

Continuous Fiber Reinforcement in Wind Turbine Rotor Blades

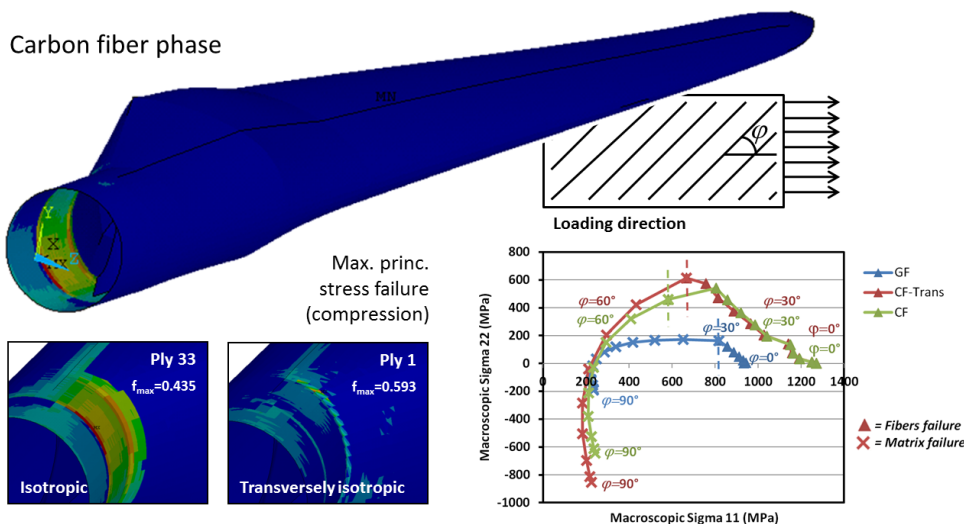
PARTNER: CADFEM GmbH

- ANSYS Competence Center FEM in Germany - Reseller of leading software solutions (ANSYS®, DIGIMAT) and provider of engineering services
- More than 25 years of FEA experience
- Know-how of more than 100 experts in FEM, consulting and support

CHALLENGE

- Design of bigger turbine blades with low weight & high rotational inertia
- Optimal use of expensive high-end composite materials
- Flexible & realistic simulation approach to investigate design concepts

HOW TO BRIDGE THE GAP BETWEEN MICRO AND MACRO SCALE?



DIGIMAT SOLUTION

- Multi-scale analysis based on ANSYS Composite PrepPost™ model
- Describe GFRP and CFRP composites via a unique material modeling approach using the mean field homogenization on the microscopic scale in DIGIMAT
- Fiber description taking into account isotropic or transversely isotropic properties
- Systematic analysis of failure directly in the Epoxy and the fiber phases

RESULTS

- Failure indicators are in general much lower for carbon fiber than for glass fiber reinforcement
- Carbon fiber reinforced blade fails on different ply level compared to the glass fiber design
- The usage of a transversely isotropic description for the carbon fibers is critically important for a realistic simulation approach

MATERIALS

Reinforced plastics

PERFORMANCES

Stiffness

DIGIMAT

Digmat-MF, Digimat-CAE

CAE TECHNOLOGY

ANSYS

INDUSTRY

Renewable energy

APPLICATION

Wind turbine blade



"DIGIMAT enhances our product portfolio and closes the gap towards advanced modeling of heterogeneous anisotropic and nonlinear materials. We see a large potential for taking into account the micromechanical properties of fiber reinforced plastics."

Martin Kracht, Product Manager DIGIMAT at CADFEM GmbH - ANSYS Competence Center FEM in Germany



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 **M**ean-**F**ield homogenization software used to predict the nonlinear constitutive behavior of multi-phase material
- **Digimat-FE**; the **F**inite **E**lement modeling of realistic Representative Volume Elements (RVE) of material microstructures
- **Digimat-MX**; the **M**aterial **eX**change 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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