

Experimental Analysis Of Process Induced Draping Effects In Textile Preforms

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Abstract. In the manufacturing process of fiber reinforced composite components, the fiber orientation in the finished structure is created during the forming of textile fabrics into a three dimensionally shaped preform. The fiber orientation and the fiber volume content which define the mechanical properties of the structure are usually derived from a draping simulation. However, during the forming process, local imperfections change the local fiber volume content and thus influence the mechanical properties of the final structure. These so called draping effects, such as fiber waviness, gapping and transverse compression due to shear, cannot fully be predicted by a forming simulation up to now. The aim of this research is to experimentally describe the aforementioned draping effects in a complex preform (**FIGURE 1.**) and to quantify gaps and waviness to estimate their influence on the local fiber volume content.



FIGURE 1: L-shaped preform of unidirectional carbon fiber non-crimp fabric

The method presented comprises experiments forming unidirectional non-crimp fabrics (NCF) into a complex L-shaped mold and qualitative as well as quantitative analysis of draping effects. The forming tool (**FIGURE 2.**) includes a corner blend, two different draft angles, a global punch holder and 19 adjustable pressure pads to influence the resulting draping effects in the NCF structure. In single and double layer preforms, the draping effects will be analyzed by optical image analysis to identify regions of

interest (ROIs) where draping effects will be further quantified. Computer tomography is used to analyze draping effects in inner layers of an ROI of a multi-layered preform.

The experimental characterization of forming induced draping effects will enable the improvement of material forming simulation and thus facilitate a continuous virtual process chain.

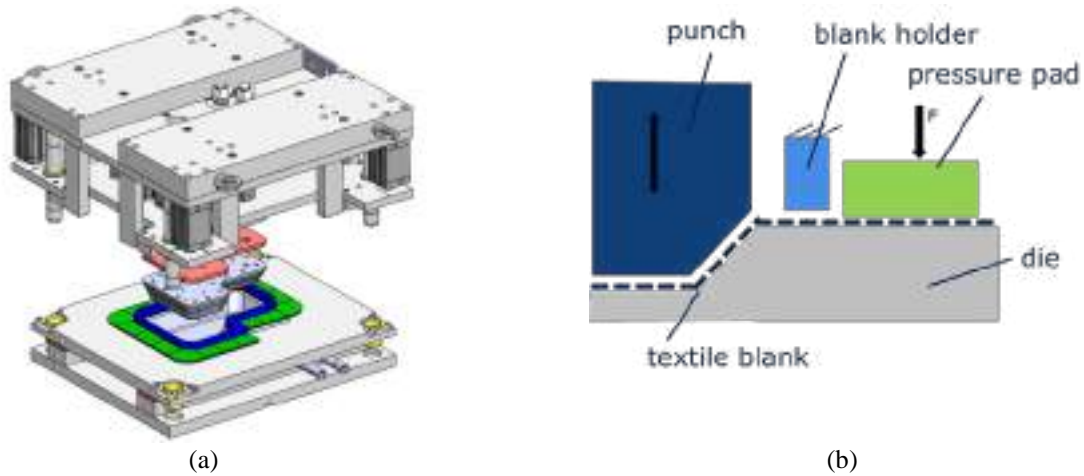


FIGURE 2: Illustration of the draping concept to investigate draping effects: (a) mold for experimental investigation of draping effects (partially exploded view), (b) schematic of the mold concept with the basic parts

Keywords:

- Preforming
- NCF
- Draping effects
- Fiber waviness
- Virtual process chain
- Mould design