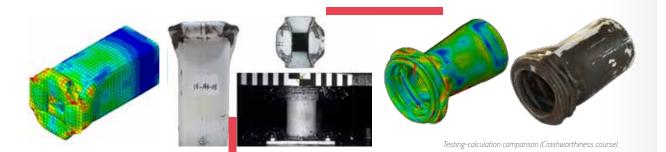**REINVENT** ENGINEERING

**CENTRALE NANTES**

**2ND AND 3RD YEAR SPECIALISATION**

# ADVANCED MODELLING & ANALYSIS OF STRUCTURES

To train engineers with strong skills in both modelling and numerical simulation in mechanics, and with an opening towards new experimental field measurement techniques. This analytical approach combining simulation and image-based experimental methods for solid mechanics is likely to play a major role in the solutions that science and technology can provide to the challenges of tomorrow (factory of the future, sustainable development, health, energy and mobility). More than preparing the student for a specific profession, the purpose of this specialisation is to instruct the engineer in this dual approach to analysis, which can then be applied to numerous industrial fields (automotive, aeronautics, space, energy, railway, naval, environment).



*Testing-calculation comparison (Crashworthiness course)*

## COURSE CONTENT

> Finite element method
> Architectural structures
> Solid dynamics and modal analysis
> Composite structures
> Fracture and damage mechanics
> Numerical methods for non-linear mechanics
> Fluid structure interaction
> Plasticity models

> Project 1
> Multiphysic couplings
> Crashworthiness and transportation safety
> Numerical methods for experimental analysis
> Scientific conferences
> Project 2
> Internship

## INDUSTRY SECTORS

> Transport (rail, automotive, aeronautics, space, naval)
> Energies (nuclear, fossil fuels, renewables)
> R&D
> Biomedical sector

## CAREER PROSPECTS

> R&D Engineer
> Structural Engineer
> Engineering Consultant
> Expert or managerial position
> Computing project manager

## TEACHING STAFF

**HEAD OF SPECIALISATION:**

Thomas Heuzé

**CENTRALE NANTES LECTURERS:**

Patrice Cartraud, Nicolas Chevaugeon, Pascal Cosson, Laurent Gornet, Thomas Heuzé, Grégory Legrain, Nicolas Moës, Hervé Oudin, Guillaume Racineux, Julien Réthoré, Patrick Rozycki, Rian Seghir, Laurent Stainier

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

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## EXAMPLES OF PREVIOUS PROJECTS

> Eulerian numerical simulation of waves in hyperelastic solid media
> Implementation and study of a concurrent multiscale approach
> Finite element simulation of inflatable wings
> Numerical simulation of thermal waves
> Shape optimization for acoustics
> Modeling pyrotechnic reactions
> Implementation of a (model-free) data-driven finite strain solver using FEniCS
> Self-heating fatigue limits and electrical resistance
> Study of dynamic cracking of a 1D bar using the cohesive element method.
> Data-driven approaches to viscoelastic heterogeneous materials
> Simulation of homologation tests and shape optimization of an electric bicycle frame assembled by bonding.
> Study of anterior tibial tubercle osteotomies using finite elements

## EXAMPLES OF PREVIOUS INTERNSHIPS

> Material Interface reconstruction for a multi-material Euler solver (Numerics GmbH)
> Model reduction on damageable composite structure (Safran Aircraft Engines)
> Study of the mechanical behavior of new generation leading edges (Safran Aircraft Engines)
> Knee mapping modeling (Segula)
> Study of diffusion phenomena in flexible pipes (Bureau Veritas Marine & Offshore)
> Fatigue study of a large container ship (Bureau Veritas Marine & Offshore)
> Numerical simulations of plasma jets (Akryvia)
> Analysis of mechanical behavior of fuel assemblies (Framatome)
> Vibration isolation and damping of space structures (Thales Alenia Space)

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