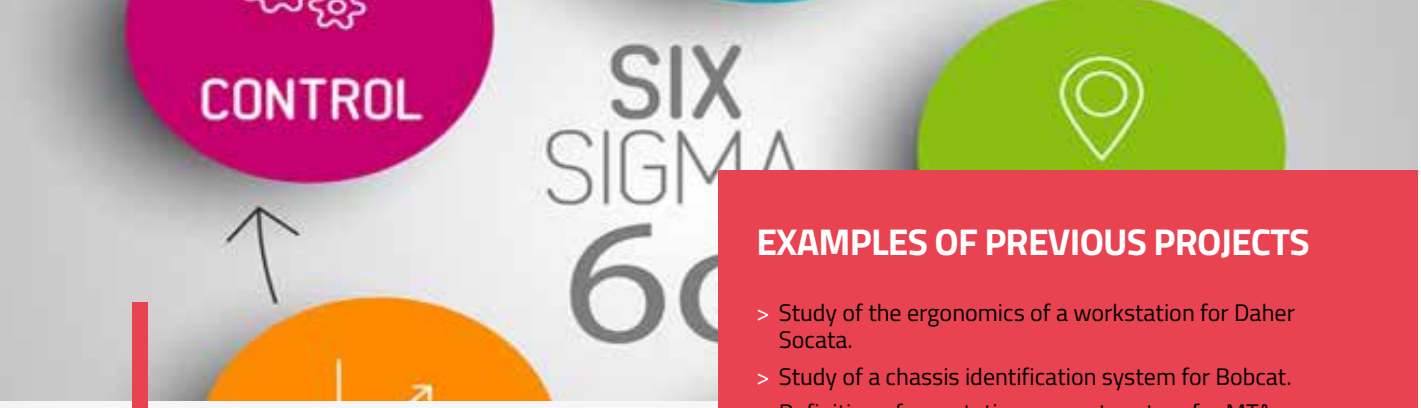






COURSE CONTENT

- Roles and organization
- Production management
- Decision-making tools and methods
- Product modelling
- Enterprise modelling and performance
- Information systems and knowledge management
- Risk management
- Processes, quality and standards
- Value networks
- Costing, purchasing and pricing
- Change management
- Simulation and operations research
- Project



EXAMPLES OF PREVIOUS PROJECTS

> Study of the ergonomics of a workstation for Daher Socata.
> Study of a chassis identification system for Bobcat.
> Definition of a quotation support system for MTA Industrie.

INDUSTRY SECTORS

> All (automotive, aeronautics, defence, food processing, IT or company performance consultancy etc)

CAREER PROSPECTS

> Production management/organisation, management of industrial processes
> Internal and external supply chain
> Stocks / purchasing
> Costing / pricing
> Consultancy (information systems, continuous improvement)
> Industrial reference and best practice systems

EXAMPLES OF PREVIOUS INTERNSHIPS

> Continuous improvement
> Optimization of production
> Logistics and Supply
> Junior Management Consultant

TEACHING STAFF

HEAD OF SPECIALISATION:

Raphaël Chenouard

LECTURERS:

Catherine da Cunha, Émilie Poirson, Jérôme Friant, Christian Le Gonidec, Jean-François Petiot, Jean-Yves Hascoët, Matthieu Rauch, Alain Bernard, Florent Laroche, Hervé Thomas, Laurence Bertho, Pascal Gilquin.

CONTACT:
raphael.chenouard@ec-nantes.fr

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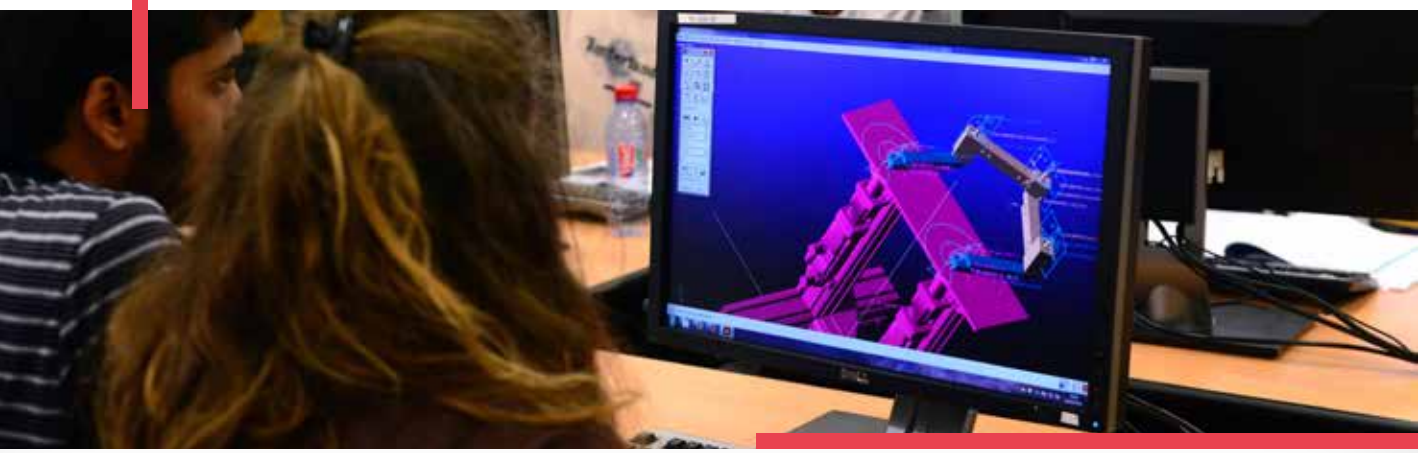

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2ND AND 3RD YEAR SPECIALISATION

COMPUTER SCIENCE

Providing future engineers with the knowledge required to manage IT projects across all sectors of application. The course deals with the major concepts required for the majority of projects, from the different perspectives of customer, contractor and project manager. Two options: Computer Engineering or Information Systems.

COURSE CONTENT

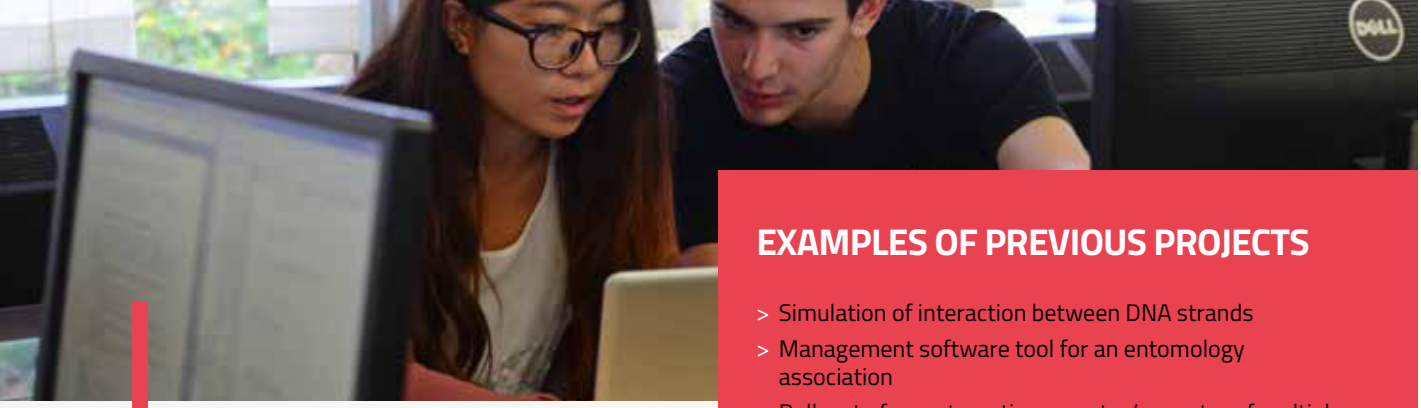
- Databases
- Software engineering
- Discrete mathematics
- Object oriented programming
- Functional programming
- Industrial software development
- Systems and networks
- Language theory
- Software development project
- Group Project

COMPUTER ENGINEERING OPTION

- Step-by-step real time kernel building
- Logic programming
- Artificial intelligence
- Parallelism and model checking

INFORMATION SYSTEMS OPTION

- Information systems
- Systems and data security
- Knowledge analysis and representation
- Web programming



INDUSTRY SECTORS

> IT services
> IT Consultancy
> large industrial groups
> SMEs
> Banking and insurance

CAREER PROSPECTS

> Software Analyst, Designer, Systems Integration
> Web and IT developer
> Information Systems Architect
> IT Support
> IT Project manager
> Systems and data security
> Data Scientist

TEACHING STAFF

HEAD OF SPECIALISATION:

Jean-Yves Martin

CENTRALE NANTES LECTURERS:

Carito Guziolowski, Jean-Sébastien Le-Brizaut, Didier Lime, Morgan Magnin, Jean-Yves Martin, Pierre Molinaro, Guillaume Moreau, Olivier Roux, Myriam Servières, Vincent Tourré

EXTERNAL SPEAKERS:

Pierre Auclair (RippleMotion), Raphaelle Chapuis (EY), Victorien Foret (CGI), Félix Lecuyer (Wavestone), Éric Paille (TOTAL), Yves Schuller (Cap Gemini), Guillaume Sevestre (Voyage SNCF), Benjamin Vialle (CNIL).

CONTACT :
jean-yves.martin@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Simulation of interaction between DNA strands
> Management software tool for an entomology association
> Roll-out of an automatic generator/corrector of multiple choice tests
> Construction of collaborative abstracts on Android
> Implementation of an API demonstrator for form recognition (MyScript)
> Android application for a healthcare protocol (Nantes University Hospital)
> Implementation of computerized discharge prescriptions at Nantes University Hospital

EXAMPLES OF PREVIOUS INTERNSHIPS

> Web API for cloud-based energy management and forecast (Wattics Ltd)
> Big data and unstructured data (Solucom)
> Development of a customer management software tool (IOS, Android and Web) for flight cancellations (Amadeus)
> Security in IT services companies (Natixis)
> Paperless social security returns (Sopra)
> Cyber Defence consulting (Sopra)
> Natural User Interface (University of Dublin, Microsoft, Skype)
> Project portfolio management support (Total)
> Automated reporting (Crédit Agricole CIB)
> Data acquisition software (DCNS)

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Centrale Nantes is a French engineering school and member of the Ecoles **Centrale Group**. Its graduate, master and PhD programmes are based on the latest scientific and technological developments and the best management practices. Founded in 1919, Centrale Nantes' 40-acre campus welcomes 2320 students, including 1550 graduate students, 150 Executive Education and degree apprenticeship students, 240 PhD students and 380 Master and Advanced Master students.

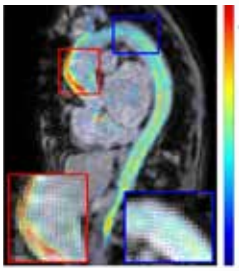
2ND AND 3RD YEAR SPECIALISATION

DATA ANALYSIS AND APPLICATIONS IN SIGNAL AND IMAGE PROCESSING

The objective of this specialisation is to train multidisciplinary engineers to design and implement methodological and algorithmic solutions to data processing problems in various industrial application fields.

The courses are based on the theory and the practice of methods from computational statistics, applied mathematics, signal and image processing, as well as applied computer science and scientific computing. These courses also offer application-oriented content from healthcare, research and development, imaging science, information and communication technology.

This specialisation confers Centrale engineers the skills needed for a professional orientation to research and innovation in industrial and academic fields related to data sciences, audio engineering, industrial imaging, decision support and biomedical engineering



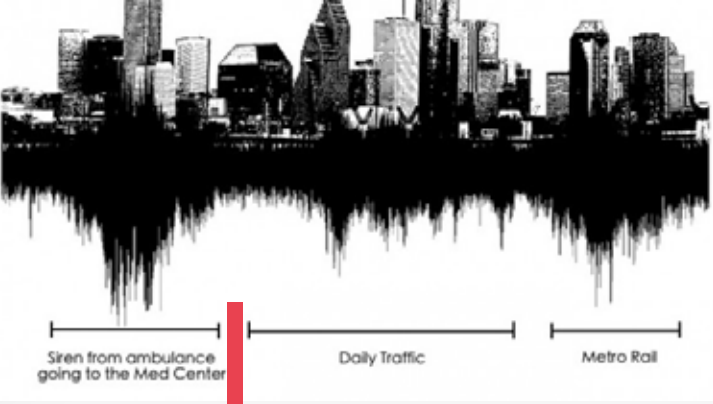
COURSE CONTENT

AUTUMN SEMESTER

- Scientific computing and numerical optimization
- Signal representation and analysis
- Image processing and analysis
- Statistical data modelling and analysis
- Machine learning theory and practice
- Systems identification and signal filtering
- Imaging and inverse methods
- Biomedical signal analysis
- Project in signal and image processing

SPRING SEMESTER

- Biomedical imaging
- Audio content analysis and Information Retrieval
- Multimodal data analysis
- R&D applications
- Project in signal and image processing



INDUSTRY SECTORS

> Data sciences
> Biomedical engineering
> Digital, sound and multimedia
> Industrial R&D (troubleshooting, decision support)
> ICT

CAREER PROSPECTS

> R&D engineer
> Data scientist
> Digital applications design
> Data acquisition and processing project manager

TEACHING STAFF

HEAD OF SPECIALISATION:
Saïd Moussaoui

CENTRALE NANTES LECTURERS:
Sébastien Bourguignon
Eric Le Carpentier
Jean-François Petiot

CNRS NANTES:
Jérôme Idier
Mathieu Lagrange

EXTERNAL SPEAKERS:
Ewen Carcreff (DB SAS, Nantes)
Thomas Carlier (CHU Nantes)
Alexandre Dufour (Institut Pasteur, Paris)
Cédric Fevotte (CNRS, Toulouse)
Grégoire Pau (CHU, Rennes)
Vincent Roualdes (CHU Nantes)

CONTACT:
said.moussaoui@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Real-time processing of audio signals
> Optimization algorithms for ultrasonic waves
> Hyperspectral image analysis of the coastline to identify plant species
> Brain-computer interfaces using Emotiv electroencephalographic headsets
> Study on the perception of environmental sound scenes
> Handling of a system for recording electromyographic signals

EXAMPLES OF PREVIOUS INTERNSHIPS

> Voice and gesture control for sound design tools, Genesis, Aix-en-Provence
> Optimization and online checking of fuel mixtures, Total, Lyon
> Fast algorithms for structured illumination microscopy, Institute of Photonic Technology, Jena, Germany
> Characterization of sports movements from accelerometric signals, Parrot
> Decomposition and classification of electromyographic signals, University Hospital Göttingen, Germany
> Processing of electroencephalographic signals for brain-machine interfaces, CHU Nantes

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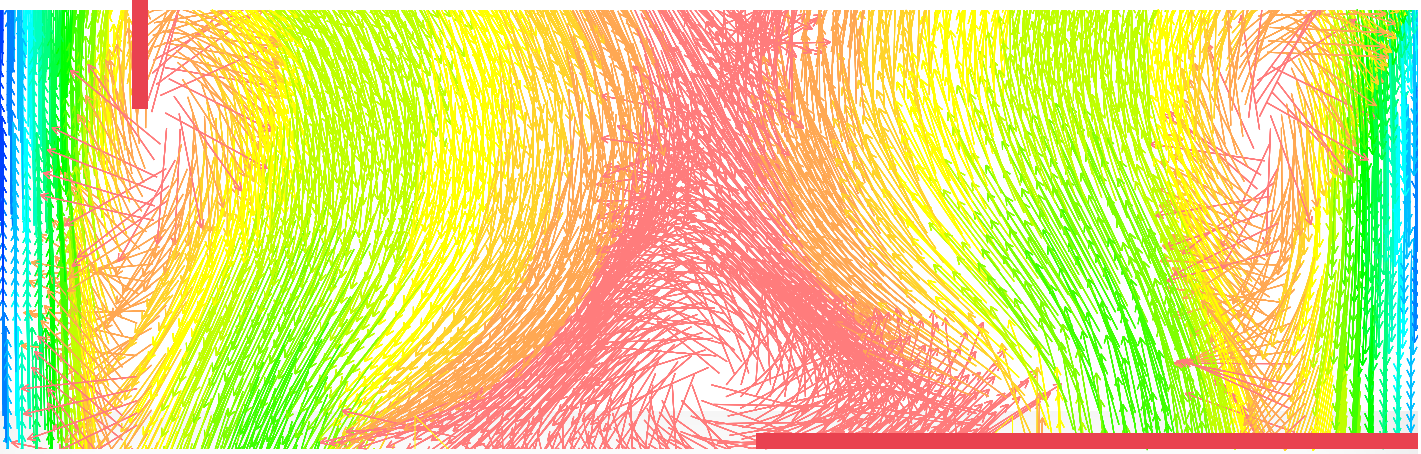
SHAKE THE FUTURE.

CENTRALE NANTES



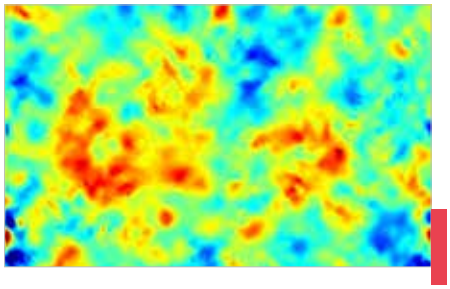
graduate programme | Ingénieur grande école

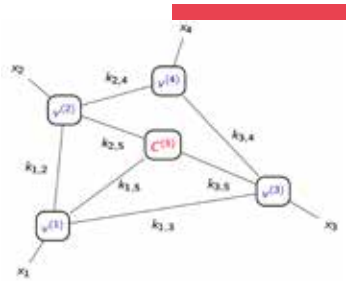
2ND AND 3RD YEAR SPECIALISATION

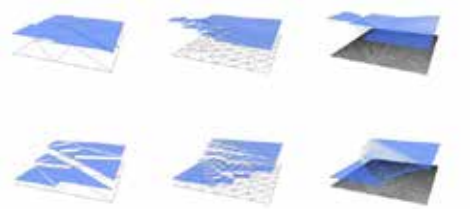
MATHEMATICS AND APPLICATIONS

This specialisation provides a broad-based curriculum in applied mathematics, from the core notions in analysis, probability and statistics to more applied vocational concepts in statistical learning or scientific computing. The multidisciplinary nature of this specialisation represents an advantage across a wide range of sectors requiring a sound understanding of mathematical tools and concepts in order to meet new technical and economic challenges.

The aim is not only to provide a solid grounding in mathematics, but also a good grasp of the current issues in applied mathematics. The teaching staff undertake research linked to different industrial sectors, thus illustrating mathematical concepts and tools on concrete applications and guiding students towards possible career orientations.







COURSE CONTENT

CORE COURSES:

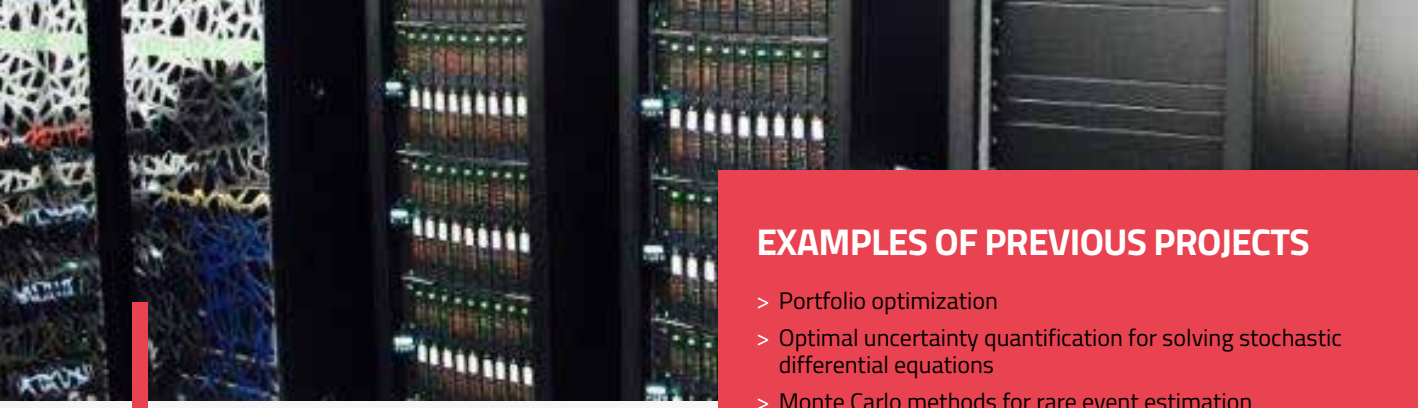
- Probability
- Hilbertian analysis
- Deterministic numerical methods
- Probabilistic numerical methods
- Statistical learning
- Advanced statistical learning
- Stochastic processes
- Uncertainty quantification
- Project

NUMERICAL ANALYSIS AND PROBABILITY TRACK:

- Partial differential equations
- Numerical analysis
- Advanced numerical analysis
- Stochastic modelling
- Modelling for health and biology

STATISTICS AND DATA SCIENCE TRACK:

- Statistics 1
- Statistics 2
- Computational statistics
- High dimensional statistics
- Bayesian methods and hierarchical models



INDUSTRY SECTORS

- Health
- Environment
- Finance
- Insurance
- Energy
- Transport
- Telecommunications

CAREER PROSPECTS

- Data scientist
- Statistical engineer
- Simulation engineer
- Logistics engineer
- Quantitative analyst
- R&D engineer
- Researcher
- Banking/Insurance consultant
- Actuarial analyst

TEACHING STAFF

HEAD OF SPECIALISATION:

Anthony Nouy

LECTURERS:

Paul Rochet, Marianne Bessemoulin,
Marie Billaud-Friess, Philippe Carmona,
Antonio Falco, Françoise Foucher, Benoît Grébert,
Bertrand Michel, Anthony Nouy,
Nicolas Pétrélis, Anne Philippe,
Mazen Saad, François Jauberteau, Hélène Mathis.

Some courses are taught jointly in conjunction with the Master in Applied Mathematics at the University of Nantes.

CONTACT:
anthony.nouy@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

- Portfolio optimization
- Optimal uncertainty quantification for solving stochastic differential equations
- Monte Carlo methods for rare event estimation
- Statistical learning methods for metamodelling of a flight controller
- Patterns of Alan Turing
- Portfolio risk measures
- Population dynamics and breast cancer tumor growth modelling
- Data mining for the analysis of petroglyphs
- Numerical simulation of the transport of nuclear waste
- Matrix completion for painting restoration
- Multilevel Monte Carlo methods for option pricing
- Metamodelling of chaotic dynamical systems
- Study of the graph of Erdos Renyi

EXAMPLES OF PREVIOUS INTERNSHIPS

- Classification and Forecasting of load curves (GDF Suez strategy division)
- Outsourcing of post-trade tasks (Accenture)
- Integration of external variables to optimize hotel prices (Amadeus)
- Development of a simulator (Thalès Alenia Space)
- Reporting of investment funds (Prévoir)
- Environmental characterization of the aircraft fleet (Safran)
- Actuarial problems in reinsurance (Wills Re)
- Reliability assessment of hybrid dynamical systems (EDF, Division Management of Industrial Risks)
- Reporting of market risks for gas portfolio (EDF, Division Economy, Rate and Price)
- Uncertainty quantification of Pégase (SAFRAN)
- Structure condition forecast using Markov chains (University of Nevada Las Vegas)
- Combination of statistical models for photovoltaic power forecasting (Reuniwatt)
- Optimization of a statistical tool for sale forecasting (PSA)
- Stochastic methods for the solution of high-dimensional PDEs (Ecole Centrale Nantes)
- Mathematical analysis and numerical methods for a PDE model governing a ratchet-cap pricing in the EURIBOR (Universidad Cardenal Herrera Valencia)

Ingénieur grande école | **graduate** programme

École Centrale de Nantes. Direction de la communication mars 2019

SHAKE THE FUTURE.

CENTRALE NANTES

graduate programme | Ingénieur grande école

2ND AND 3RD YEAR SPECIALISATION

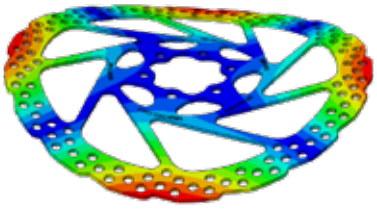
MODELLING AND SIMULATION IN MECHANICS

Numerical simulation has become an essential tool across industry for improved understanding, design and action.

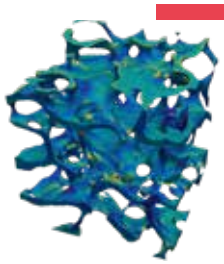
It has a major role to play in the solutions that science and technology can provide to meet tomorrow's challenges (factory of the future, mechanics for healthcare, energy and transport). For engineers, it means proposing models that can reflect reality on the basis of minimal ingredients.

To this end, this specialisation allows students to acquire skills in numerical methods and modelling, as well as an awareness of the limits of the models and numerical tools used.

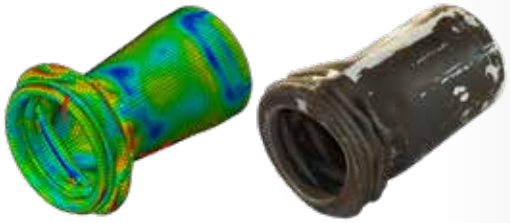
Comparing tests with calculations, via the physical interpretation of results, makes it possible to validate or, where appropriate, improve the models used.



Vibration mode of a brake disc



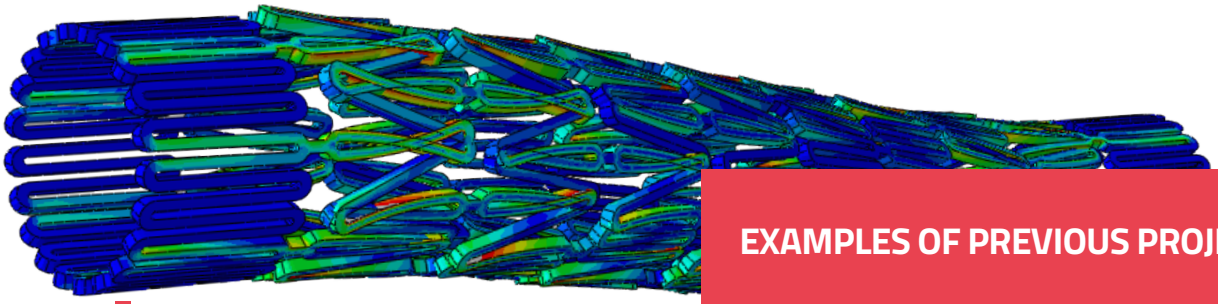
Determination of the mechanical properties of the cortical bone



Testing-calculation comparison (Crashworthiness course)

COURSE CONTENT

- Finite Element Method
- Structural mechanics
- Materials selection in mechanical design
- Solid dynamics and modal analysis
- Finite Element modelling and methodology
- Numerical methods for non-linear mechanics
- Plasticity models
- Composite structures
- Crashworthiness and transportation safety
- Thermo-mechanics and uncertainties
- Fracture and damage mechanics
- Scientific conferences
- Project



Sizing of an arterial stent

INDUSTRY SECTORS

> Transport (rail, automotive, aeronautics)
> Energy (nuclear, renewables)
> Offshore
> Mechanics for healthcare
> R&D

CAREER PROSPECTS

> R&D engineer
> Structural engineer
> Consultant
> Specialist / management positions
> Project manager

TEACHING STAFF

HEAD OF SPECIALISATION:

Grégory Legrain

CENTRALE NANTES LECTURERS:

Patrice Cartraud, Raphaël Chenouard, Nicolas Chevaugeon, Pascal Cosson, Laurent Gornet, Thomas Heuzé, Grégory Legrain, Nicolas Moës, Hervé Oudin, Patrick Rozycki, Laurent Stainier

+ faculty from the University of Nantes and external speakers from industry

CONTACT:
gregory.legrain@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Modelling of a fluid flow around a flexible structure
> Design and simulation of a crash system
> Simulation of magnetic pulse crimping
> Simulation composite material ruin
> Calculation from 2D / 3D images.
> Modelling of electric cables for floating wind turbines.
> Welding modelling.
> Simulation of acoustic environments.
> Study of large excavation stability

EXAMPLES OF PREVIOUS INTERNSHIPS

> Simulation of blade loss in a reactor (Snecma)
> Identification of acoustic leakage (Renault)
> Mechanical modelling of fuel assemblies (Areva)
> Dynamics of space launchers (EADS)
> Deployment of space structures (Thalès)
> Simulation in watch-making (Swatch)
> Simulation of the individual movements of a foetus
> Simulation of moving structures (Michelin)
> Reliability and sizing optimisation of a hydro-turbine (HydrOcean).

Ingénieur grande école | **graduate** programme

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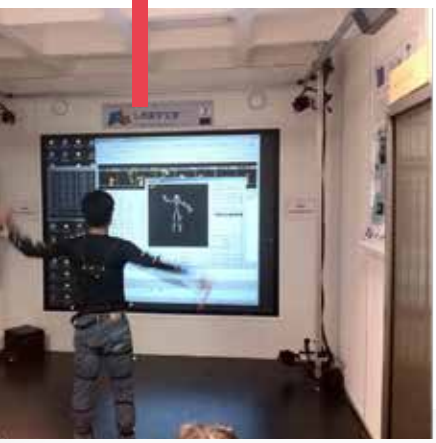
CENTRALE NANTES

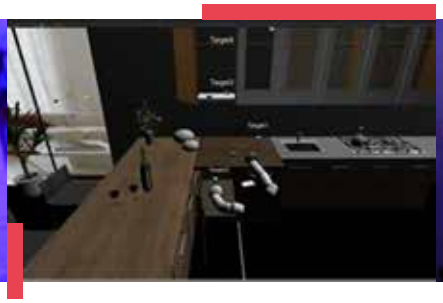


graduate programme | Ingénieur grande école

2ND AND 3RD YEAR SPECIALISATION

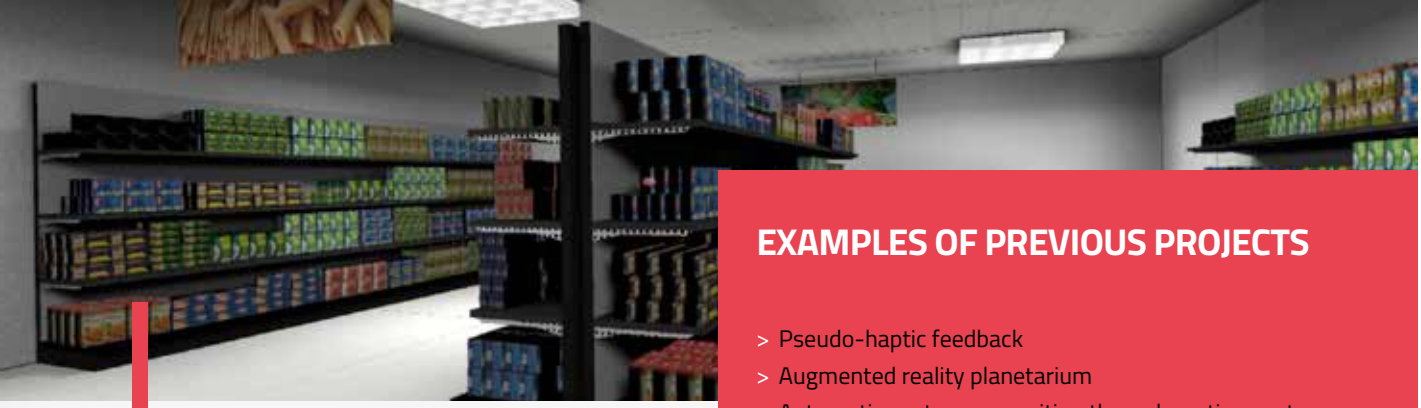
VIRTUAL REALITY

Acquire skills in computer science and image synthesis as well as in related disciplines that help to build effective immersive applications: cognitive sciences, mechanics and biomechanics, computer vision, human-machine interaction. A comprehensive 500-hour course reflecting the changing needs in virtual reality in business today.



COURSE CONTENT

- C++ programming
- Real-time 3D computer graphics
- Fundamentals of virtual reality
- From physical geometry to 3D virtual models
- Industrial software development
- Audio immersion
- 3D Interaction
- Hands on VR - simulation and interaction in Virtual Reality
- Collision detection and haptic feedback
- Computer vision and augmented reality
- Scientific visualisation
- Virtual Reality Applications: (conference week in Laval)
- Project



INDUSTRY SECTORS

> Aeronautics
> Automotive
> Shipbuilding
> Cinema, video games
> Simulation and VR publishing

CAREER PROSPECTS

> Virtual reality engineer
> Real-time 3D developer (video games, cinema etc)
> RV/Augmented reality (AR) applications designer
> R&D engineer
> RV/AR Consultant
> Project Manager (RV / video games)
> Image analysis and design engineer

TEACHING STAFF

HEAD OF SPECIALISATION:

Jean-Marie Normand

CENTRALE NANTES LECTURERS:

Jean-Marie Normand, Myriam Servières, Vincent Tourre, Franck Mars, Alain Bernard, Florent Laroche, Isabelle Milleville, Emilie Poirson, Alban Leroyer

EXTERNAL PARTNERS:

CLARTÉ

EDF
Inria Hybrid team*
Airbus*
Renault*
PSA*
Dassault Aviation*
Naval Group*

**During the conference week in Laval*

CONTACT:
jean-marie.normand@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Pseudo-haptic feedback
> Augmented reality planetarium
> Automatic gesture recognition through motion capture
> Origami production support in augmented reality
> Capture of the user environment for incorporation in a virtual reality game
> Automatic land generation in 3D
> Production of mini video games in 3D
> Interaction metaphor development for urban design in virtual reality.

EXAMPLES OF PREVIOUS INTERNSHIPS

> Development of a brain-computer interface - INSEP Vincennes.
> Augmented Reality operator guidance - CLARTE.
> Therapeutic rehabilitation in Virtual Reality - Motekforce Link, Amsterdam
> Studies and development of augmented glasses - Technicolor Rennes
> RV / AR Rendering Engine for the Web - Gingalab, Paris
> Augmented reality demonstrator for urban mobility - Sogeti, Aix-en-Provence
> Development of an RV platform for sport - LiveLike, New York
> Development of advertisements in augmented reality - Wipon, Lille
> Ophthalmic correction simulator - Essilor, Créteil
> Augmented Reality for visiting cultural sites, Histovery - Paris

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CENTRALE NANTES

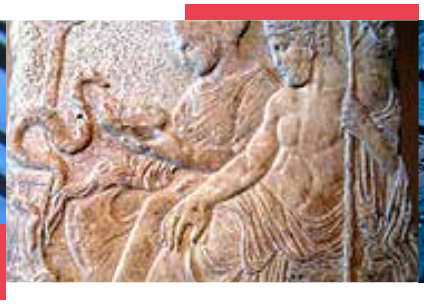
graduate programme | Ingénieur grande école

2ND AND 3RD YEAR SPECIALISATION

DIGITAL SCIENCES FOR LIFE SCIENCES AND HEALTHCARE

A cutting-edge programme in the transdisciplinary field of digital science and technologies (information processing and communication) applied to life sciences and healthcare technology.

Medicine, in particular, has moved into the Big Data age with the ramping up of high speed data for diagnosis and therapy. Biotechnologies are expanding significantly in fields such as green chemistry, the use of bacteria for biofuel synthesis, soil decontamination, the development of new biomaterials.



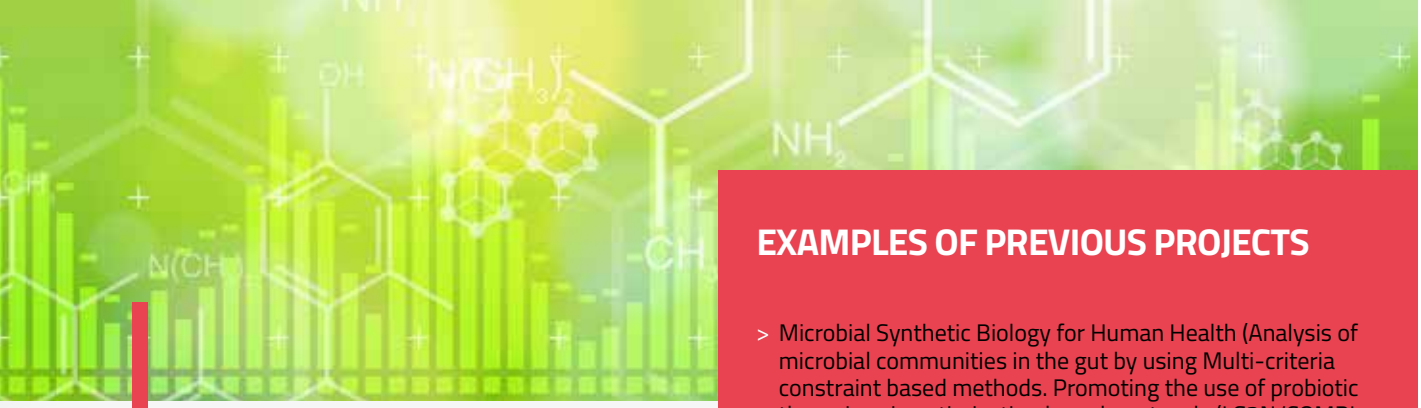
COURSE CONTENT

LIFE SCIENCES:
- Cellular biology
- Immunology
- Molecular biology, genetics, evolution

LIFE SCIENCES AND DIGITAL SCIENCES:
- Bioinformatics and genomics: biotechnological revolutions and "big data"
- Systems Biology: Discrete Modelling and Qualitative Analysis of Biological Networks
- Systems Biology: Probabilistic Modelling and Quantitative Analysis of Biological Networks

DIGITAL SCIENCES:
- Operating Systems and Databases
- Statistics and stochastic modelling
- Physics and Biomechanics
- Computational Surgery
- Advanced Computer Science

CONFERENCES AND PROJECTS
- Conference cycle
- Supervised project



INDUSTRY SECTORS

- Hospital sector
- Food industry
- Biomedical engineering and therapeutic bioengineering
- Pharmaceutical industry, chemicals and cosmetics
- Bioinformatics platforms
- Bio-technological development
- Innovation in environment and energy

NB: according to the Attali report, the healthcare industry accounts for almost 2 million jobs, or 9% of the labour force.

TEACHING STAFF

HEAD OF SPECIALISATION:

Olivier Roux

CENTRALE NANTES LECTURERS:

Domenico Borzacchiello, Francisco Chinesta , Éric Le Carpentier, Sophie Limou, Morgan Magnin, Jean-Yves Martin, Olivier Roux, Aurélien Serandour

EXTERNAL SPEAKERS (UNIVERSITY OF NANTES AND CNRS):

Jérémie Bourdon, Damien Eveillard, Yannick Guilloux, Abdelhalim Larhlimi, Loïc Paulevé, Xavier Saulquin

CONTACT:
olivier.roux@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

- Microbial Synthetic Biology for Human Health (Analysis of microbial communities in the gut by using Multi-criteria constraint based methods. Promoting the use of probiotic therapies via optimization based-protocols (LS2N/COMBI, UMR 6004, Nantes)
- Contribution on learning time series data and analysis of dynamic models for participation in the DREAM11 Challenge (LS2N/MeForBio, UMR 6004, Nantes)
- Kinetic descriptions of the theory of evolution (ICI, Nantes)
- Single cell approach in cancer genomics and epigenomics: from cellular microfluidic purification to bioinformatics data analysis (CRCINA, UMR_S 1232, Nantes)
- Marker imputation in genetics or the move from the lab to 'in silico' (ITUN - CRTI - UMR Inserm 1064 –Nantes University Hospital)
- Image registration for two types of acquisition mode: fluorescence and beta-type radioactive imaging (SFR Santé François Bonamy UMS 3556 IRS-UN, Nantes)

EXAMPLES OF PREVIOUS INTERNSHIPS

- Differentiation of T1 and T2 breast tumours by DNA methylation markers based on whole-genome bisulfite sequencing (CEA, Paris)
- Reduced order modelling for flexible prosthetic robots (University of Saragossa, Spain)
- Study of the long-term variability of DNA methylation (at the genome level) (INSERM, Lyon)
- Analysis of large-scale multi-dimensional genetic data (Institut Pasteur, Paris)
- Testing optimal control models of human saccadic eye movements (Radboud UMC, Nijmegen, Netherlands)
- Implementation of a protocol for a new skin imaging method (Laboratoire Clarins, Paris)
- Test the hypothesis of background genetic variation being a contributor to the off-target effects of CRISPR (Cancer Research UK, Cambridge Institute, UK)
- CNV detection from targeted sequencing data (Assistance Publique - Hôpitaux de Paris)
- Flow/mass cytometry and next-gen sequencing analysis (CLIP Laboratory, Prague, Czech Republic)
- Development and optimization of a compressed-sensing reconstruction algorithm to accelerate the acquisition of MRI images. Application for the detection of metastases. (CRMSB CNRS, Bordeaux)
- Simulation and study of neurons and their networks (CNRS, Lille)
- The role of normal and cancer RNA levels in the causation of colorectal cancer (Roslin Institute, Edinburgh, UK).
- Contraction of metabolic networks (Freie Universität Berlin, Germany)
- Multiplex PCR reaction modelling (bioMérieux, Marcy l'Etoile).

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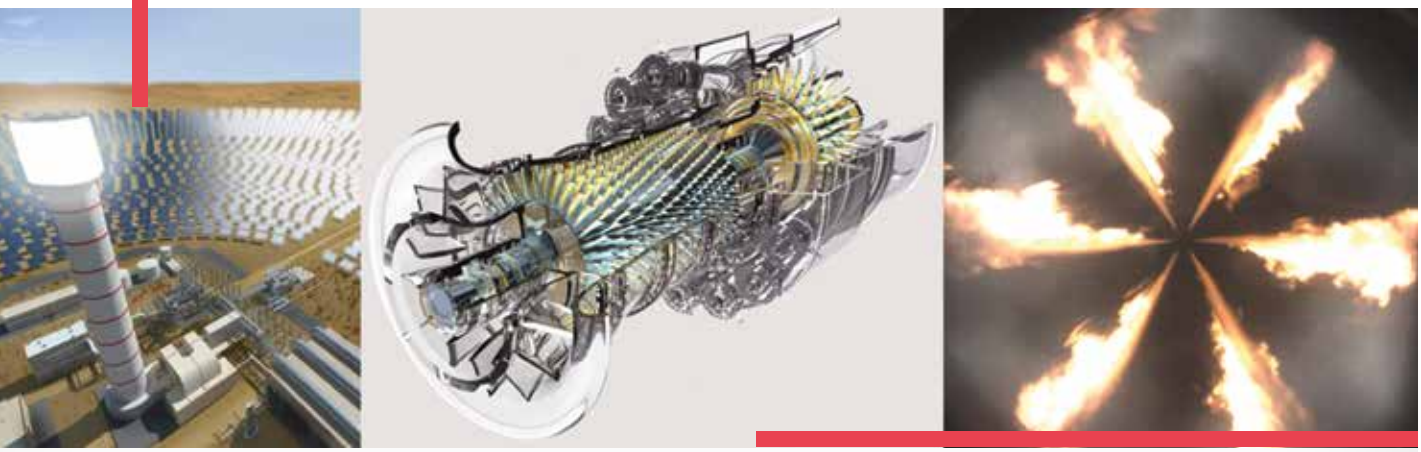


graduate programme | Ingénieur grande école

2ND AND 3RD YEAR SPECIALISATION

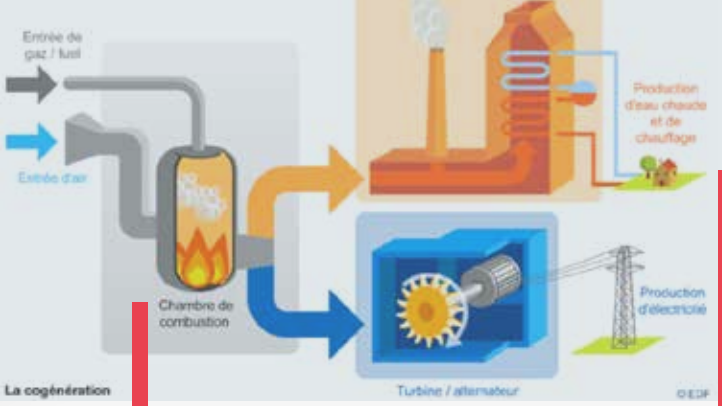
ENERGY PRODUCTION AND MANAGEMENT

Training future engineers to deal with cross- and multi-disciplinary issues linked to energy.

Fields covered: conventional energy production (thermal, nuclear); renewable energy production (wind, solar power etc.); energy management, transport and storage; efficient use of energy (in industry and construction); consideration of the environmental constraints linked to energy (depollution of energy production systems).

COURSE CONTENT

- Combustion and pollutant emissions
- Turbomachinery
- Applied thermodynamics
- Thermodynamic of engines
- Conventional energies
- Low-carbon energies
- Transport - storage - conversion and energy management
- Practical work
- Thermal performance of buildings
- Heat and air-conditioning systems
- Solar captation
- Carbon balance and energy auditing
- Project



La cogénération

INDUSTRY SECTORS

> Energy production (traditional and renewable)
> Energy transport
> HVAC sector

CAREER PROSPECTS

> Engineering consultancy
> Energy consultant
> Design engineer / R&D
> Project manager

TEACHING STAFF

HEAD OF SPECIALISATION:

Alain Maiboom

CENTRALE NANTES LECTURERS:

David Chalet, Pascal Chessé,
Jean-François Hétet, Thierry Jaszay,
Alain Maiboom, Vincent Berthome, Xavier Tauzia

EXTERNAL SPEAKERS:

EDF, Cohérence énergies, Valéo, IFPEN, RTE, ENGIE, GRT Gaz, CEREMA, INDIGGO, Saunier Duval EM2C, LHEEA, IMN

CONTACT:
alain.maiboom@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Design, production and testing of a thermal solar collector
> Choice, purchase, and installation of a 1kWc photovoltaic plant on the school campus - instrumentation and measurements
> Instrumentation and experimental study of air-water heat pump for an individual house
> Study on inter-seasonal heat storage
> Study on concentrated solar power
> Thermal study of housing - steady-state calculation and dynamic thermal simulation. (INDIGGO)
> Photovoltaic-Diesel Hybridization (JP Energie Environnement)
> Pre-design and parametric study of a cogeneration system.
> Study of an ocean thermal energy system
> Electricity storage by the Power to Gas process.
> Coupling of CO2 storage and geothermal energy.
> Development of the rotating machines used in STEP systems.

EXAMPLES OF PREVIOUS INTERNSHIPS

> Dynamic thermal modelling of a block of buildings by state-space representation: detailed and reduced models (EDF)
> Managing the energy performance of hospitals (AIA Ingénierie)
> Simulation and optimization of vehicle energy arbitrage (PEUGEOT CITROEN AUTOMOBILES SA).
> Design of a tool to improve reduction strategies (Smart Grid Energy).
> Photovoltaic-Diesel Hybridization (JP Energie Environnement)
> Consultant in Carbon and Energy Transition Strategy (Carbone 4)
> Study and improvement of tomorrow's power grid (RTE)
> Integration of wind turbines into the electricity market (Maïa Eolis)
> A feasibility study on the use of an electricity storage solution in the form of hydrogen for the residential and tertiary sectors (ENGIE).
> Thermo-hydraulic & Structural Analysis of ITER Vacuum Vessel & Cryostat Thermal Shield (Panels & Manifolds) (ITER).
> Development of an economic framework for multi-energy systems modelling in the German context (EIFER - Germany).
> LCA and Responsible Sourcing in Construction (BRE – UK)
> Development of a marine current power control system (Tidal Stream Limited – UK).

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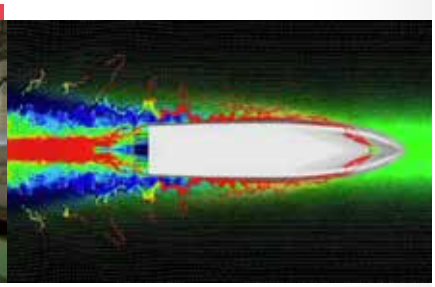
2ND AND 3RD YEAR SPECIALISATION

OCEAN: HYDRODYNAMICS AND MARINE ENGINEERING

Provide the students with the scientific and technical knowledge in hydrodynamics and ocean engineering to allow them to address societal issues linked mainly to energy (offshore oil, marine renewable energies) and maritime transport (building of environmentally-friendly ships and transport of offshore wind turbines).

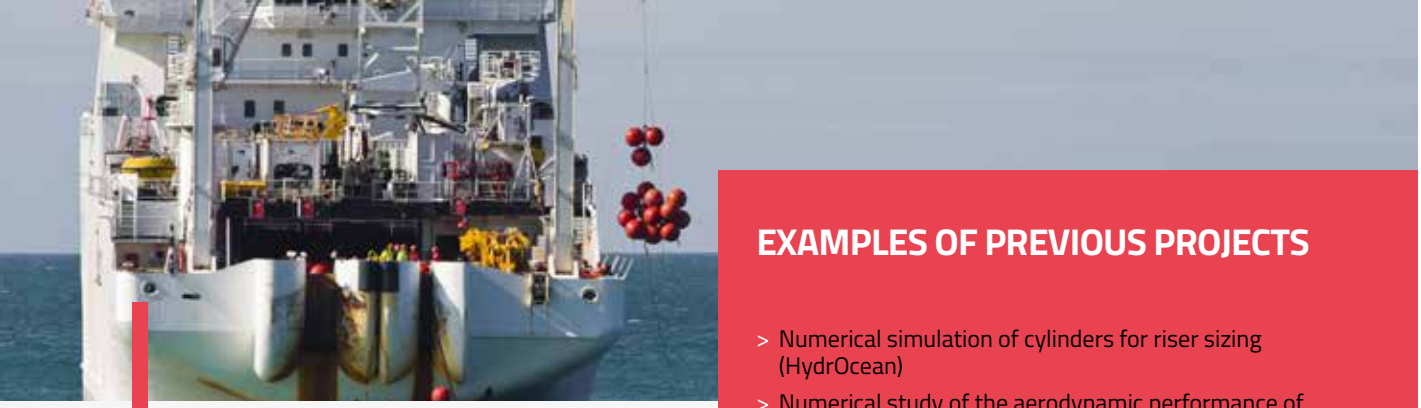


COURSE CONTENT

- Introduction to hydrodynamics
- Marine environment and hydrodynamic loads
- Seakeeping and stability
- Numerical hydrodynamics: Part 1
- Ship manoeuvrability and moorings
- Experimental hydrodynamics
- Lifting bodies and propulsion
- Numerical hydrodynamics 2
- Shipbuilding and maritime economy
- Fluid-structure interaction
- Advanced hydrodynamics
- Project

OPTIONS:

- Marine Renewable Energies (20 students)
- Offshore oil and gas (10 students)



INDUSTRY SECTORS

- Offshore oil
- Marine Renewable Energies
- Naval engineering
- Maritime transport
- Research (private or public sector)
- Coastal engineering
- Numerical simulation in hydrodynamics and fluid mechanics

CAREER PROSPECTS

- R&D engineer
- Installation and operations engineer (MRE offshore)
- Project engineer
- Quality engineer
- Production management engineer
- Supply chain manager

TEACHING STAFF

HEAD OF SPECIALISATION:

Félicien Bonnefoy

CENTRALE NANTES LECTURERS:

Sandrine Aubrun, Félicien Bonnefoy, Isabelle Calmet, Antoine Ducoin, Guillaume Ducrozet, Pierre Ferrant, David Le Touzé, Zhe Li and researchers from the Research Laboratory in Hydrodynamics, Energetics & Atmospheric Environment (LHEEA)

EXTERNAL SPEAKERS:

Academics: Université de Nantes, École navale (Brest), ICAM Nantes

Naval architecture: HT2

Marine Renewable Energies: Innosea, EDF-EN, Naval Group

Offshore oil: Principia, Total, Saipem, Subsea 7

CONTACT:
felicien.bonnefoy@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

- Numerical simulation of cylinders for riser sizing (HydrOcean)
- Numerical study of the aerodynamic performance of a vertical axis wind turbine (LHEEA)
- Influence of anchor modelling on the performance of a wave energy convertor (Innosea)
- Design and build of two electrically propelled boats (Hydrocontest student competition)
- Exploratory study for the deterministic measurement and prediction of sea states (LHEEA)
- Architecture of a floating wind farm (LHEEA)
- Characterization of the small wave tank (LHEEA)

EXAMPLES OF PREVIOUS INTERNSHIPS

- Hydrodynamic study of a sailing project, K-epsilon, Sophia Antipolis.
- Naval design and engineering studies, Marc Lombard, La Rochelle.
- Study of models using coastal environment software MIKE FM (DHI, Denmark)
- Offshore data analysis and study of anchor line fatigue (Exeter University, UK)
- Modelling of the dynamic behaviour of an anemometer (Ecole Navale, Brest)
- Calculation in the naval field, Segula Engineering, Saint-Herblain.
- Study of an offshore facility (Innosea, Edinburgh, UK)

Centrale Nantes is a French engineering school and member of the Ecoles **Centrale Group**. Its graduate, master and PhD programmes are based on the latest scientific and technological developments and the best management practices. Founded in 1919, Centrale Nantes' 40-acre campus welcomes 2320 students, including 1550 graduate students, 150 Executive Education and degree apprenticeship students, 240 PhD students and 380 Master and Advanced Master students.

SHAKE THE FUTURE.

CENTRALE NANTES

graduate programme | Ingénieur grande école

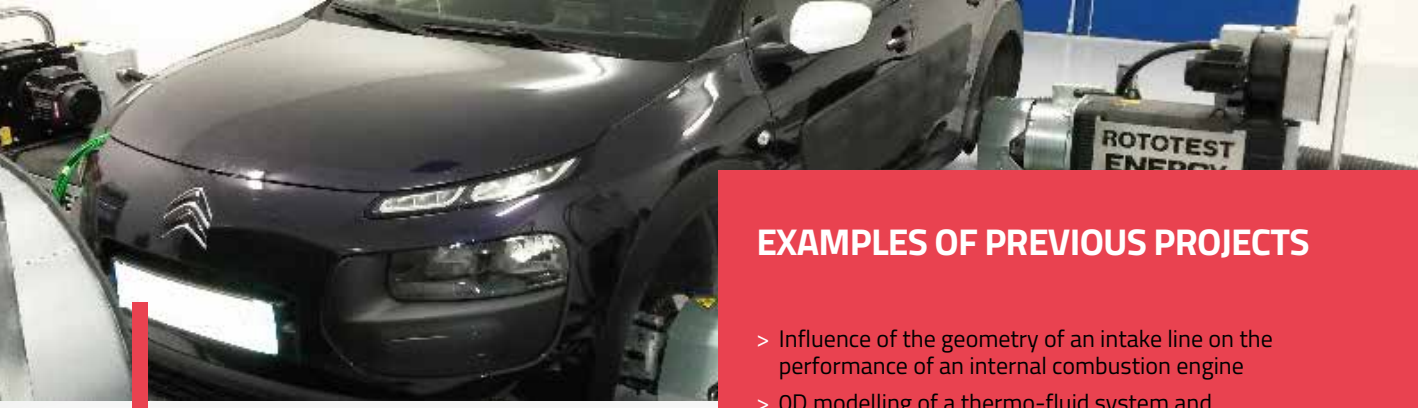
2ND AND 3RD YEAR SPECIALISATION

PROPULSION AND TRANSPORT

The blend of skills acquired will allow students to get to grips with propulsion systems in their entirety, using an energy-based approach (modelling, experimentation and simulation), and covering the technical, economic and environmental challenges. The originality of this specialisation lies in its multi-disciplinary nature (thermodynamics, gas dynamics, combustion, optimisation).

COURSE CONTENT

- Combustion and pollutant emissions
- Turbomachinery
- Applied thermodynamics
- Internal combustion engines
- Gas dynamics
- Energy management in automotive applications
- Aeronautical propulsion
- Automotive propulsion
- Marine propulsion
- Space propulsion
- Railway engineering
- Practical work in propulsion
- Projects



INDUSTRY SECTORS

> Energy-related propulsion
> Automotive
> Aeronautics
> Aerospace
> Naval
> Railway
> Design office

CAREER PROSPECTS

This specialisation gives access to numerous professions in the automotive, aeronautical, space, maritime and railway sectors:

> Design engineer
> Modelling and optimisation engineer
> Test engineer
> Technical marketing engineer, etc.

TEACHING STAFF

HEAD OF SPECIALISATION:

David Chalet

CENTRALE NANTES LECTURERS:

Vincent Berthomé, David Chalet, Pascal Chessé, Jean-François Hétet, Thierry Jaszay, Alain Maiboom, Laurent Perret, Xavier Tauzia

EXTERNAL SPEAKERS:

Academic: Centrale Paris, University of Nantes, etc.

Industry: Renault, PSA, MANN+HUMMEL, Honeywell, IFPEN, MAN, Snecma, Turbomeca, Alstom, etc.

CONTACT:
david.chalet@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Influence of the geometry of an intake line on the performance of an internal combustion engine
> 0D modelling of a thermo-fluid system and experimental validation
> Improvement in the experimental setup of a turbojet bench
> Energy optimisation on-board ship

EXAMPLES OF PREVIOUS INTERNSHIPS

> Arianespace: 0D / 1D fluid modelling of a cryogenic upper stage (ESCA) for Ariane 5
> Mann+Hummel: Improvement in thermal simulation of an internal combustion engine through nodal modelling of the cylinder block and head
> Snecma: Kinematic study of the control system with variable valve high pressure compressor
> Manitou: Study and modelling of an engine / transmission / hydraulic control solution for a telescopic forklift truck in order to optimize the vehicle's energy resources
> AVL: Engineering on engine test bench
> CMT: Analytical and experimental study of automotive turbocharged engines
> Renault Formula 1: Study and development of water, oil and air regulations in order to simulate F1 engine behaviour during a lap
> PSA: Combustion modelling for spark-ignition engines
> STX/ Reduction of the pollutant emissions for a ship
> Semitan: Determination of the natural gas consumption of buses

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CENTRALE NANTES

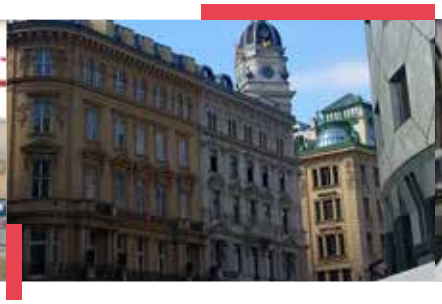
graduate programme | Ingénieur grande école

2ND AND 3RD YEAR SPECIALISATION

CIVIL ENGINEERING

Master the design, construction and operational phases as well as rehabilitation and demolition, taking account of the durability of materials and of environmental risks (e.g. seismic risk).

All students in this specialisation follow the core courses and two courses according to their choice of option: **Durability and Risks or Construction Engineering.**



COURSE CONTENT

- Civil engineering materials
- Mechanics and physics of materials
- Structural calculations
- Case studies
- Modelling in civil engineering
- Construction engineering management
- Reinforced concrete
- Geotechnical engineering
- Structural design I
- Earthquake engineering
- Projects

DURABILITY AND RISKS OPTION:

- Underground structures
- Durability of concrete structures

CONSTRUCTION ENGINEERING OPTION:

- Building information modelling
- Structural design II
- Project

EXAMPLES OF PREVIOUS PROJECTS

> Design and construction of an office building: in response to a call for tenders (Bouygues).
> Behaviour of superficial foundations and piles.
> Design and construction of an underground car park: in response to a call for tenders (Bouygues).
> Modelling of concrete creep in deep storage centres.

INDUSTRY SECTORS

> Public works and buildings
> Construction
> Risk management
> Recruitment across all company sizes from multinationals to national and local SMEs etc.

EXAMPLES OF PREVIOUS INTERNSHIPS

> Ensuring production quality control for the different phases of pre-stressing.
> Project management - design and operations of Bouygues Telecom site development.
> Project management - underground tunnel construction work.
> Thermo-mechanical modelling of bituminous materials.
> Modelling of a full-scale test of crack growth under traffic on bituminous roads.

CAREER PROSPECTS

> Construction project management
> Civil engineering risk management
> Consultancy
> Methods
> R&D in civil engineering

TEACHING STAFF

HEAD OF SPECIALISATION:

Syed Yasir ALAM

LECTURERS:

Syed Yasir ALAM, Frédéric GRONDIN, Panagiotis KOTRONIS, Ahmed LOUKILI, Yvon RIOU, Emmanuel ROZIERE, Zenhyu YIN

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syed-yasir.alam@ec-nantes.fr

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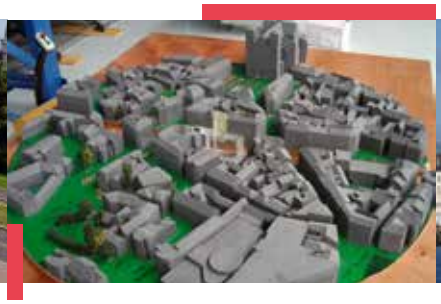
2ND AND 3RD YEAR SPECIALISATION

ENGINEERING SCIENCE FOR HOUSING AND URBAN ENVIRONMENT

Acquire strong scientific skills relating to the physical architecture of cities and housing. Two options are offered within the specialisation: housing (building performance and thermal technology, building materials, air treatment) and urban engineering (energy at the city scale, urban hydrology and atmosphere, noise and waste management, transportation engineering).



COURSE CONTENT

- Urban issues
- Applied thermodynamics
- Urban hydrology and atmosphere
- Acoustics, light and solar radiation
- Building engineering
- Automatic systems
- Geographic information systems and databases
- Virtual reality
- Projects

HOUSING OPTION

- Thermal performance of buildings
- Air treatment and conditioning
- Building technology
- Materials for building comfort

URBAN ENGINEERING OPTION

- Energy at the city scale
- Applied urban hydrology and atmosphere
- Noise management
- Waste management and transportation engineering

INDUSTRY SECTORS

> Engineering consultancy
> Inspection and certification bodies
> Technical centres
> Local and regional authorities
> Specialist Institutes

CAREER PROSPECTS

> Engineering consultant in thermal technology for buildings
> Construction site engineer (new build / renovation)
> Energy efficiency engineer
> Consultant in sustainable development, energy - building

TEACHING STAFF

HEAD OF SPECIALISATION:

Jean-François Hétet

LECTURERS:

Jean-François Hétet, Yvon Riou, Jean-Yves Martin, Alain Maiboom, David Chalet, Frédéric Grondin, Florent Laroche, Isabelle Calmet

EXTERNAL SPEAKERS:

ENSA Nantes
Saunier Duval
Ubiant
Bouygues Construction
IFFSTAR Nantes
ALTRAN

CONTACT:
jean-francois.hetet@ec-nantes.fr

EXAMPLES OF PREVIOUS PROJECTS

> Eco-neighbourhoods (indicators)
> Smart grid
> Smart city
> Drinking water networks
> Regional energy efficiency
> Pattern of urban movements
> Olympic Games + World Cup: Impact on the Rio de Janeiro urban area
> Case Study on building thermal performance
> Bioclimatic building
> Cultural heritage in Virtual Reality
> Establishment of a BIM model

EXAMPLES OF PREVIOUS INTERNSHIPS

> Renovation of the Santé prison (Bouygues Construction, Paris).
> Sustainable development initiative (Guarani - Brazil).

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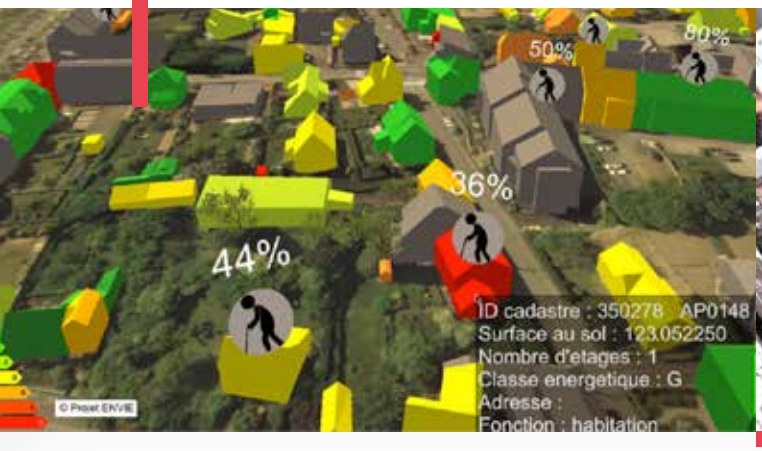

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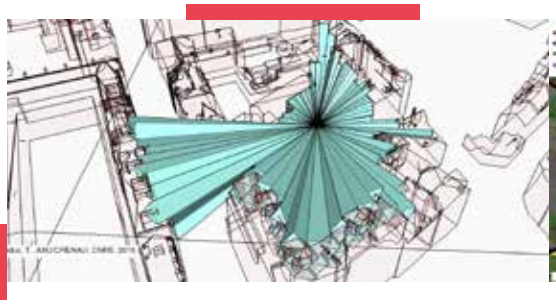
2ND AND 3RD YEAR SPECIALISATION

DIGITAL CITY
GEOMATICS AND URBANISM

Understand the city through the creation and use of its digital twin:

- Analyze, model, process and represent urban data from acquisition to decision-making
- Address the complexity of urban systems, their stakeholders and processes for sustainable management of "smart" cities.



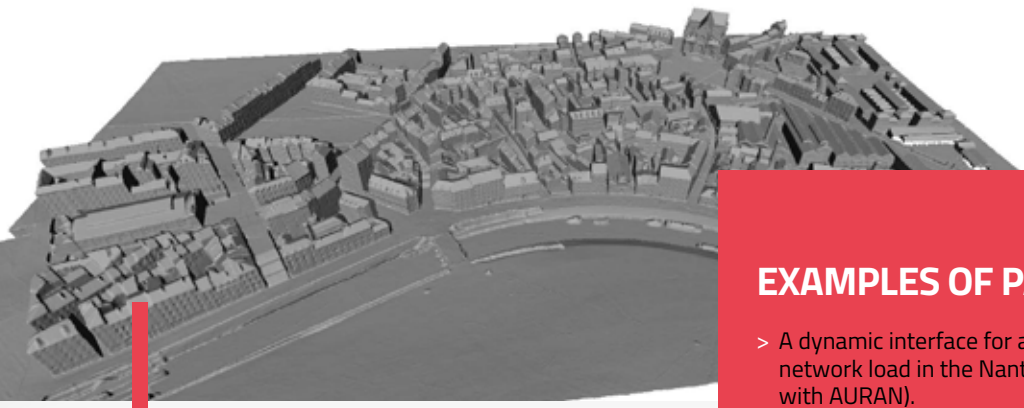
COURSE CONTENT

GEOMATICS

- Geographical Information Systems (GIS)
- GIS Engineering
- Urban data modelling
- Databases
- Introduction to Programming
- Image analysis and processing

URBANISM

- Urban issues
- Urban models
- Urban data analysis
- City representation
- Urban policies
- Professional applications



INDUSTRY SECTORS

> Local or regional authority
> Planning agency (AURAN, IAU etc)
> Urban engineering consultancy
> Companies in the digital sector such as Cap Gemini, Sopra, IBM
> Architecture, engineering and building firms: Suez, Vinci Construction, GRDF, Artelia
> Research bodies (IGN, CNRS)

CAREER PROSPECTS

> Urban data officer
> Geomatic engineer
> 'Smart city' project manager
> Heritage project manager
> Planning engineer
> BIM manager

TEACHING STAFF

HEAD OF SPECIALISATION:

Myriam Servières

LECTURERS:

Jean-Marie Normand, Jean-Yves Martin, Guillaume Moreau, Said Moussaoui, Myriam Servières, Vincent Tourre

LECTURERS ENSA NANTES/AAU CRENEAU :

Ignacio Requena-Ruiz, Pascal Joanne, Laurent Lescop, Daniel Siret

EXTERNAL SPEAKERS

Gwendal Petit (UBS), Gilles Gesquière (LIRIS), Valérie Renaudin (IFSTTAR), Laurent Vigneau (Artelia) Hugo Mercier (Oslandia), Nicolas Chavent (OSM), Matthieu Mosser (Siradel), Thomas Guret (MGDIS)

CONTACT :
myriam.servieres@ec-nantes.fr

EXAMPLES OF PAST PROJECTS

> A dynamic interface for analyzing the public transport network load in the Nantes conurbation (in partnership with AURAN).
> Definition of urban environment indicators (in partnership with the AAU-CRENAU research laboratory).
> Humanitarian rendering of OpenStreetMap geographic data - implementation of an SLD for the free software package QGIS (in partnership with HOT (Humanitarian OpenStreetMapTeam) collective).
> Development of indicators for 3D urban data (in partnership with Oslandia).
> Representation of mobility and accessibility using an interactive 3D isochronous representation (in partnership with Siradel).

EVENTS

> CityLab Alliance with 10 partner companies.
> Workshop Mobiance: pedagogical research workshop on Mobility, Ambiances and Urban Design.

EXAMPLES OF PREVIOUS INTERNSHIPS

> Design, build and integration of GIS (Sopra Nantes)
> Creation of an IT tool for feedback and testing of geomatic techniques for decision-making in order to prioritize the handling of industrial risks. (GrDF Paris)
> Construction of 3D models, design and administration of spatial databases and development of operational tools (ForCity).
> GIS/Smart Cities Consultant (Sopra).
> GIS configuration of roadside trees (local authority)
> Design and implementation of a style model adapted to a 3D web application (IGN-COGIT).
> BIM Development in Digital Services (Vinci Construction).
> Construction of BIM digital heritages and management of real estate databases (Foundation).

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2ND AND 3RD YEAR SPECIALISATION

SCIENTIFIC CHALLENGE 2024

HIGH FIDELITY MODELLING OF THE COMPLETE BOAT-OAR-ROWER SYSTEM

With the upcoming 2024 Olympic and Paralympic Games in Paris and the relationship forged between Centrale Nantes and the French Rowing Federation through various research projects, there is a willingness to expand the links between scientific research and the sports community.

Students are afforded the opportunity to take part in these scientific challenges - to develop tools capable of providing concrete answers in the field, and to acquire scientific skills and knowledge, through an ambitious engineering

and research project.

COURSE CONTENT

In the first year of the project, a prototype simulator of the boat-oar-rower(s) system was finalized. The challenge now lies in the industrialization phase, so that the simulator is operational from the start of the 2020-2024 Olympiad

- Make digital simulation an operational tool for rowing for the 2024 Olympic Games
- Improve reliability and facilitate simulator implementation to ensure professional quality
- Undertake the essential validation phase using existing field measurements, but also by developing measurement methods for missing data
- Conduct parametric studies of the determinants of sports performance in rowing from simulations
- Make the research results accessible for sports experts
- Use the simulation results to propose training tools for coaches

2018/2019 project team

FIELDS OF ACTIVITY

> Research and development
> Instrumentation
> Modelling
> Scientific computing
> Sports performance analysis
> Company organisation
> Communication

SKILLS

> Project engineering
> Numerical simulation
> Software development
> Experimental Methods
> Managing complexity
> Teamwork
> Knowledge transfer

TEACHING STAFF

HEAD OF SPECIALISATION:
Alban Leroyer

SPORTS RESEARCH CONTACT:
Sophie Barré (CREPS des Pays de la Loire)

SPORTS PARTNER:
Fédération Française d'Aviron
(French Rowing Federation)

CONTACT:
alban.leroyer@ec-nantes.fr

PROJECT-BASED TEACHING

The objective is to train engineers capable of undertaking large-scale projects, providing relevant solutions to issues in the field, within efficiently organized project teams. This innovative project-based teaching method will allow students to acquire competences in a different way thanks to:

> A customised training programme
> Agile and autonomous organisation
> Tailored support
> Scientific challenges linked to industrial issues (naval hydrodynamics, MRE, simulations, etc.)
> A database of experimental measures carried out within the French teams
> An opportunity to take concrete action on an ambitious performance support project in preparation for the 2024 Paris Olympics

PROJECT DELIVERABLES

> A programme to process field measurements performed by the French team, which will also serve to train the whole team on the key project tools
> A module to generate all the data input (biometric measurements of rowers, body movements, equipment parameters, etc), with a measurement protocol (scan, dedicated bench, etc.) for each part
> A realistic display model as a vehicle for communication to enhance performance and discussion with the sports
> community
> An experimental validation database
> Analysis and optimization of the SPRing simulator's performance
> Regular project monitoring deliverables (minutes, reports and progress indicators, planning, set up of a bug/improvement tracking tool)

EXAMPLES OF PREVIOUS INTERNSHIPS

Project-based learning is highly valued by companies. Student internships are quite varied, and reflect the diversity of backgrounds.

> Development of hydrodynamic meta-models and CFD validation, Artemis Technologies, UK
> Graphic reconstruction of an electronic horizon, Renault Software Labs, Sophia-Antipolis
> Executive Assistant: Project Management and Financial Reporting, Haemers Techologies, Brussels
> Thermo-hydrodynamic modelling on a heat exchanger, Naval group, Nantes
> Numerical simulation of ship maneuvers, Numeca Int., Brussels,
> CAD and subsystem design of the 'Heron Tree', Les Machines de l'île, Nantes

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CENTRALE NANTES

graduate programme | Ingénieur grande école

2ND AND 3RD YEAR SPECIALISATION

PROJECT
CARBON NEUTRALITY

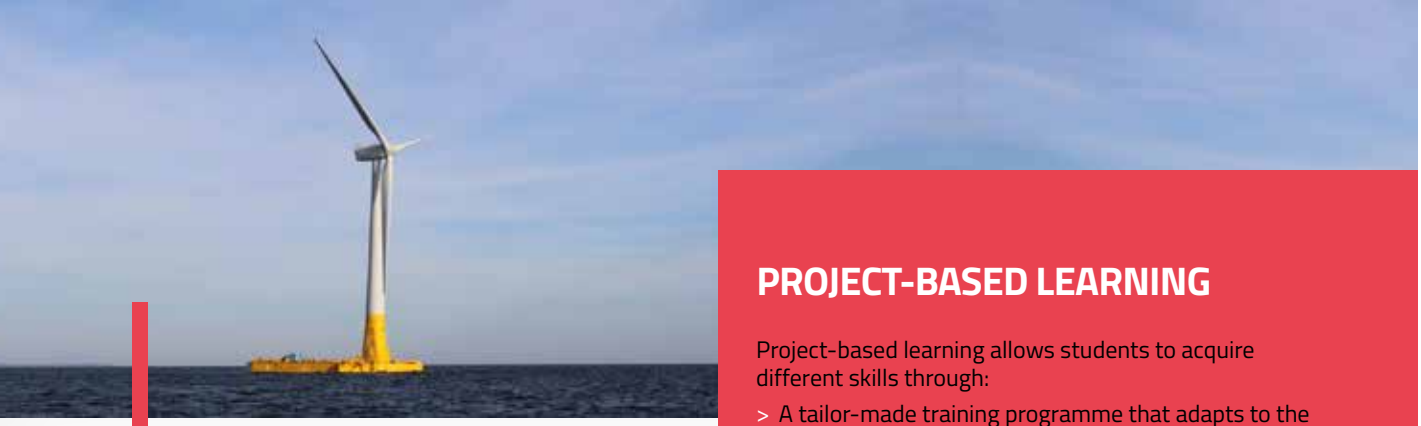
It's now a matter of real urgency that we understand and have others understand that the IPCC reports are not mere opinion, but scientific reality. In order to limit global warming to 1.5°C, the IPCC concludes that we must reduce our CO2 emissions by 45% (from 2010 levels) by 2030, reaching 'net zero' by the middle of the century.

This project specialisation is designed for students to take action to support the school - and more broadly, society - in reducing its carbon footprint. Students will be fully immersed in this topic on a daily basis, affording them the knowledge and skills to take action on this issue during their professional careers.

COURSE CONTENT

Support the school in an ecological and solidarity transition process to achieve carbon neutrality:

- Know and understand the main sciences and technologies related to energy, eco-design, climate change issues, etc., while exploring the associated solutions,
- Assess the school's carbon footprint and compare it with the previous measure. Propose an action plan to reduce the carbon footprint,
- Raise awareness about climate issues among students and school staff
- Develop digital tools to calculate the carbon footprint of a higher education institution and its users,
- Develop a platform accessible to other institutions to support them in their ecological and solidarity transition process,
- Implement, in agreement with Centrale Nantes, one or more actions with a high cost/benefit ratio and significant short-term impact,
- Communicate and share the work carried out in order to guide as many people as possible to reduce their carbon footprint.



INDUSTRY SECTORS

> Environment
> Energy
> Management
> Consultancy
> IT
> Innovation
> Communication
> Social

SKILLS

> Project engineering
> Carbon impact
> IT
> Data processing and analysis
> Knowledge transfer
> Change manangement
> Complexity management
> Teamwork
> Creativity

TEACHING STAFF

HEAD OF SPECIALISATION:
Emmanuel Rozière
Benoit Hilloulin

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emmanuel.roziere@ec-nantes.fr
benoit.hilloulin@ec-nantes.fr

PROJECT-BASED LEARNING

Project-based learning allows students to acquire different skills through:

> A tailor-made training programme that adapts to the needs of students
> Agile and autonomous organisation
> Tailored support
> An opportunity to take concrete action on a current and global issue,
> Full immersion in ecological and climate themes

PROJECT DELIVERABLES

> Carbon footprint of Centrale Nantes - Scope 3 CO2 (direct and indirect) emissions,
> Tools to measure the school's carbon footprint and also one's individual carbon footprint to encourage others to act collectively,
> Workshops and support media to raise user awareness and disseminate knowledge,
> Proposal for a climate action plan based on the carbon footprint,
> Regular project monitoring deliverables (minutes, progress reports and indicators, planning etc.),
> Assessment of the impact of the actions carried out within the specialisation to reduce Centrale Nantes emissions

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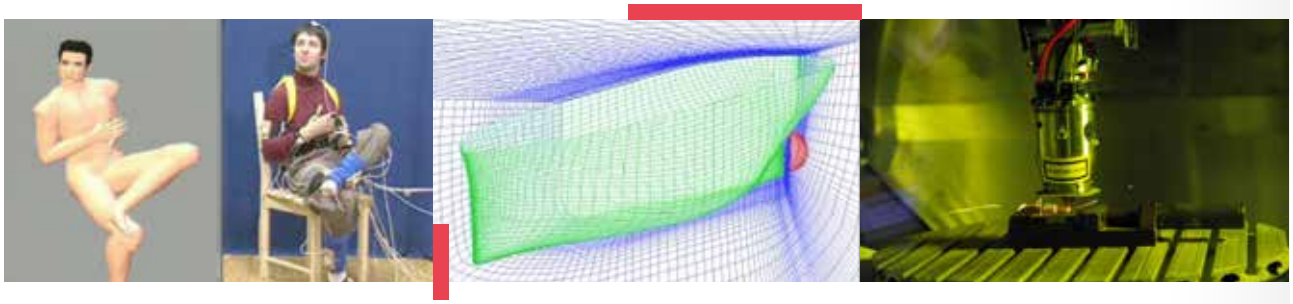
2ND AND 3RD YEAR SPECIALISATION

DOCTORATE

Centrale Nantes offers a doctorate option to final year students who are attracted to the sciences and want to turn progressively towards research, developing expertise in order to embark upon a PhD.

The aim of this option is to propose a research pathway to students who wish to pursue a PhD. Thus, students devote most of their final year of study to commencing research work which they will then pursue with a PhD at Centrale Nantes.

Centrale Nantes thus offers a suitable course and naturally leads students who wish to engage in research towards a PhD.



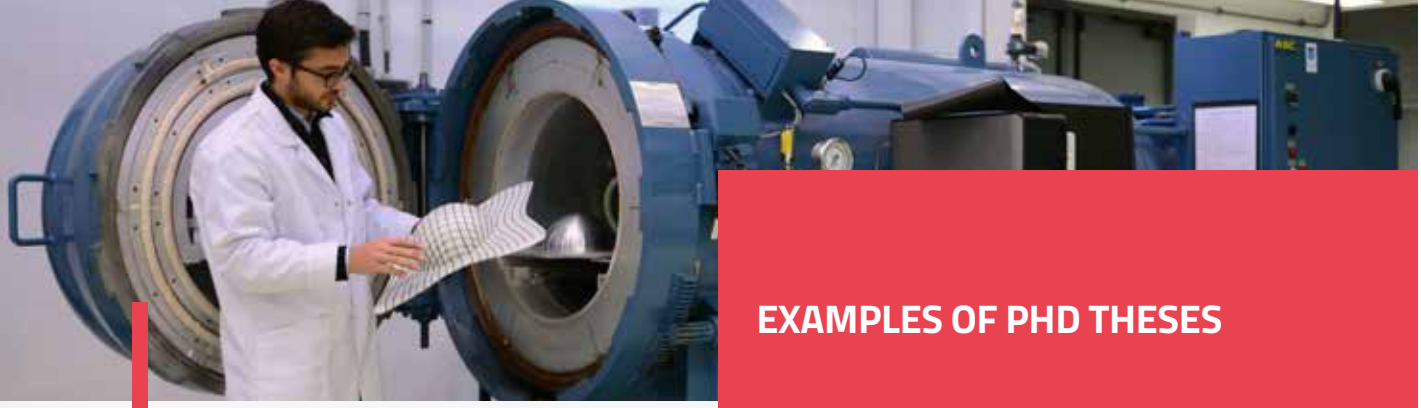
COURSE CONTENT

FROM SEPTEMBER TO THE END OF MARCH:

- Research work, replacing the specialisation
- Professional option
- Modern language classes and sport

FROM APRIL UNTIL THE END OF SEPTEMBER:

- 6-month full-time paid internship on the thesis subject. The internship can be undertaken in a laboratory outside Centrale Nantes (including abroad), or in a company.



RESEARCH LABORATORIES

Centrale Nantes hosts six laboratories on campus in collaboration with the CNRS (the National Center for Scientific Research) and other institutions such as Nantes University and Institut Mines Télécoms:

> Research Laboratory in Hydrodynamics, Energetics & Atmospheric Environment - LHEEA
> Laboratory of Digital Sciences of Nantes - LS2N
> Research Institute in Civil and Mechanical Engineering - GeM
> Urban Architecture Nantes Research Centre - AAU
> Jean Leray Mathematical Institute
> High Performance Computing Institute - ICI

Our laboratories work on the three challenges for growth and innovation: manufacturing, health and energy transition. Their thematic coverage is therefore vast and heightens the versatility of our training programmes.

INDUSTRY SECTORS

> Industrial R&D
> Academia

TEACHING STAFF

HEAD OF SPECIALISATION:

Jean-Yves Hascoët

CONTACT :
jean-yves.hascoet@ec-nantes.fr

EXAMPLES OF PHD THESES

> Ontological engineering for the creation and management of adaptive teaching resources.
> Behaviour of recycled concrete at earlier and later ages: influence of initial water saturation and substitution rate.
> Contribution to understanding the mechanisms of passivation in concrete reinforcements exposed to sea water: theory and thermochemical modelling.
> Virtual reality tools for universal design
> Advanced methods and multi-scale analysis for the study of the self-healing of cracks in cementitious materials.
> Ego-centred representations for the autonomous navigation of a humanoid robot.
> Influence of image features on face portraits - social context interpretation: experimental methods, crowdsourcing based studies and models.
> Deterministic modelling of large-scale sea states at variable depths.
> Predictive control and estimation of uncertain systems with delayed input.
> Model reduction method for parametric equations - Application to the quantification of uncertainty.
> Input-state linearization and decoupling of nonlinear systems with delays

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