RECHERCHE

COMMET

Materials Behaviour, Modelling, Experimentation and Theory

Main activities

The objective is to develop tools for observing and quantifying deformation, damage and failure mechanisms, to propose and formulate reliable mathematical behaviour models for materials and structures, and to implement them numerically. These physically-based models of mechanical behaviour are intended to be adapted to industrial problems and needs and to predict the behaviour of these materials and structures in service and in extreme conditions.

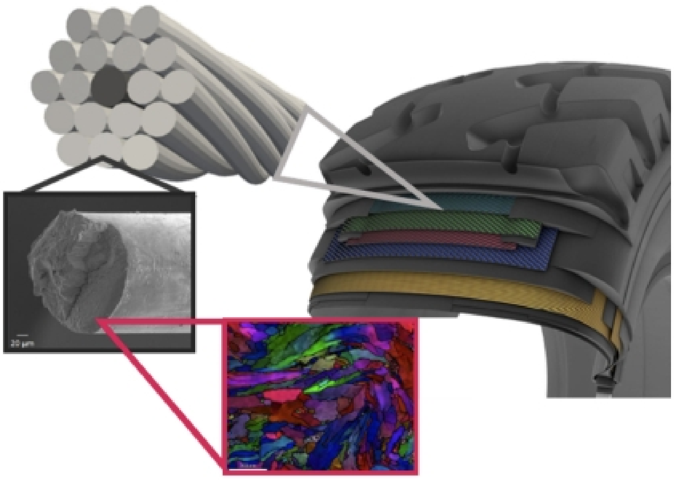
The team pays particular attention to the development of state-of-the-art experiments, from the atomic scale, with transmission electron microscopy (TEM), to the scale of the continuous medium and structures, via intermediate scales with the latest generation tools such as the SEM-FIB, SEM, nanoindenter, tomograph, X-ray diffractometer, etc., within which in situ mechanical tests are carried out. These developments involve complex loadings (uniaxial or multiaxial, under monotonic or non-monotonic conditions, quasi-static or dynamic, fatigue, multiphysics, under environment). This includes aspects from test management to the most modern techniques for identifying and validating models developed in parallel in the team.

Experimentation at all scales supported by 2D and 3D field measurements, multi-scale modelling of mechanical behaviour, multiphysical couplings and metallurgical transformations, anisotropy, damage to solid materials and cracking of structures, and theoretical mechanics, linked to fundamental mathematics (invariant theory and differential geometry) for modelling, characterise the team's main activities. The models developed are nourished by an in-depth knowledge of the underlying physical mechanisms and by the use of appropriate scale transition methods thanks to this close link between modelling and experimental characterisation. Particular attention is paid to the use of these models in the specific context of their use by our industrial partners.

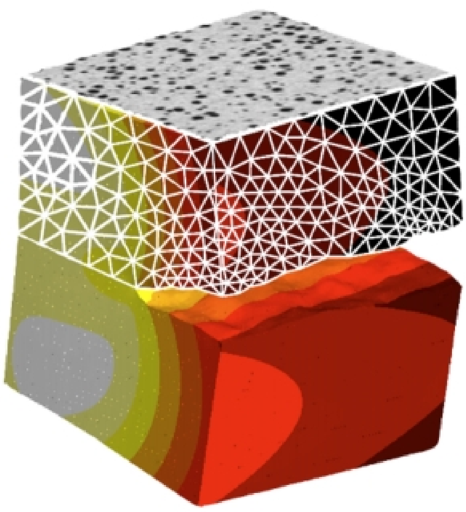
Objectives

The main applications are for materials used in the transport industry (aerospace, automotive, rail and shipbuilding), the energy production industry (nuclear power, oil and gas, and wind power) and the processing industry (ceramics, metallurgy and plastics).

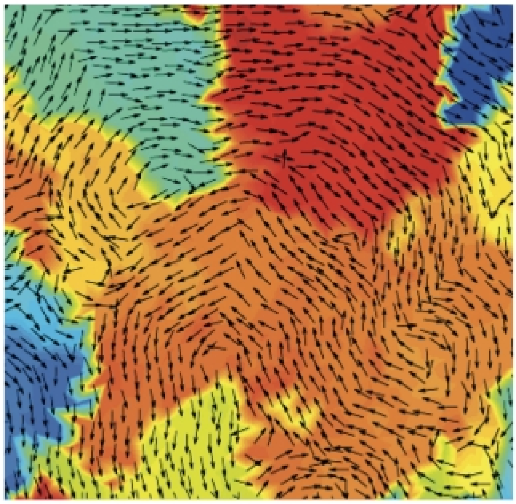
Research Operations (RO)



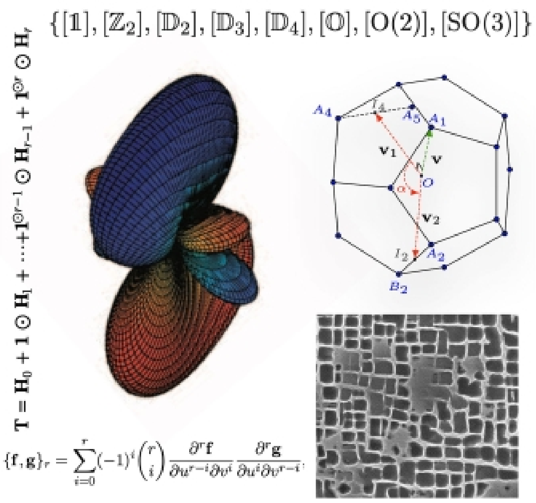
RO1 : Multiscale approaches to deformation, damage and failure



RO2 : Eikology



RO3 : Dynamic and multiphysical behaviour of materials



RO4 : Geometry and mechanics

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In pictures