Structural model updating of bolted joints in dissimilar material structure

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ABSTRACT

This paper focusing on the joint modelling techniques of Finite Element (FE) to model a light dissimilar structure with bolted joints made up of bolts and nuts. The usage of a model update strategy is employed to improve the FE model's dynamic behaviour. In the FE model, a joint strategy is constructed using three different types of element connectors: CBAR, CBEAM, and CFAST. The modal parameters of a bolted joint structure made of dissimilar materials AZ31B and AA6061 were determined using Finite Element Analysis (FEA) and Experimental Modal Analysis (EMA) in this research (natural frequencies, damping ratio, and mode shapes). The number of elements, number of nodes, and total percentage errors of respectively initial FE model, when compared to EMA results, were evaluated. In comparison to the others, the CBAR element was chosen to represent a fastener joint for the updating process due to its accurate prediction of mode shapes and inclusion of updating parameters. Sensitivity analysis is performed before the updating process to choose the most sensitive parameter for updating purposes. In the FE model updating procedure, MSC Nastran's optimization technique is applied. Therefore, the discrepancies between FEA and EMA have been decreased. When compared to the measured equivalent, the percentage of error for the modified CBAR model drops from 4.37 percent to 2.71 percent. As a result, it is discovered that updating the FE model is a systemic and efficient technique in conducting the appropriate FE model in recreating the genuine structure.

KEYWORDS

Joint modelling techniques; Finite Element; Dynamic behavior; Material Structure

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