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Influence of Superposition Length on Transverse Impact Response of Single-Lap Adhesive Joints

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Steel remains the most common material used for structural purposes because of competitive advantages, making it the best choice in areas such as automotive and transportation. On the other hand, the development of feasible and durable adhesives induced the use of adhesive joints as an alternative to the traditional mechanical joints. Single-lap joint is the simplest and it is known to be quite sensitive to changes in geometrical parameters, like the superposition length [1, 2]. There is an ideal overlap length, which gives the best stress distribution, i.e., the lowest stress concentration.

This work aims to contribute to a better understanding the influence of superposition length on transverse impact response of single-lap adhesive joints. The joints are designed essentially to carry in-plane loads, although, they are also prone to transverse loading like crashes, tool drops, etc. The specimens were manufactured as 20 mm wide bars, cut from steel plates with 1 mm thickness, and bonded with epoxy adhesive. Low-velocity impact tests were performed using a drop weight-testing machine IMATEK-IM10 and a hemispherical impactor of 20 mm diameter with a mass of 2.545 kg was used. The results were analysed in terms of impact strength and the residual tensile strength of the joint after impact. A numerical study was developed to obtain stress and strain fields and to verify the applicability of simple damage criteria to quantify joint failure. The adhesive were modeled as elastic-plastic, while the high elastic limit steel were modeled as linear elastic.

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