TOP TEN

Elli Moutsompegka
University of Patras

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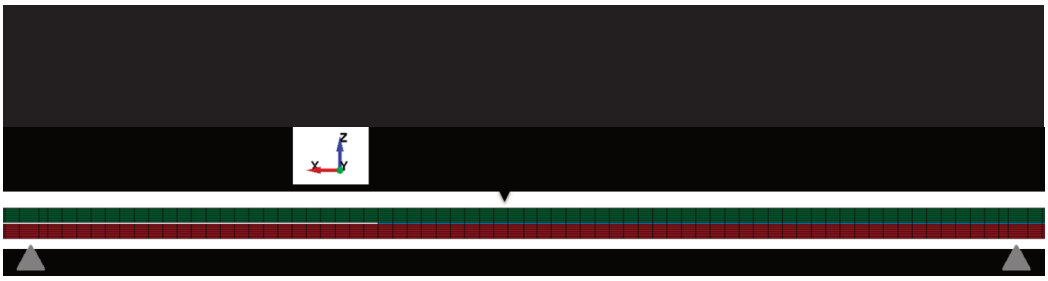
A full methodology for the strength prediction of adhesively bonded composite joints exposed to hygrothermal service conditions

In the last two decades, the use of adhesive bonding has been continually increasing in aircraft structures both for assembling fiber-reinforced structural parts and applying composite patch repairs due to the numerous advantages it provides over conventional structural joining methods, e.g. mechanical fastening where the introduction of holes in composites leads to stress concentrations and can affect the overall load-carrying capacity of the structure. One of the main factors hindering the wider application of adhesive joints is the sensitivity of the bondline integrity to the environmental factors, such as temperature and moisture that adhesively bonded joints are exposed to during service. In order for the designers to meet the aviation certification rules, the limit load capacity of the adhesive composite joint which would result in catastrophic loss of the aircraft must be substantiated. In the present work, the lack of accurate mechanical behavior prediction of adhesively bonded composite joints exposed to hygrothermal environments is addressed and a methodology is proposed to this end. The first step is the prediction of thermal and moisture diffusion in the adhesive joint components, and the effect on their mechanical performance. These data will act as input into a process computational model where the curing of the aged components will be simulated. The final aged joints will then be virtually tested using a modified cohesive zone modelling approach, which derives from the first step, to virtually model the progressive damage and failure of the aged bonded joints.



Key Characteristics

Adhesive composite joint • Strength prediction