SIMULATION SUPPORTED DEVELOPMENT OF LIGHTWEIGHT PANELS WITH HIGH DELAMINATION RESISTANCE

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A new type of panels is developed that is based on spacer woven fabrics. A stable composite tape made of glass fiber rovings and a thermoplastic matrix is used as input material. These composite tapes are first formed with a pair of gears at elevated temperature to give them a three dimensional shape for weft insertion. The geometries of the gears depend on the configuration of the final panels. Secondly, the composite tapes prepared in this way are further processed on the weaving machine and spacer fabrics are fabricated. Finally, the spacer fabric is consolidated with a thermoset or thermoplastic matrix to form the final panel. A meso-scale finite element model based on shell elements is developed and used for the simulation of the panel manufacturing process and the structural behavior of the panels.

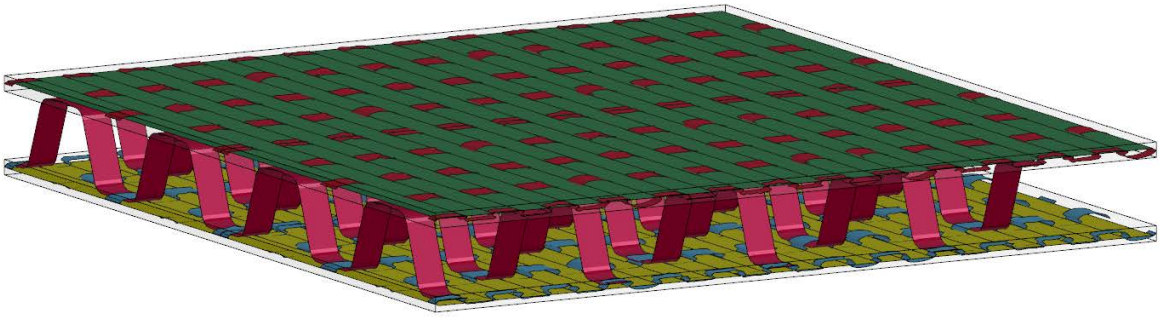

Figure 1: Model of consolidated panel

According to the computational results, the geometrical configuration of the inserted roving plays an important role in the mechanical behavior of the final panel under compression, bending and shear loads. A compromise between the compression and shear resistance must be chosen, depending on the actual loading. With the help of the numerical models, a suitable geometrical configuration for a practical working case can be decided prior the actual production. This helps saving time and cost by avoiding the "trial-and-error" method. The modelling method and the validation of the models are presented.

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