ANISOTROPIC GROUND ASSESSMENT BY RAYLEIGH WAVE DISPERSION EXTRACTED FORM AMBIENT NOISE IN URBAN AREAS

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Surface wave has been widely used as a non-destructive, economical and effective technique to assess ground conditions in urban areas. But medium anisotropy has not been considered in these methods. With the development of geophysical exploration techniques, seismic anisotropy assessment of the near-surface has played an important role to the site characterization of urban underground facilities, such as parking lot, commercial plaza and subway transportation. In order to increase the prediction accuracy and the resistance of constructions to natural disasters (e.g. earthquake), medium anisotropy should be considered in the ground assessment. In this paper, we utilize multi-mode Rayleigh waves extracted from ambient noise to estimate the bedrock depth and anisotropy parameters of the near-surface. This approach consists of four steps. First, convert the received ambient noise to Rayleigh waves generated from a virtual source, using the wave interferometry theory and the principle of superposition. Second, extract dispersion curves from real data using Fourier Transform. These curves will be considered as the reference in the inversion. Third, apply the forward modeling based on the dispersion equation of Rayleigh wave in a multi-layered vertical transverse isotropy (VTI) medium, which is a reasonable assumption for the urban near-surface. The multi-mode dispersion curves can be picked by solving the dispersion equation. Finally, conduct the inversion to estimate the bedrock depth and anisotropy parameters simultaneously by comparing these two sets of dispersion curves from real data and the calculation. A synthetic case and a real case are given to show this approach's feasibility and efficiency. Overall, this approach is a new attempt to obtain ground conditions including anisotropy information of the near surface. It will have important significance on the incensement of prediction accuracy and the construction safety in urban areas.