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Physical modeling studying the travel times and reflection points of SH-waves reflected from transversely isotropic media with a tilted symmetry axis

Young-Fo Chang (1), Chih-Hsiung Chang (2), Li-Chung Sun (3), and Chia-Lung Chung (1)

(1) Institute of Seismology, National Chung Cheng University, Chiayi 62102, Taiwan (seichyo@ccu.edu.tw), (2) General education center, National Chiayi University, Chiayi 62103, Taiwan (charles@mail.ncyu.edu.tw), (3) Department of Electrical Engineering, Nan Kai Institute of Technology, Nantou 54210, Taiwan (sunlc@nkut.edu.tw)

As an elastic wave propagates in a transversely isotropic media (TIM), SH-wave is the one possessed a pure mode polarization under reflection who does not convert to P- and SV-waves, and vice versa. The simplicity in SH-wave itself thus provides an easy way to view into the details of SH-wave propagation in a TI medium. In this study, we attempt to inspect the theoretical reflection moveouts of SH-waves reflected from a transversely isotropic (TI) layer with a tilted symmetry axis and verify the reflection point which could be shifted away from the common reflection point (CRP) in a common mid-point shooting (CMPS) by numerical calculations and physical modeling. In a traveltime-offset analysis, the moveout curves in the TIM with different tilted symmetry axis are computed by a TI modified hyperbolic equation and the Fermat's principle, respectively. It turns out that both of the computed moveout curves fit well to the one observed from physical models but in a vertical transversely isotropic (VTI) case for the Fermat's principle method due to the numerical error. The reflection points for a CRP gather computed by Fermat's principle show that they are close to CRP in both VTI and horizontal transversely isotropic (HTI) cases but shift away in other cases with a tilted symmetry axis. And the shifts are verified by the physical modeling. Additionally, our laboratory works also demonstrate the attenuation of SH-wave in a TIM is strongest for VTI case. As the symmetry axis is tilted from vertical to horizontal, the attenuation in the propagating energy is decreased.