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Calculation And Measurement of Material Properties of Laminated Polymer Composite

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ABSTRACT

The mechanical representation of fibre-reinforced polymer composite materials is currently of major interest with their expanding utilization in the industry. These progressive materials have excellent material characteristics, which can be obtained numerically or by experimental tests. This paper presents different approaches for obtaining the longitudinal Young´s modulus of thin unidirectional laminated carbon fibre-reinforced polymer (CFRP) composite based on the microstructure model, cohesive zone model, tensile test, three-point bending test, and the Impulse Excitation Technique. Experimental results are juxtaposed to the results obtained from the numerical homogenization technique and numerical delamination in mode I for evaluation of the accuracy of the different approaches. Within the micro-level numerical approach, the fictitious periodic microstructure model is used. With the use of Karamba 3D FEM analysis, the longitudinal Young´s modulus was obtained using simulation of a tensile test. A quasi-static formulation of an interface damage model which incorporates Rayleigh damping of viscoelastic CFRP composite is presented. The interface traction-relative displacement response assumes a thin adhesive layer with behaviour that is analogous to cohesive zone models. The solution to the delamination problem is sought by a semi-implicit time-stepping procedure. The obtained results demonstrate the applicability of the described numerical and experimental models.

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