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Finite Element Analysis for the Inhibition of EMAT Lamb Waves Multimode

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The guided waves, especially Lamb waves, due to its longer propagation, lower loss and higher efficiency and sensitivity, are widely used in various kinds of thin layer structure testing (for example plates, pipelines and tanks). Electromagnetic ultrasonic Lamb waves testing combining the characteristics of Electromagnetic ultrasonic testing and guided waves, which has a better application prospect. Unfortunately, Lamb waves possess the multi-modes characteristic: several different modes propagate in the specimen simultaneous. Moreover, all of the modes of lamb waves are dispersive. Both make the received signals so complex and messy that the echo signals of the flaws might be difficult or even impossible to interpret in the practical application. In this paper, according to the characteristics of electromagnetic ultrasonic excitation and combining with the structure of the double transducer and the method of phase cancellation [1,2], the characteristics of single lamb waves were studied by theory and simulation methods. The results of point force and complete EMAT double transducers simulation were showed in Figure 1 and Figure 2.
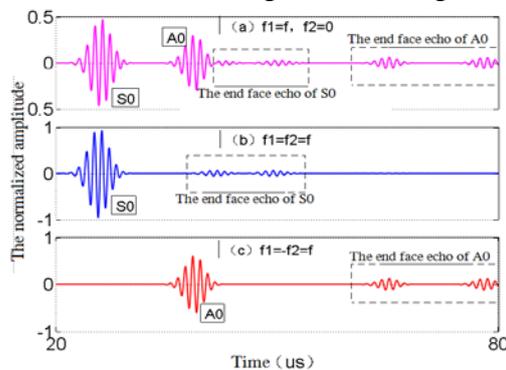

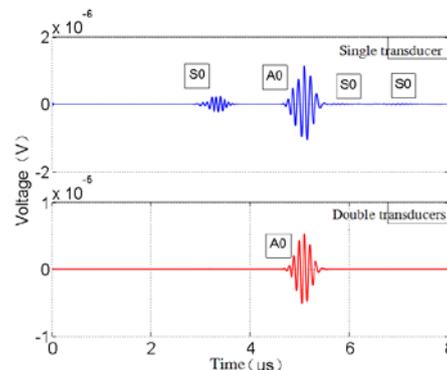**Figure 1.** The results of point force simulation   **Figure 2.** The results of complete EMAT

The simulation results show that the structure of the double transducers can completely eliminates a mode and enhances another to excite single-mode. The single-mode exciting reduces the difficulty of the subsequent signal analysis and processing, which provides reliable information for the practical application of detecting flaws.

References:
1. Young-Han Kim, Dae-Hyun Kim, Jung-Ho Han. Damage assessment in layered composites using spectral analysis and Lamb wave[J]. Composites: Part B, 2007, 38:800–809.
2. X Wang, Y Lu and J Tang. Damage detection using piezoelectric transducers and the Lamb wave approach-1 System analysis[J]. smart materials and structures, 2008, 17: 025033.