Estimation of Soil Profile through Rayleigh Wave Dispersion of Microtremor Measurements by Random Inverse Analysis

K. Tokeshi, M. Karkee, C. Cuadra

Department of Architecture and Environment Systems, Akita Prefectural University, Yuri-Honjo, Akita, Japan

(tokeshi@akita-pu.ac.jp / Fax: +81-184-27-2186 / Phone: +81-184-27-2065)

The estimation of the soil profile using fundamental Rayleigh wave dispersion curve of microtremor measurements by random inverse analysis is proposed in this paper.

Several inverse analysis methods, such as the well known least-squares method, the genetic algorithm (GA), the neighbourhood algorithm (NA), are being used nowadays for estimating the soil profile from Rayleigh wave dispersion characteristics.

One of fastest methods would be the NA method proposed by Sambridge, which uses a stochastic direct technique for non-linear geophysical inverse problems through multi-dimensional parameter spaces. However, his NA code is available only for work stations and significance efforts are required for implementing it in common personal computers. Another algorithm, the GA, is being employed for searching of the optimum velocity model but the code is not available in internet. Finally, the least-squares method is one of the easiest methods for inverse analysis but the full searching of several parameters for certain variation intervals in ranges is very slow.

Thereby, a new method for inverse analysis using a random searching is proposed in this paper. This method is faster than the least-squares method but comparatively slower than the NA and the GA. The number of trials is controlled as a percentage of the total number of possibilities when all parameters for certain variation intervals are considered. The several solutions for soil profiles are obtained when the theoretical phase velocity is within 10 percent of the variation of observed phase velocity for each analyzed frequency. The estimated values of the thickness and the shear wave velocity for each layer are obtained as the average of the values obtained for each parameter.

This method promises successful results when the soil profile structure is a horizontally multi-layered soil.