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ON MODELING HARD ADHESIVES WITH MICRO-CRACKING DAMAGE

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ABSTRACT

Bonding assembly is increasingly used in many industrial fields such as aeronautic, automobile, nuclear, civil, mechanical and bio-engineering, mainly because structural adhesives offer low-cost assembly techniques, lightness, reduced stress concentrations and a great design freedom. In the case of hard (or stiff) adhesives, few models are able to accurately describe their under-loads mechanical behavior. A new analytical modeling approach for thin adhesives is herein proposed, providing a hard interface condition with evolutive micro-cracking damage, allowing for a suitable replacement of adhesive layers in numerical simulations. The analytical model is obtained by combining asymptotic theory and micromechanical homogenization in the framework of several schemes, strain and stress-based. Depending on the chosen scheme, it is found that the model is able to describe both ductile and brittle damage occurring in adhesives. The constitutive and structural behavior of the interface model under several loading conditions are illustrated by academic examples and comparisons with experimental data available in literature. Promising results are obtained suggesting that the proposed interface model can provide an accurate macroscopic description of hard adhesives with micro-cracking damage.

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