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MICROMECHANICS BASED RELIABILITY ANALYSIS FOR LAMINATED COMPOSITE STRUCTURES

Abstract

A novel micromechanics based reliability analysis method for laminated composite structures is proposed. The contributions of the work are mainly shown in two aspects: 1) the uncertainty modelling of the constituents mechanical properties; 2) a reliability analysis method based on the model. Compared with the existing uncertainty models of laminates, the elastics and strengths of the constituents are considered simultaneously as random variables, which enables the analysis of the micro mechanical uncertainties to be realized. Based on the model, computational homogenization is employed to link the elastics of constituents to that of the structure. Then the micro stress is solved to judge the failure of the constituents using micromechanics of failure theory. The estimation of the reliability index are realized using first-order reliability method. The micromechanics based reliability analysis reveals the sensitivity of microscopic uncertainties and the correlations of the structural elastics. A numerical case of AS4/3501 laminates is studied to demonstrate the validity of the proposed reliability analysis method.