Numerical Modeling of an Innovative Forming Process for Three-Dimensional Fiber-Metal Laminates

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Abstract. Fiber-metal laminates (FML) are known for their excellent fatigue properties. Therefore, they are used in the aviation industry for the fuselage. The geometric complexity of these parts is limited to large one-dimensional curvatures. In order to use FMLs for various industries, such as the automotive industry, new manufacturing techniques are needed to increase the formability of FMLs for more complex geometries. A new approach is the combination of deep drawing with the thermoplastic resin transfer molding (T-RTM). This process makes it possible to produce three-dimensional FMLs in just one process step from the raw materials (metal sheet and dry fiber fabric) without preliminary stages, such as pre-forming the textile or metal sheet. The process was developed based on a generic cup-shaped geometry. In order to use it for more complex geometries, numerical tools are needed for the prediction of forming behavior and tool development. The aim of this paper is to show a first approach to model this combined process for the tested generic geometry. With this approach, the interaction between the different deformation behavior of the metal and of the textile and their influence on the forming result of the hybrid fiber-metal laminate will be investigated.