# Efficient digital framework for a better understanding of damage initiation in discontinuous fibers composites

**CONTEXT:**

The ecological and economic pressures push aeronautics, naval and automotive industries to increasingly rely on composites. Such materials combine lightness and strength, contribute to the weight saving of structural parts and help reducing the dependence on fossil energy vehicles. Due to the complexity of the composite microstructure, a number of mechanisms are not yet described in a good manner: one of them is damage initiation.

In order to improve our understanding of the relationship between microstructure morphology and damage initiation of short fibers reinforced thermoplastic composites, we propose through this postdoctoral study to establish a realistic modeling of their microstructure. The main purpose will be: i) to model digital microstructures (Figure 1) obtained from tomography analysis generated from *in situ* testing; ii) to introduce pertinent damage mechanisms for modeling damage initiation at the representative volume element (RVE) scale and; iii) to improve the predictive response of the simulation by coupling RVE modeling with Digital Volume Correlation (DVC) techniques.

This study is part of a more global approach aiming at modeling the behavior and durability of polymer materials for automotive and aeronautical parts.

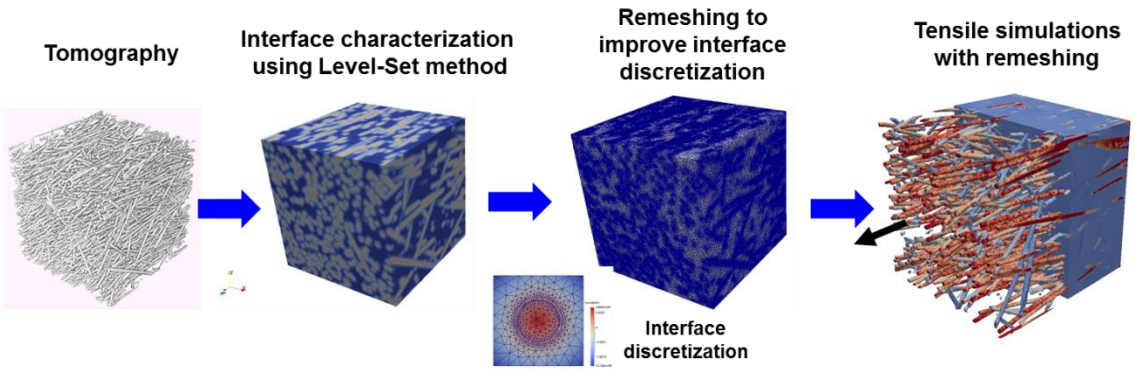


Figure 1: Immersion and tensile simulation of a RVE generated from the microtomography of a composite reinforced with discontinuous fibers.

**OBJECTIVES :**

The main objectives are:

- to qualitatively model the damage initiation at the microscale,
- to size the RVEs and to calibrate the numerical parameters in order to analyze the sensitivity of the damage response to different parameters of interest (fiber volume fraction, fiber orientation and / or length distributions, fibers shapes, interface quality, etc.).

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| Project Type / Collaboration | Study performed in collaboration with Art et Métier ParisTech (Bordeaux) and LMT. |
| Keywords | RVE – digital material – thermoplastic composite – damage – full field homogenization techniques. |
| Skills – Ability requested | Skills: finite element methods, C++, material constitutive behavior, good English skills, abilities to work with multi-disciplinary teams. |
| Contract duration | 12 months |
| Remuneration | 3000 euros monthly |
| CEMEF Teams | The Postdoctoral study will take place in the Physical Mechanics of Industrial Polymers (MPI) and MultiScale Modeling (MSM) Research Teams under the supervision of J.L. Bouvard and M. Bernacki. The study will be part of a collaboration with Art et Métier ParisTech (Bordeaux) under the supervision of N. Saintier and with LMT under the supervision of F. Hild. |
| Location | MINES ParisTech - CEMEF, Sophia-Antipolis (06), France |
| To apply | An application as a single file in PDF format should include a CV, a brief statement of research interests, and two names of reference. Send your application to : jean-luc.bouvard@mines-paristech.fr |