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Lamb Waves Propagation in Elastic-Viscoelastic Three-Layer Adhesive Joints

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Abstract : In this paper, the propagation of lamb waves in three-layer joints is investigated using global matrix method. Theoretical boundary value problem in three-layer adhesive joints with perfect bond and traction free boundary conditions on their outer surfaces is solved to find a combination of frequencies and modes with the lowest attenuation. The characteristic equation is derived by applying continuity and boundary conditions in three-layer joints using global matrix method. Attenuation and phase velocity dispersion curves are obtained with numerical solution of this equation by a computer code for a three-layer joint, including an aluminum repair patch bonded to the aircraft aluminum skin by a layer of viscoelastic epoxy adhesive. To validate the numerical solution results of the characteristic equation, wave structure curves are plotted for a special mode in two different frequencies in the adhesive joint. The purpose of present paper is to find a combination of frequencies and modes with minimum attenuation in high and low frequencies. These frequencies and modes are recognizable by transducers in inspections with Lamb waves because of low attenuation level.

Keywords : three-layer adhesive joints, viscoelastic, lamb waves, global matrix method
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