4. Interlaminar Damage Behavior of CFRP Composite Laminates under Cyclic Shear Loading Conditions

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Abstract

This paper provides quantitative description of interlaminar damage process in CFRP composite laminates under cyclic shear loading. Quasi-static end-notched flexural (ENF) test on 16-ply CFRP composite laminate beam, $[0]_{16}$ and its complementary validated FE model provide the reference "no-interlaminar damage" condition. Two identical ENF samples were fatigue to 50000 cycles, but at different load amplitude of 90 and 180 N, respectively (Load ratio, R = 0.1) to induce selectively property degradation at the interface crack front region. Subsequent quasi-static ENF tests establish the characteristic of the interlaminar damage degradation. The residual peak load for the fatigued ENF samples is measured at 1048 and 914 N for the load amplitude of 90 and 180 N, respectively. Cyclic interlaminar shear damage is represented by a linear degradation of the residual critical energy release rate, G_{IIC} with the accumulated damage. Reasonably close comparisons of the predicted residual load-displacement responses with measured curves serve to verify the suitability of the assumed bilinear traction-separation law for the cyclic cohesive zone model (CCZM) used.

Keywords: CFRP composite laminate; Interlaminar shear damage; Cyclic cohesive zone model; Finite element simulation

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