Abstract

In the present study a micromechanics based damage mesomodel based on model proposed by Ladevèze et al for initiation and propagation of damage in different parts of a composite laminate has been developed for unidirectional fibrous composite under quasi-static loading. In this case, laminate is modeled as consisting of plies and a very thin layer of interface in between adjacent plies. Laminae here are considered to be transversely isotropic with known effective properties while the interface between them is regarded as an isotropic material having same properties as the matrix material. Along with the analysis, starting from macro-level strain calculations, different modes of failure at micro-level can also be predicted using this model. The various modes of failures considered in the analysis are fiber breaking, fiber matrix debonding and matrix cracking in the lamina. There can be interlaminar failure, i.e., delamination due to transverse stress or shear stress as well. The macro stresses in the lamina and the micro stresses in different constituent phases are related to each other with strain concentration factors calculated from the micromechanical analysis on a RVE model. The damage indicators are assumed to be same at micro-level and lamina level. Hence failure in any of the constituents results in failure of the laminate as a whole. Lamina level models are developed with 0°, 90° and ±45° fiber orientations. The model is tested for Silenka E-Glass/1200texY556/HT907/DY063 epoxy material. The results obtained for traction and compression loading are in good agreement with the results presented in World Wide Failure Exercise (WWFE).

Note: Proposed Model: Ladevèze P., Allix O., Deü J-F. and Lèvêque D. A mesomodel for localisation and damage computation in laminates. 183:105122, 2000.