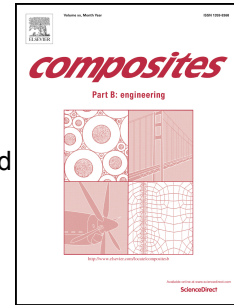


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An interpretation of the load distributions in highly torqued single-lap composite bolted joints with bolt-hole clearances

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Abstract: A detailed interpretation of load distribution in composite single-lap bolted joints is presented based on theoretical, experimental and numerical investigations. Modified instrumented bolts (MIBs) were used to measure bolt shear loads consisting of the bolt bearing load and the friction force between the laminate and nut. The bolt-load carrying mechanism in single-bolt joints and the load transfer mechanism in multi-bolt joints with various tightening torques and bolt-hole clearances were revealed based on theoretical and numerical analyses and validated against experimental results. The load transferred by each bolt in a multi-bolt joint was determined with greater fidelity, and the load distributions obtained using a three-dimensional finite element (FE) model and a spring-based method were compared. The load distributions obtained from the established 3D FE model were found to be identical to those obtained using the spring-based method; the bolt-hole clearances significantly impacted the load distributions, but the effects of the bolt tightening torques on the load distributions could be ignored.

Keywords: Composites; Bolted joints; Contact force; Clearance; Tightening torque

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