MASTER THESIS PROJECT

An approximation to the elastodynamic far field in a plate loaded by an angle beam transducer

Abstract

To improve the ultrasonic detection of defects in a steel plate, it is important to know the elastodynamic wave field generated by an angle beam transducer in an elastic plate without defects. Figure 1 depicts the configuration in which this forward problem is to be solved. The transducer may be modelled as a line segment of normal traction that moves with a constant speed over the plate surface [1]. The length of the line segment is determined by its momentary position with respect to the aperture of the transducer. In case of ultrasonic inspection, the plate thickness may be assumed much larger than the characteristic wave length ($d \gg \lambda$) and the distance between the source and the receiver will be much larger than the plate thickness ($L \gg d$). This implies that a suitable far field approximation to the elastodynamic wave field may be applied. Bakker and Verweij [2] have derived an approximation to the far field generated by an angle beam transducer in an elastic halfspace. The approximate expressions they obtain consist of a time convolution of a paraxial wave and a transfer function. A main step in the derivation of the approximate expressions is the application of a first-order Taylor approximation for the arrival time difference between two source points. It is suggested to apply the same kind of analysis to the different kinematic families of generalized rays [3] in the elastic plate.

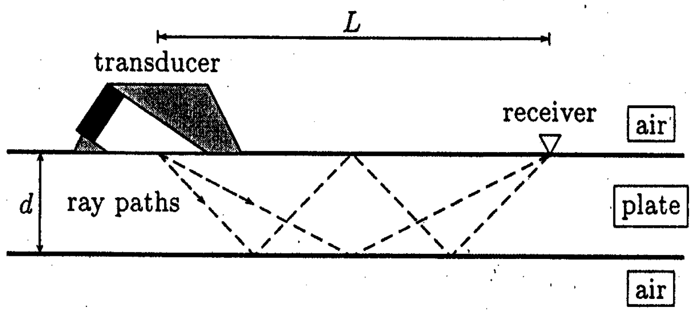

Figure 1: Configuration