

Finite Difference 2D model for Lamb waves propagation in Single Lap Joints for Structural Health Monitoring

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Abstract. This study is focused on the development of a 2D Finite Difference (FD) model to simulate Lamb wave propagation through Single Lap Joints (SLJs). A method based on Lamb waves is proposed for evaluating disbonds in SLJ typically used in aerospace industry. This method is based on the interference of elastic waves generated by piezo sensors bonded onto thin bonded plates and travelling through the adhesion area. Destructive interference conditions are promoted when the adhesive is partially debonded and this is related to the length of the disbond. The main advantage of the proposed numerical model is the mathematical ability to easily reproduce the presence of a damage (debonding) as a discontinuity in velocity values. This makes the FD model suitable for continuous and embedded Structural Health Monitoring (SHM) of a 2D structure. Numerical simulations and experimental campaigns are presented in order to validate the obtained novel reduced-order FD model that appears leaner, cleaner and more simplified than FE model.