Automated Virtual Material Characterisation of Woven Reinforcement Fabrics

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Keywords: Meso-Scale, Shear, Weave

The interest in reducing weight of transport vehicles is rising, due to resource scarcity, legal provisions and environmental awareness. Lightweight materials are one approach for reducing vehicle masses. Fibre reinforced composites (FRC) are among the most promising lightweight materials, which combine high mechanical properties with low density. Besides these benefits, FRC are just used selectively due to high development and production costs which arise from complex production steps within the process chain. One step within the creation of an FRC is the preforming process, which causes approximately 50 % of the costs [1]. A way to achieve cost reduction and therefore a better accessibility of FRC is a virtual assessment of the reinforcement textiles, which leads to reduced development costs and better understanding of the material behaviour.
Within the scope of this research, an approach for automated virtual material tests of reinforcement weaves is presented with focus on shear deformation (see Fig. 1).
For this, a modelling approach on meso scale is developed based on [2] and [3]. This approach is automated utilising python, which includes an automated model creation, simulation and evaluation. For the automated model creation different input parameters are required, such as the yarns mechanical properties, the yarns cross section, spacing between yarns and the weave structure. With this automated simulation, parameter studies are done to assess real and potential parameter variations on the shear properties of woven textiles.

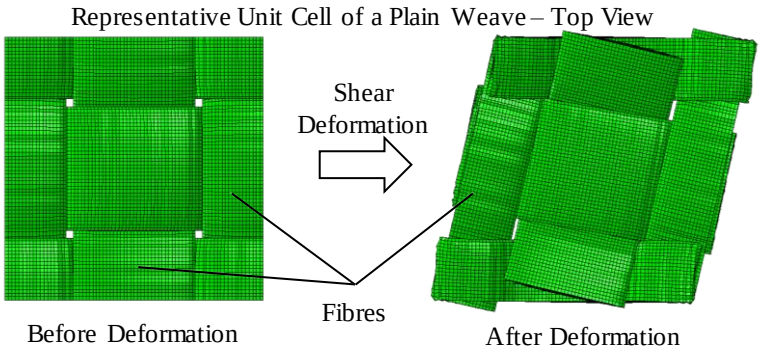

Fig. 1: Shear deformation simualtion of a plain weave representative unit cell

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