Dimensioning of hybrid Bolted and Bonded Joints involving Fibre Reinforced Polymers

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Résumé

The overall performance and the long term efficiency of any structure depend on the connections that join their components; as such they constitute the most critical component. This is particularly true for hybrid structures, where joining of components, either between Fibre-Reinforced-Polymers (FRP) and/or to other materials is mostly achieved by the means of mechanical fasteners or adhesively bonding. Since these two joining methods come from radically different backgrounds, the resulting design procedures are almost incompatible. This paper aims to hand practitioners a unified dimensioning procedure for the two most frequent fastening methods in FRP structures, i.e. bolted and adhesively bonded joints. Relatively simple double-lap joints connecting flat FRP lamellas and complex joints between FRP tubes and lamellas connected by the means of aluminium brackets were experimentally tested. The joints were numerically investigated using three dimensional finite element analyses coupled to a probabilistic post-processing routine for strength prediction, which subsequently was validated against the experimental data. Good agreement between experimental and predicted strength was achieved, which validates the design process and allows generalising for dimensioning of the bolted and bonded joints in FRP structures. The presented approach opens the door for the practical design of a wide variety of joints encountered in FRP structures, thus overcoming a major problem limiting the widespread of composite construction.

Mots-Clés: adhesive, bonding, frp, bolted, design, structurs, joint

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