

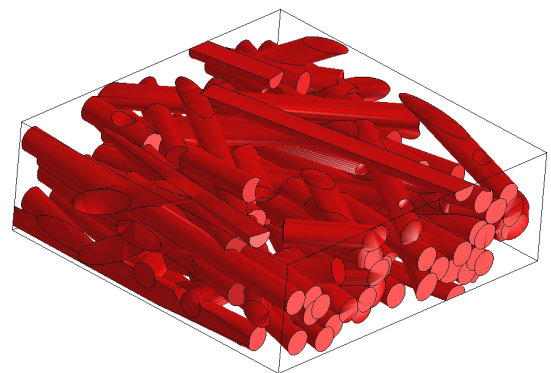
# Case Study: e-Xstream engineering

## Digimat-FE to identify Anisotropic Damping Behavior of multi-phases materials

### Challenge

Reinforced plastics and composite materials are chosen more and more because of their improved performance regarding damping for NVH applications compared to current metals. Material specialists need to efficiently identify this mechanical characteristic which, like the stiffness and failure, is anisotropic and driven by local fiber orientations in the material's microstructure. Moreover for NVH purposes, the frequency dependency must be clearly identified in order to provide accurate material models to design engineers.

On the other hand, the large variety of grades available makes it almost impossible to execute all experimental tests that would be necessary, especially in the early design stages, not only because of their cost but also because of the time required to do it. A numerical method can help material engineers quickly select the better grades to test for a given NVH target or even completely skip the physical test phases.



Representative Volume Element geometry for SFRP generated directly by Digimat-FE



**“Digimat-FE is an easy-to-use solution to create, run and post process advanced material finite element studies for various complex performances, such as damping in one and unique tool.”**

– Sylvain Calmels, Business Development Engineer, e-Xstream engineering

### Solution

*Digimat, effective modeling solution*

Among the tools available in the Digimat platform, Digimat-FE offers all required capabilities to treat such problem.

- Create and calibrate the necessary input material model with Digimat-MF
- Fully characterize the composite with multiple detailed material microstructures (RVEs) with Digimat-FE
- Perform a virtual DOE through transient dynamic FEA on the models for various frequencies

### Output:

- damping vs frequency curves for several directions of load and several fiber orientations to measure the level of anisotropy

### Results/Benefits

- Available in < 2 days when using available constituent models
- Quickly evaluate various multiphase materials to identify the best candidates for NVH targets
- Avoid waiting time and unneeded cost of performing additional experimental tests for each candidate material

### Key Highlights:

**Digimat:**  
Digimat-MF, Digimat-FE

**CAE Technology:**  
Marc

**Industry:**  
Automotive

**Application:**  
Multi-Phase Material Advanced Studies

**Performances:**  
NVH

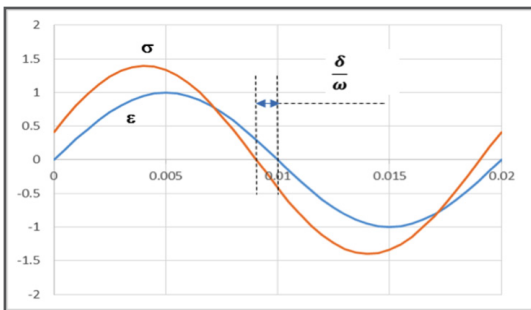


Figure 1: Damping is measured by the time gap between macro strain and stress answers on the RVEs

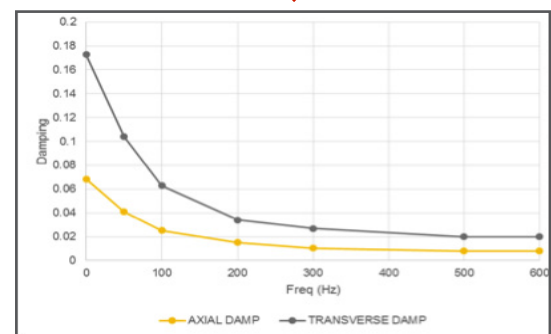
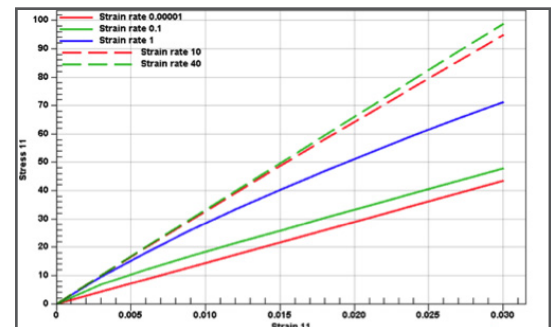


Figure 3: Get anisotropic and frequency dependent damping characterization from visco-elastic material behavior with FEA on RVEs

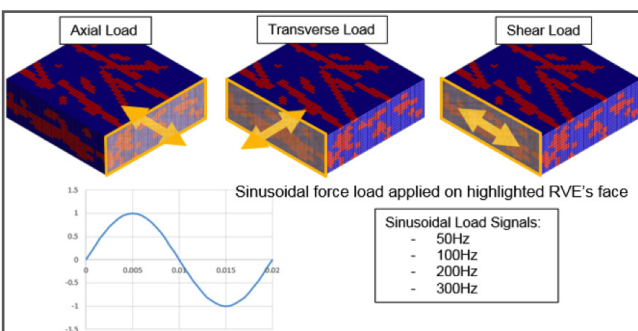


Figure 2: Numerical damping characterization based on Transient Dynamic analysis performed on various RVEs FE models fully created in Digimat-FE

For more information on Digimat and for additional Case Studies, please visit [www.e-Xstream.com](http://www.e-Xstream.com)