Advanced modeling of the mixed-mode delamination for composite specimens

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Abstract

In recent years, many engineering components are made of high performance laminated composites and adhesively bonded interfaces. One of the most important damage modes of laminated structures is related to the non-linear and irreversible delamination process, including the formation and propagation of inter-laminar cracks, up to the complete detachment of the adherends. In this context, we address the interfacial delamination problem through an innovative cohesive formulation, named as Enhanced Beam Theory (EBT), where the specimen is considered as an assemblage of two composite sublaminates, partly bonded together by an elastic interface. This last one is represented by a continuous distribution of elastic springs acting along the normal and/or tangential direction, depending on the interfacial mixed-mode condition. This generalizes the idea suggested recently in [1] for a single mode-I delamination, and extended in [2] to include mixed loading, geometrical and mechanical conditions. The problem is here handled numerically through the Generalized Differential Quadrature (GDQ) approach, to determine the delamination onset and propagation along weak interfaces of arbitrary shape, made of composite materials and subjected to mixed-mode conditions. The accuracy of the proposed formulation is verified against analytical predictions and theoretical formulations available in literature [3][4].

Keywords: **Adhesive interfaces; GDQ method; Laminated structures; Mixed-mode delamination**

References

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