

Investigation on Welding Residual Stress Effects on Modal Parameters on AA5056 Samples; An Experimental and Numerical Study

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Most manufacturing processes introduce some type of residual stress. Unlike some types of residual stress measurement tests that are mostly time-consuming and expensive, modal analysis is a suitable substitute that can investigate this procedure efficiently. In this project, experimental modal analysis was conducted along with a semi-destructive residual stress measurement technique (Center Hole Drilling) to demonstrate the relation between vibrational parameters and welding residual stresses. A comparison was made between natural frequencies and damping factors before and after the welding, and the experiment was validated by Euler-Bernoulli relations too. Finite element analysis of the welding, cutting and stress/modal analysis procedures was performed and the results reveal that welding residual stresses made the specimen harder, leading to a 2% increase in natural frequencies and variations in damping factors. Cutting process also reduced the residual stress level by up to 34%. This case study could be beneficial to applications where residual stress measurement is not convenient.