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Derivation of Imperfect Interface Laws for Multi-Physic Composites by a Multiscale Approach: Theoretical and Numerical Studies.

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Structural bonding assembly has become an important technological solution over the past few years and is increasingly replacing bolting assembly. The resulting structure has many advantages, such as weight savings or the elimination of stress concentration.

In the present study, we consider a specific type of composite, constituted by two media, called the adherents, bonded together with a thin interphase layer, called the adhesive. We assume that the composite constituents are made of different multi-physic materials with different constitutive properties. The study considers a generic multi-physic coupling in a very general framework and can be adapted to well-known multi-physic behaviors, such as piezoelectricity, thermo-elasticity, as well as to multifield microstructural theories, such as micropolar elasticity.

The general multi-physic interface model developed is then numerically tested through the finite element method. In particular, in the framework of piezoelectricity, we compare the results obtained by modeling the adhesive as an interphase, having a thin finite thickness, with the results obtained with the general multi-physic interface model.

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