

ACOUSTICS2008/1642

Lamb and Stoneley wave interactions with a fluid droplet

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In order to analyse wetting aspects from an acoustical point of view, the present work investigates the interaction of a liquid droplet with Lamb and Stoneley waves propagating on a plane plate. A horizontal plane plate is in contact with a liquid on its lower interface, air in contact with its upper interface, the droplet lying on the top interface. Lamb waves are generated by a pulse through a contact transducer placed at one edge of the plate. This generates in a wide range the high wave numbers of the Lamb modes A₀, A₁, S₀ and the fluid born Sholte Stoneley wave (A-wave). For low wave numbers, the transducer is placed at normal incidence, under both the plate and the droplet. Signals obtained by emission/reception with the same transducer (2MHz) clearly exhibits a coupling effect between acoustic modes inside the droplet and Lamb modes. Laser Doppler scans around the droplet show reflection/refraction/diffraction patterns of the incident line wavefront through the droplet. These experiments carried out with various wetting conditions point out a good correlation between the parameters of the acoustical resonances and the wetting properties, enabling an acoustic estimation of the wetting in a wide frequency range.