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Studying the Load Sharing and Failure Mechanism of Hybrid Composite Joints Using Experiment and Finite Element Modeling

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Abstract : Composite joints have been getting attention recently due to their high specific mechanical strength to weight ratio that is crucial for structures such as aircrafts and automobiles. In this study on hybrid joints, quasi-static experiments and finite element analysis were performed to investigate the failure mechanism of hybrid composite joint with respect to the joint properties such as the adhesive material, clamping force, and joint geometry. The outcomes demonstrated that the stiffness of the adhesive is the most imperative design parameter. In this investigation, two adhesives with various stiffness values were utilized. Regarding the joints utilizing the adhesive with the lower stiffness modulus, it was observed that the load was exchanged promptly through the adhesive since it was shared more proficiently between the bolt and adhesive. This phenomenon permitted the hybrid joints with low-modulus adhesive to support more prominent loads before failure when contrasted with the joints that utilize the stiffer adhesive. In the next step, the stress share between the bond and bolt as a function of various design parameters was studied using a finite element model in which it was understood that the geometrical parameters such as joint overlap and width have a significant influence on the load sharing between the bolt and the adhesive.

Keywords : composite joints, composite materials, hybrid joints, single-lap joint
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