

# Numerical simulations of overmolded composite parts by means of a cohesive zone model

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In order to increase the production speed of composite parts, CETIM has developed the Quilted Stratum Process (QSP) which consists in the thermoforming of thermoplastic composite parts made up of long fibers patches, possibly including overmolded elements reinforced with short fibers. A crucial element for the sizing of the parts is the behavior of the interface between the long fiber and the short fiber zones. In this work, the damage and failure response of this type of junction is investigated by means of a cohesive zone model.

The structure considered here is a simple T joint and the results of tensile tests were provided by CETIM. A dissipation-driven algorithm was implemented in order to simulate the full response of the structure, including snap-back [1]. A parametric analysis was then carried out to study the influence of the parameters of the cohesive law, especially the critical energy release rate  $G_c$  and the peak stress  $\sigma_0$ , on the breaking load and the size of the process zone [2]. The value range of the parameters covers thermosetting and thermoplastic materials [3].

Depending on the chosen values, one can either be in the case of small-scale bridging, for which only  $G_c$  controls the failure, or large-scale bridging, for which both  $G_c$  and  $\sigma_0$  play a role. Both behaviors were observed within the range of parameters retained for the analysis.

The orders of magnitude of the breaking load obtained in the simulations were consistent with those of the tensile tests. This demonstrates the pertinence of the modeling approach, and it highlights the need for specific experimental tests to characterize the long fibers/short fibers interface properties.

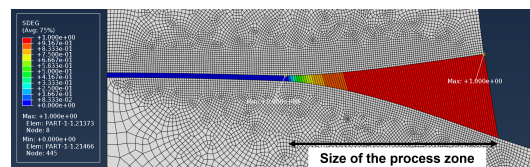


Fig. 1: Contour plot of damage (SDEG) in the cohesive zone on Abaqus

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