Enhanced beam-theory models for delamination test specimens

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Keywords: Composite laminate, delamination, mixed-mode fracture, beam theory.

A wide variety of laboratory tests is currently employed to characterise the delamination toughness of composite laminates in both pure and mixed fracture modes. Test results are interpreted by means of suitable theoretical models, which enable the determination of the critical energy release rate, G_c, and its modal contributions, G_{Ic}, G_{IIc}, and G_{IIIc} [1].

In the case of I/II mixed-mode fracture, the Authors have developed enhanced beam-theory models of the ADCB and MMB tests, where the specimen's delaminating layers are modelled as laminated beams connected by an elastic–brittle interface [2–4]. Accordingly, the exchange of normal and tangential interfacial stresses between the sublaminates is explicitly accounted for, in particular in the neighbourhood of the crack-tip.

The adopted modelling approach has been later generalised to deal with the case of a delaminated laminate subjected to generic boundary conditions, showing that a complete explicit solution to the problem can be deduced, including analytical expressions for the internal forces, interfacial stresses, energy release rate, and mode-mixity angle [5]. The solution obtained can be effectively applied to interpret experimental results of the most popular mixed-mode delamination test specimens such as, for instance, the ADCB, ELS, MMB, and SLB tests.

References
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