Fatigue damage characterization and modelisation on thermoplastic composite reinforced by continuous fibres

Stéphane GILLET
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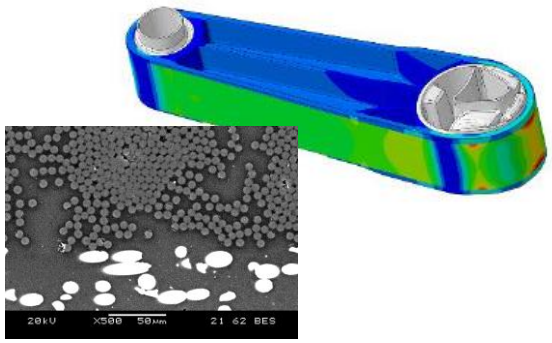
Industrial Partner: Cooper Standard
Supervisors: L. Laiarinandrasana, S. Joannès, N. Bedrici



- Monotonic and fatigue mechanical characterization of thermoplastic composite
- In situ Xray tomography testing in order to understand damage mechanism
- Fatigue criteria
- Application to engine mount bracket

Abstract:

Mass reduction for ground vehicle is a major goal of automotive industry in order to decrease C02 emission. Thermoplastic composite is an interesting solution in order to obtain compromise between mass reduction, mechanical performance and production rate.
Thermoplastic composites with long or short fibres are currently used in structural application like frame for engine mount. Their durability behaviour is becoming know but numerical models are not deployed for industrial application. An improvement is to use continuous fibres in order to increase mechanical properties and the possibility of mass reduction.
It is necessary for industrial actors to have model in order to predict the durability of technical parts. For this purpose, they need predictive mechanical models as well as monotonic than fatigue solicitation. Concerning thermoplastic composites reinforced with short and continuous fibres we must investigate before mechanical behaviour and damage taking account environment parameters (temperature and humidity) and micro-structure induced by process.
This work associate experimental and numerical approach in order to identify and simulate damage mechanism at different scale.
The first step of this thesis was to analyze the service condition part in order to limit the thesis perimeter (Stress ratio, stress triaxiality level, water uptake, tests procedures…). The second step was to obtain representative sample by designing and building an injection mold. Currently we analyse micro-structure of samples by MEB and micro-tomography. The next step is the experimental campaign with the purpose to understand mechanical behavior and damage mechanism. For this we develop a new X-ray tomography in-situ testing machine. Final step will concern numerical approach, with micro-mechanic model in order to represent damage at microscopic scale, and the determination of fatigue criteria at industrial part scale level.