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**Finite element modelling of transient elastic wave propagation in
an inhomogeneous anisotropic fluid/solid multilayer medium: a
time-domain method**

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The axial transmission technique is used clinically for cortical bone assessment. However, ultrasonic propagation in this multiscale medium remains unclear, in particular because of the heterogeneous nature of cortical bone. The aim of this work is to evaluate the effect of spatial gradients of elastic moduli on the ultrasonic response of the bone structure. Therefore, a 2D finite element time-domain method is developed to simulate transient wave propagation in a three-layer medium constituted of an inhomogeneous transverse isotropic solid layer sandwiched between two acoustic fluid layers and excited by an acoustic linear source located in one fluid layer delivering broadband ultrasonic pulses. The model couples the acoustic propagation in both fluid media with the elastodynamic response of the solid. The conditions of continuity are used to model the fluid-structure interaction. A constant spatial gradient of material properties in the direction perpendicular to the layer is considered in the solid structure. In presence of a gradient, the first arriving signal (FAS) velocity depends on the average material properties when the thickness is smaller than the wavelength (guided wave modes) whereas the FAS velocity depends on the velocity at the surface when the thickness is larger than the wavelength (lateral wave).