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DYNAMIC STUDY OF ADHESIVE JOINTS UNDER DIFFERENT LOADING RATES

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ABSTRACT

The improvement of structural adhesive bonding performances led this technique to replace progressively more the traditional assembling methods (welding, riveting or bolting). This assembling technique preserves the integrity of the bonded parts; generates a uniform transmission of load; gives a better appearance product and is highly efficient to bond dissimilar materials… This led the structural adhesive bonding to find ever-increasing applications as structures components in the domains of automobile, aircraft, aerospace constructions and shipbuilding industries. But this increasing interest is faced by an inadequate knowledge on the dynamic behaviour of the adhesive joints and their F.E. modelling. The aim of the present work is to improve the knowledge about the adhesive joints under different speed rates and better understand how to build F.E. models capable to predict their strength with accuracy. The rate-dependent behaviour of adhesively bonded double lap joints structures was experimentally investigated by applying different tensile loading rates. The tensile tests were conducted at four different rates (5mm/min, 50mm/min, 1m/s, and 10m/s). Substrates of aluminium T6082 and glass/epoxy laminated woven composite were used to construct aluminium/aluminium and laminate/laminate specimens. The experimental results showed the effects of increasing the loading rate on the joint strength. This work is largely concerned by the modelling of the adhesive dynamic behaviour at different loading rates and its F.E. implementation, to assess the strength and predict the damage of this kind of assembly. The cohesive elements are used to model the initiation and the evolution of the adhesive joints damage in both failure possibilities: adhesive failure (at interfaces substrate/adhesive), and cohesive failure (inside the adhesive layer).