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An HHT Based Method for Phase Velocity Analysis of SASW Exploration

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This study proposes a Hilbert-Huang Transform (HHT) based method to analyze the data acquired from Spectra Analysis of Surface Waves (SASW) method to calculate phase velocity of strata and to improve the accuracy of the phase velocity obtained. By the empirical mode decomposition of the HHT, the time series data of SASW test results can be decomposed into several intrinsic mode functions, IMFs. The noise of the time series can be firstly reduced. According to the frequency ranges of the IMFs to be analyzed, we can select several IMFs of the two corresponding SASW stations to assemble two new time series data. The EMD and Hilbert transform are to be applied again to obtain the corresponding two time-frequency spectra. By locating the proper spectra ranges, the group velocity can be calculated and then the phase velocity be decided. The applicability of the proposed HHT based method was discussed by using the three data sets of axisymmetrical numerical simulations of SASW for three artificial strata, namely two-layer, three-layer and reverse strata. In addition, two SASW field test data sets were processed. The cross-spectra method for calculating SASW was also used for comparison purpose. The results show that the accuracy of the phase velocities analyzed by the proposed HHT based method are either better or equivalent to those obtained by the cross-spectra method.