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Behrad Koohbor, Suraj Ravindran, Addis Kidane

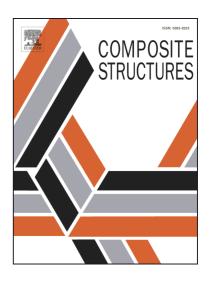
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A Multiscale Experimental Approach for Correlating Global and Local Deformation **Response in Woven Composites**

Behrad Koohbor, Suraj Ravindran, Addis Kidane¹

Department of Mechanical Engineering, University of South Carolina, 300 Main St, Columbia, SC 29208

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

¹ Corresponding Author

Address: Department of Mechanical Engineering, 300 Main St, Columbia, SC 29208, USA

Tel: +1 (803) 777-2502 | e-mail: kidanea@cec.sc.edu

1

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