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# MULTISCALE SIMULATION OF VOID GROWTH USING AUTOMATIC ANISOTROPIC ADAPTIVE MESHING AND A LEVEL FINITE ELEMENT APPROACH

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During the forming processes of thermoplastic composites, deconsolidation phenomenon due to the induced thermal or mechanical stresses can occur where the porosities appear in different forms. This work therefore aims to develop advanced simulation tools for multiphase flows occurring on thermoplastic composite forming. The objective is to better understand and predict, by direct numerical simulations, the appearance and evolution of porosities on the microscale in function of the macroscopic process conditions of prepregs manufacturing. And thus, establish a new model for the evolution of the porosity rate in part, usable at the process scale, from these direct simulations and experimental observations. At the macro scale, we use thermomechanical models considering an anisotropic multiphase medium. These models allow to obtain the local stresses and temperature state in the part. These macroscopic results will be used for the simulation of the nucleation and growth of porosities at the microscopic scale. At the micro scale, in order to precisely calculate the growth of porosities on real composites, the adaptive meshing must be considered. From tomographic images, an iterative immersion-adaption algorithm is developed to provide the adaptive anisotropic mesh using a parallel mesh generator. On the other hand, an anisotropic porosity growth model is developed, this model is based on those of the growth of spherical bubbles, readjusted in order to respect the real geometric properties of the composites preventing the growth of porosity in the fibers. Validation of computations at both scales is proposed by comparison with benchmark examples and experiments.

## REFERENCES

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