MODELING IMPERFECT INTERFACES IN LAYERED BEAMS THROUGH MULTI- AND SINGLE-VARIABLE ZIGZAG KINEMATICS

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Multiscale structural models based on the coupling of a zigzag kinematics approximation and a cohesive crack approach have been recently formulated to effectively analyze the response of shear deformable layered structures with imperfect interfaces and describe progressive delamination fracture in these systems (see [1,2] for reviews). The zigzag kinematics accounts for zigzag effects associated to the elastic mismatch of the layers and for displacement jumps due to interfacial imperfections/delaminations using a reduced number of variables, which is independent of the number of layers. The effects of imperfect interfaces on the response of structures subjected to thermo-mechanical loading and on wave propagation and dispersion have been analyzed and the advantages of this approach over discrete layer models and layerwise theories have been highlighted and discussed in [1,3]. Mode II dominant, single and multiple delamination fracture in shear deformable layered beams have been effectively studied using two displacement variables as in first order shear deformation beam theory [4].

In this presentation we will review and discuss the models in [1,3-5] and present preliminary results on novel single-variable formulations for layered beams, inspired by the technique developed for homogeneous Timoshenko beams in [6]. The formulation using zigzag kinematics is expected to offer advantages in the analytical solution of the problem and to overcome some limitations in the finite element implementation of the classical theories.

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