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ANALYTICAL AND NUMERICAL MODELING OF COMPOSITE ADHESIVELY BONDED JOINTS BASED ON THE EULER-BERNOULLI THEORY AND HIGHER-ORDER MODEL FOR ELASTIC THIN INTERFACES

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Composite adhesively bonded joints are widely used in various industrial and technological applications, including aerospace, electronics, biomedical, automotive, ship building and construction [1,2]. In this contribution, the attention is focused on layered structures consisting of two strips bonded together by an adhesive layer. For such structures, a modeling approach based on the classical Euler–Bernoulli beam theory in conjunction with an adhesive implicit interface law is introduced. This implicit form, recently proposed by the authors in the contest of linear elastic adhesive and adherents materials and small strains and small displacements theory, models the asymptotic behavior of a very thin interphase at higher orders for both the cases of hard and soft interface materials in a unified approach [3]. Accounting for higher order terms of the asymptotic expansions in the adhesive, the proposed approach is thus expected to extend simpler models based on the classical spring-type interface law or on the case of perfect contact between the adherent layers.

The proposed methodology is used to evaluate stresses in several adhesively bonded joint configurations subjected to the tensile, moment and transverse shear loadings. Numerical simulations are produced and the results show good agreements with those obtained through the finite element solutions.

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