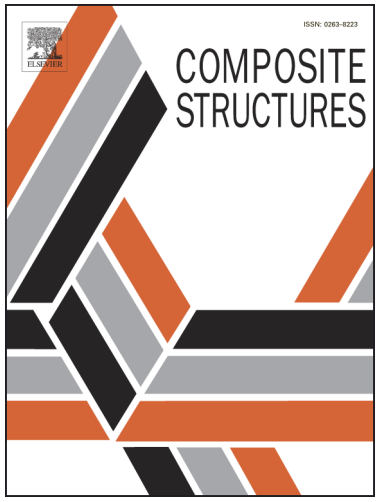

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ENERGY-BASED ANALYTICAL FORMULATION FOR THE PREDICTION OF END DEBONDING IN STRENGTHENED STEEL BEAMS

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ABSTRACT

This paper deals with the evaluation of the edge bond strength of steel beams retrofitted with Fibre Reinforced Polymer (FRP) materials. Two approaches were mainly investigated, that is the stress-based criterion and the energy-based one. The latter is simpler since it does not require assessing the mechanical and geometrical properties of the adhesive layer. The basic concept is that fracture occurs when the strain energy release rate (SERR) reaches a critical value. Then, a simplified and general-purpose energy-based analytical formulation is proposed to indirectly estimate the SERR. Actually, several linear and non-linear methods allow analysing the end debonding failure. However, such models are often difficult to develop, not immediate and a considerable calculation effort is needed. Therefore, the formulation discussed in this paper was proposed for being straightforwardly applied in the design phase of reinforced steel beams under general loading configurations and static schemes. To validate the analytical approach, experimental results for a simply supported beam are considered. A parametric analysis is also performed and the results are compared to the ones of a recently proposed numerical method. A good agreement among the experimental, analytical and numerical models was found in all the cases, showing the potentialities of the proposed approach.

Keywords: FRP materials, bond strength, interfacial crack model, fracture energy, steel beams