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Propagation of Lamb waves in an immersed periodically grooved plate: Experimental detection of the scattered converted backward waves

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Abstract: Guided waves propagation in immersed plates with irregular surfaces has potential application to detection and assessment of the extent, depth and pattern of the irregularity. The complexity of the problem, due to the large number of involved parameters, has limited the number of existing studies. The simplest case of irregularities of practical interest is the two-dimensional corrosion profile. Even this case is in general so complex, that one can extract several amplitude dominant periodic surfaces only by using a Fourier spectrum of the surface. Guided waves in plates, with one or both free surfaces having periodic perturbations of different shapes, have been presented in specialized literature. In this paper is studied the propagation of Lamb waves in an aluminum plate with a periodic grooved surface on only one side and immersed in water. The interaction between an incident Lamb wave and the grating gives rise to retro-converted waves. Preliminary numerical simulation by the finite element method is performed in order to obtain key parameters for the experiments. It is shown that retroconverted waves radiating into the water are detectable although their amplitudes are small. The phonon relation is verified for the leaky Lamb modes. The damping coefficients of the leaky Lamb modes in the grooved immersed plate are evaluated.

Keywords : Liquid–solid interfaces, Rough plate, Periodic grating, Lamb waves, Converted modes