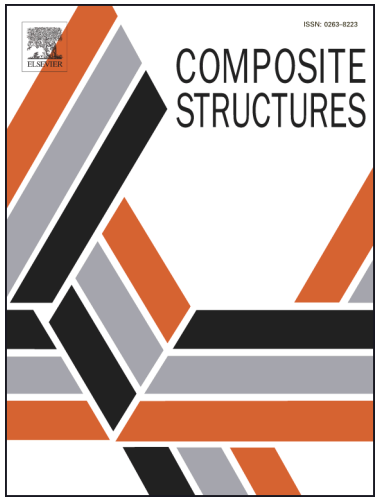

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A Multiscale Experimental Approach for Correlating Global and Local Deformation Response in Woven Composites

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Abstract

A multiscale experimental approach is introduced that facilitates correlating globally applied stress to the local material response at yarn scale. Using a high-resolution optical digital image correlation, low and high strain zones in off-axis woven composite samples loaded in uniaxial tension are identified and the corresponding full-field strains are quantified. The local strain response quantified over low and high strain domains are used along with the continuum scale deformation to establish a correlation between global and local deformation behavior as a function of fiber orientation. In addition, global stress-local strain curves are extracted for low and high strain domains at different fiber orientation angles. A simple plasticity model in conjunction with the obtained stress-strain curves is implemented and utilized to develop a phenomenological model that enables correlating global stress with the locally developed strain at different locations in a composite specimen subjected to off-axis tensile load.

Keywords: Polymer-matrix composites, Micro-mechanics, Multiscale, Digital image correlation

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