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Use of synchronous nonlinear interaction of flexural Lamb waves in NDT-application

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Workability of synchronous nonlinear interaction of flexural Lamb waves in NDT-application is demonstrated. During experiments traveling and standing A_0 waves were used. Lamb waves are dispersive, so to provide synchronous nonlinear mode for traveling waves, non-collinear interaction of two waves with frequency *f* were realized in aluminum alloy plate with defects. In the area of waves' nonlinear interaction, traveling wave of *2f* frequency appeared. Standing Lamb waves were excited with amplitude-modulated signal in a cylindrical resonator of aluminum plate. Carrier frequency f and modulating frequency $F \ll f$ are equal to natural modes of the resonator. Spectrum of amplitude-modulated waves contained oscillations with frequencies *f*, *f+F*, and *f-F*. As a result of interaction, oscillation on heterodyne frequency *F* appeared in the plate and excited a natural mode. Amplitudes of traveling and standing waves on heterodyne frequencies depend on presence of defects in investigated area (non-classic nonlinearity). Spatial distribution of amplitudes of initial waves and ones on heterodyne frequency in samples were measured with laser vibrometer PolytecPSV300. In area containing heterogeneities, amplitude increase of waves on heterodyne frequencies was observed. The possibility to define the spatial distribution of defects using measurements of heterodyne wave amplitude distribution was shown experimentally. Work supported by RFBR.