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Determination of In-Plane Mechanical Properties of Woven Composite Material Using Digital Image Correlation

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Abstract

This study investigates the use of Digital Image Correlation (DIC) to determine the in-plane mechanical properties of woven fiber-reinforced composite laminates. DIC, a full-field, non-contact optical technique, was employed to measure strain distributions during uniaxial tensile tests on specimens with various fiber orientations. The experimental setup included high-resolution imaging and speckle pattern application, with data processed using Zeiss Correlate software. Key mechanical properties, including Young's modulus, Poisson's ratio and shear modulus were extracted and validated against literature values, confirming the reliability of DIC in capturing anisotropic behavior. The results highlight DIC's capability to detect localized strain variations and provide accurate elastic property measurements, such as 70.21 GPa and 24.90 GPa for woven CFRP and GFRP,

respectively, making it a powerful tool for composite characterization and modeling. Tests were also conducted on natural fiber and hybrid composites. © 2026, The Aeronautical and Astronautical Society of the Republic of China. All rights reserved.

Author keywords

Composite; DIC; In-plane; mechanical properties; Woven

Indexed keywords

Engineering controlled terms

Correlation methods; Elastic moduli; Fiber reinforced plastics; Hybrid composites; Image analysis; Laminated composites; Natural fibers; Poisson ratio; Shear flow; Strain; Strain measurement; Tensile strength; Tensile testing

Engineering uncontrolled terms

Composites material; Digital image correlations; Fiber reinforced composite laminates; In-plane; In-plane mechanical properties; Mechanical; Property; Woven; Woven composite; Woven fibers

Engineering main heading

Weaving

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