PLANE-WAVE REFLECTION/TRANSMISSION COEFFICIENTS AT PLANE INTERFACES SEPARATING WEAKLY ANISOTROPIC MEDIA

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We present a procedure for computation of approximate formulae for the plane-wave, displacement reflection/transmission (R/T) coefficients at plane interfaces of arbitrary contrast, separating two homogeneous, weakly anisotropic media. In deriving the formulae, we use first-order quantities, with which we work when using first-order ray tracing (FORT) for inhomogeneous weakly anisotropic media (Pšenčík and Farra, 2007; Farra and Pšenčík, 2010a). As in the exact problem of reflection/transmission, the incident and generated waves satisfy boundary conditions consisting of continuity of displacement and traction. However, the quantities appearing in the boundary conditions are phase velocities, slowness and polarization vectors, which are of the first-order with respect to the deviations of anisotropy from isotropy. The slowness vectors of generated waves are sought by solving numerically the corresponding first-order eikonal equation, which must be solved separately for each generated wave. The corresponding R/T coefficients are determined by numerically solving a system of six inhomogeneous, linear, algebraic equations with considerably simpler coefficients than in the exact case (Farra and Pšenčík, 2010b).

The approximate formulae for the R/T coefficients involve, as in isotropic media, only two waves: a P wave and a coupled S wave. Thus the derived R/T coefficients transform an incident P or coupled S wave into a reflected/transmitted P or coupled S wave. Coefficients are applicable for any incidence angle and for any azimuth. It means that they can be used both in subcritical and overcritical regions.

On numerical examples, we illustrate accuracy and applicability not only of R/T coefficients, but also of other involved quantities like slowness and polarization vectors. Numerical tests, which involve R/T at small as well as stronger-contrast interfaces, indicate that, except for critical regions, the approximate coefficients approximate the exact coefficients with high accuracy. Failure in critical regions is not a problem in applications in the ray theory since the ray theory itself does not work properly in these regions.

References

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