UTILIZATION OF MORPHING/SIZING CAPABILITIES TO OPTIMIZE PERFORMANCE OF REINFORCED PLASTIC COMPONENTS TAKING INTO ACCOUNT THE FIBER ORIENTATION EFFECTS

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KEYWORDS – Morphing, Sizing, Optimizing, Fiber, Plastic

ABSTRACT – Static or dynamic simulations of plastic components is a process that requires knowledge of the material behavior which is dependent on many different factors. One of the major advantages of plastic part design is the high degree of flexibility to adjust sectional properties such as wall thickness and shape. This flexibility also increases the complexity of designs which makes analysis predictions quite difficult. The designer/analyst responsible for predicting the response of such a part utilizing a plastic material faces the difficulty of making assessment on the part performance and then quickly make adjustments to improve performance. Analysis predictions are significantly depended on the orientation of fibers whenever a reinforced material is utilized. The dependency of performance to processing and thus fiber orientation effects is highly depended on part properties such as geometry and thickness.

Morphing and automatic sizing of different parts of a design can be utilized in a loop process to quickly yield results that normally require multiple design iterations of a CAD 3D model which require a lot of time to complete. This has a negative impact on cost as well as timing for the completion of the project. The process utilized here can evaluate a large number of design iterations in a relatively short time. Once a satisfactory design is achieved the fiber orientation effects for the particular plastic material are taken into account and the appropriate analysis is performed. Analysis results taking into account the anisotropic behavior of plastic materials yield a very accurate prediction where the failure of the material is taken into account.