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Numerical simulations of adhesive squeeze flow: a review

L.A. Silva¹, C. Espinosa¹, L.F.M. da Silva², E. Paroissien¹, F. Lachaud¹

¹Institut Clément Ader (ICA), Université de Toulouse, ISAE-SUPAERO, INSA, IMT MINES ALBI, UTIII, CNRS, 3 Rue Caroline Aigle, 31400 Toulouse, France

²Department of Mechanical Engineering, University of Porto, 4200-465, Portugal

Debonding on demand structural adhesives is becoming a relevant topic for, in particular, recycling strategy issues. A debonding methodology has been developed by the FEUP using Thermally Expandable Particles (TEP). In order to enhance the properties of the material, it is expected to control the distribution of the TEPs in the uncured adhesive. After dosage and mixing, the adhesive is applied manually or automatically on a substrate. At this point starts the fluid structure interaction (FSI), where the substrates are approached and fixed before the last step, when the adhesives becomes solid, by the process of curing [1]. To optimize the on demand debonding, it is first necessary to control the distribution of the fillers in this uncured phase. We are interested here in evaluating the different numerical methods that are used or could be used to simulate the approach of substrates and the squeezing process of charged uncured adhesive.

Grid-based numerical methods are widely used for fluid simulations, either using Lagrangian or Eulerian reference frame, including the finite difference method (FDM), finite volume method (FVM) or the finite element method (FEM) [2]. In this study, we also consider the Smooth Particle Hydrodynamics (SPH) method which is meshfree method associated with particulate discretization of the matter and the movement [3].

The knowledge of these methods allows addressing the squeeze flow problem in order to obtain the final distribution of the adhesive and inclusions in the joint.

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