A Simple Approach for the Analysis of First Vibration Mode of Layered Soil Profiles

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Abstract : Fundamental period, mode shape, and participation factor are important basic information for the understanding of earthquake response of ground. In this study, a simple approach is presented to calculate these basic information of layered soil profiles. To develop this method, closed form equations are derived for analysis of free vibration of layered soil profiles firstly, based on equilibrium between inertia and elastic forces. Then, by further associating with the Madera procedure developed for estimation of fundamental period, a simple method that can directly determine the fundamental period, mode shape and participation factor is proposed. The proposed approach can be conveniently implemented in simple spreadsheets and easily used by practicing engineers. In addition, the accuracy of the proposed approach is investigated by analyzing first vibration mode of 67 representative layered soil profiles, it is found that results by the proposed method agree very well with accurate results.

Keywords : layered soil profile, natural vibration, fundamental period, fundamental mode shape
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