

Residual strength prediction for multi-directional composites subjected to arbitrary fatigue loads

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ABSTRACT

As it is important to know a structures capacity of carrying further loads after particular load or time periods, a in-depth investigation on the computation of residual strength of multi-directional laminates is presented in this paper. The computational model focuses on ply-wise structural analysis of continuous fibre reinforced plastics at the mesoscale level and thus it belongs to the group of mechanistic models. The aim of the paper is to determine the fatigue life and residual strength of multi-directional laminates with the exclusive use of uni-directional ply data. For this reason, detailed strength degradation at the ply level is considered and the application of suitable models for the lifetime and residual strength estimation after certain combined fatigue loads is examined. Results for laminates under pulsating and alternating stress ratios for the different models are discussed in terms of their benefits and limitations for a practicable application. It is finally shown, that the nonlinear models are a great improvement for residual strength calculation and agree very well with experimental data from well documented composite fatigue data base OptiDAT.