Simulation of fibre reinforced polymers with adaptive FEM

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Lightweight construction is an important approach to increase energy efficiency. The usage of composite materials like fibre reinforced polymers (FRP) plays an important role in lightweight construction. FRP can be characterised by transversely isotropic material behaviour, a special case of anisotropy. Utilizing a homogenisation of the material as a continuum no modelling of the single fibres is needed.

A precise simulation of FRP components and safe failure criteria are the necessary basis for efficient design of lightweight structures. A fast as well as highly accurate computation can be achieved using the adaptive finite element method with its solution-dependent automatic mesh refinement.

In our talk we present the necessary efforts to include such material behaviour into an existing adaptive FEM code. We will show some results of our simulation of FRP with the adaptive finite element method.

References:

[1] Weise, M.; Meyer, A.: Grundgleichungen für transversal isotropes Materialverhalten. Chemnitz Scientific Computing Preprints CSC/10-03, Chemnitz, 2010

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