Case Study: Valeo Thermal Systems

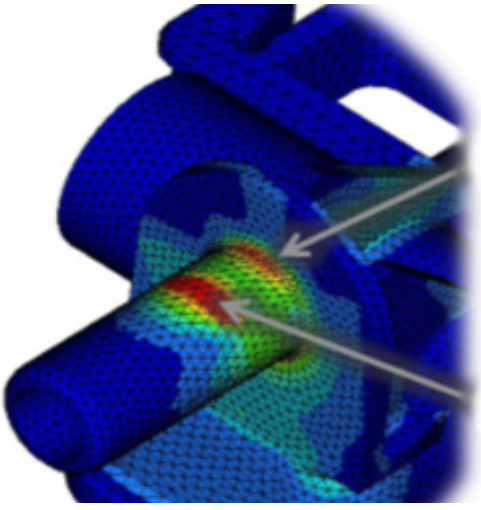
Improving failure prediction of injected parts made of reinforced plastics

Destructive test simulation of an automotive radiator component made of short glass fibers filled plastic

Challenge

Predicting the ultimate strength and failure location on a radiator cooling tank made of short glass fiber injected plastic remains a complicated task. This difficulty is due to the direct influence of the manufacturing progress on the mechanical behavior. In reality the fiber orientation distribution affects the local material behavior.
Metal inherited modeling techniques based on isotropic material model are known to lack in robustness. A material properties knock-down must be calibrated based on the part experimental response. The accuracy obtained after this calibration, if good enough, will not be repeatable for:
- different loadcases,
- different parts or even a new iteration on the same part,
- different manufacturing process parameters.

A more robust method is required to ensure a high fidelity prediction without any part testing and for all the cases involving the same material.



Failure indicator results showed 96% correlation to real test

"Thanks to Digimat-RP and a good Digimat material model checked, validated and sent directly by the material supplier (Solvay), the complete simulation process including rheology-structure coupling was fast and accurate."

– Rodrigo Benevides, Simulation Expert & Team Leader, Valeo Thermal

Solution

Digimat, effective modeling solution

The technology embedded in Digimat platform is based on micromechanical material model usage. This model can be directly provided by the material supplier in addition to the local fiber orientation tensor mapped from the injection mesh onto the structural mesh.

This methodology ensures to predict accurately the local anisotropic stiffness through the part and the risks of failure, in terms of part strength and failure location.

Results validation

Static failure high accuracy prediction

Digimat failure indicator values are post-processed for two different load cases, once experimentally measured force at failure occurs.

Failure's risk is identified for:
- Load case 1 : FI=0.96/1
- Load case 2 : FI=0.97/1

Benefits

Time & cost saving

• Lower Time & Costs.
No need to calibrate isotropic material model against existing part test data.

• Success at first attempt.
Accurate, reliable and easy simulation with Digimat model provided by material supplier.

• Model interoperability.
Only one Digimat model available for all loads, new iterations with CAD and manufacturing process.

• User-friendly.
Easy to use and interactive interface with a guided 4 steps process . No need to be an expert to get the best of the technology.

• Productive asset.
Time and costs savings let the opportunity to work on additional projects.

Key Highlights:

Digimat:
Digimat-MX, Digimat-RP,
Digimat Structural FEA

Customer:
Valeo Thermal Systems

CAE Technology:
Abaqus, Moldflow

Industry:
Automotive

Application:
Radiator Tank design

Performance:
Static failure

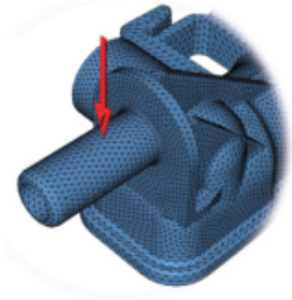


Figure 1: Load case 1

Figure 2: Load case 2

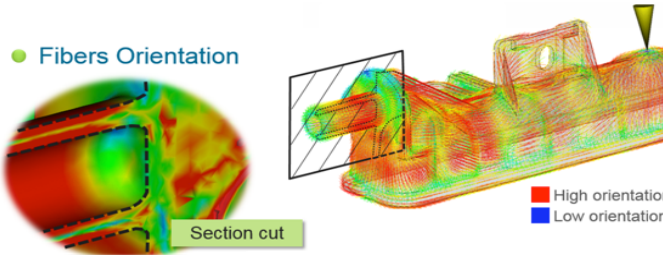


Figure 3: Fiber orientation field from Moldflow simulation

For more information on Digimat and for additional Case Studies, please visit www.e-Xstream.com

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