

Curing of Carbon Fiber Reinforced Plastics (CFRP)

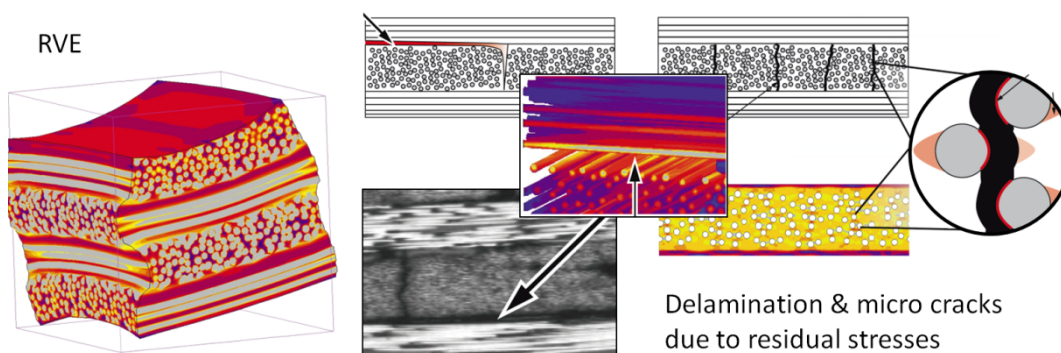
CUSTOMER: ISEMP (Integrative Simulation and Engineering of Materials and Processes)

- ISEMP aims at the simulation of material details and not only the macroscopic overall properties
- ISEMP aims at considering manufacturing process by the simulation
- ISEMP uses commercially available software tools

CHALLENGE

- Processing of CFRP results in residual stresses in the material
- Residual stresses lead to micro-damage & failure of CFRP
- Goal is to simulate residual stresses of a carbon fiber composite material at the micro scale with realistic topology

HOW CAN DIGIMAT CONTRIBUTE TO THE INVESTIGATION OF THE CFRP CURING PROCESS?



DIGIMAT SOLUTION

- Generation of RVE with continuous fibers and layered microstructure
- Realistic RVE with stochastically distributed fibers
- CAD geometry of RVE to be used with external solvers

RESULTS

- The FE-Simulation of laminate layers with inhomogeneous properties enables a detailed analysis of stress distribution and possible origins for different types of micro defect formation
- Highest stresses can be found at the fiber matrix interface
- Matrix areas between very close fibers are under higher load
- Fiber matrix interface between differently oriented laminate layers shows higher stresses

MATERIALS

Reinforced Plastics

PERFORMANCES

Residual stress

DIGIMAT

Digmat-FE

CAE TECHNOLOGY

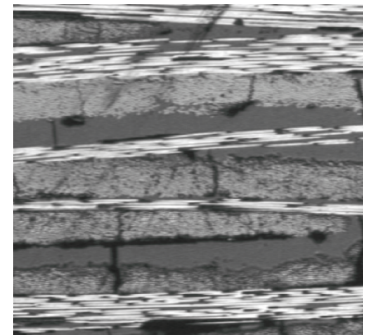
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INDUSTRY

Aerospace

APPLICATION

Manufacturing Process
Simulation



Manufacturing process defects in CFRP: segmentation cracks, pores, matrix enrichment & delamination.

"DIGIMAT enables us to perform in depth studies of complex and realistic microstructures. As an invest into the future we base our simulation approach on the DIGIMAT software, both for our research and the education of a new generation of simulation engineers who will be experts in the modeling of materials."

Prof. Vasily Ploshikhin,
Airbus endowed chair for
Integrative Simulation
and Engineering of
Materials and Processes
(www.isemp.de)



The Nonlinear Multi-scale Material & Structure Modeling Platform

DIGIMAT material modeling platform means developing innovative, optimized and cost-effective products. As a unique nonlinear multi-scale material and structure modeling platform, DIGIMAT offers:

- **Digimat-MF**; the **Mean-Field** homogenization software used to predict the nonlinear constitutive behavior of multi-phase material
- **Digimat-FE**; the **Finite Element** modeling of realistic Representative Volume Elements (RVE) of material microstructures
- **Digimat-MX**; the **Material eXchange** platform to reverse engineer, store, retrieve and securely exchange DIGIMAT material models between material experts and end users
- **Digimat-CAE**; the module that gathers interfaces to all major injection molding and structural FEA software codes
- **Digimat-MAP**; the shell and 3D mapping software to transfer fiber orientation, residual stresses, temperatures and weld lines from injection molding simulation onto a structural FEA
- **Micross**; a user-friendly tool for the design of honeycomb core composite sandwich panels based on FE analyses to compute bending and shear scenarios



The Material Modeling Company

e-Xstream engineering is a provider of simulation software & engineering services, 100% focused on advanced material modeling. Headquartered in Louvain-la-Neuve (Belgium) since 2003, today the company presence is worldwide through its branches in Luxembourg, Michigan (USA) and a large network of channel partners in Europe and Asia.

e-Xstream engineering develops and commercializes DIGIMAT – the nonlinear multi-scale material and structure modeling platform that fastens the development of optimal composite materials and parts.

DIGIMAT customers are material experts and structural engineers who accurately predict the behavior of multi-phase composite materials and structures. DIGIMAT is used by all major material suppliers and users across all industries (Automotive, Aerospace, Electric & Electronic, Leisure, Defense ...).

With this important customer base worldwide, e-Xstream combines deep expertise in material modeling and numerical simulations with the business understanding of the large variety of materials used across all industries.

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