عنوان مقاله:

Assessment of Multiple Failure in CFRP Composite Laminates Using Damage-based Models

محل انتشار:

کنفرانس دو سالانه بین المللی مکانیک جامدات تجربی (سال: 1394)

تعداد صفحات اصل مقاله: 3

نویسندگان:

S.S.R. Koloor - *Doctor Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, 81310 UTM, Skudai, Johor, Malaysia.*

M.R. Ayatollahi - *Professor, School of Mechanical Engineering, Iran University of Science and Technology, Tehran, 16846-13114, Iran*

M.N Tamin - *Professor, Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, 81310 UTM, Skudai, Johor, Malaysia*

خلاصه مقاله:

This study establishes a validated computational-experimental approach for quantitative assessment of the mechanics of deformation and mechanism of multiple failures in fiber-reinforced polymer (FRP) composite laminates. A continuum damage model for lamina and cohesive zone model for interface, are used to predict the multiple damage processes in the meso-scale of composite laminates. These constitutive and damage models are incorporated into the finite element (FE) simulation case of the structure. A carbon fiber-reinforced polymer (CFRP) composite beam specimen with anti-symmetric ply-sequence of [-45/45/-45/90/45/90/90/-45/90/45/-45/45] is tested under four-point bending loading condition. The comparable FE-predicted load-central deflection curve with measured data serves to validate the FE model with respect to the mechanics of the deformation. Results show that multiple damages of matrix cracking occur in the lamina No. 9, while the interfaces between laminas No. 8/9 and No. 9/10 experience edge delamination, as also observed experimentally. Such identical comparisons provide partial validation of the FE model with respect to the mechanisms of failure. It is noted that the fiber damage accumulation in the critical meso-scale laminas under tension (No. 10 to 12) significantly contributes to the observed stiffness degradation of the structure.

کلمات کلیدی:

CFRP Composite, Lamina Damage Modle, Cohesive Zone Model, Finite Element Simulation

لینک ثابت مقاله در پایگاه سیویلیکا:

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