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Topology Optimisation of Adhesive Joints Using Non-Parametric Methods

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Abstract

This research investigates the applicability of non-parametric structural optimisation algorithms for the optimisation of structural adhesive joints. Three types of adhesive joint; single lap, double lap and double lap strap, were used for the structural optimisation. Evaluation of the non-parametric solver was carried out by first optimising the adherend geometry of the adhesive joints and then including the adhesive fillets in the optimisation domain. Thus, optimisation of single and then multiple material domains was performed. It was noted that most of the structural features of adhesive joints can be optimised by a non-parametric optimiser, however, a few limitations of the solver for adhesive joint applications were also discovered. Engineering judgement may be needed when extracting the optimised geometries for further use. A significant reduction in the stresses in the adhesive layer were observed after the optimisation of all three types of selected joints, indicating the potential of these techniques, however a clear understanding of both the optimization methods and the engineering design requirements and constraints is needed for their effective application for adhesive joints.

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