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Soil-structure Interaction Effect on a Multi-storied Building with Pile Foundation Considering Linear Approach

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Abstract

Soil-Structure Interaction (SSI) has important effects on the seismic response of structures as it modifies both deformations and inertial forces. In this paper, an attempt to study the seismic response behaviour of a 3D multi-storied RC-framed building considering the effect of soil-structure interaction is done using the finite element method based program LUSAS 15.2. The ground response spectra as given in IS: 1893-2002 are converted into simulated time history data, by using the TARSCTH code. The obtained synthetic time history response is given as an input to DEEPSOIL V 6.1 and the deconvolution analysis is performed to obtain the appropriate input motion at a particular depth. Furthermore, the obtained input motion is used in the present numerical model and a study of fundamental frequency for different soil conditions has been carried out and it is found that SSI significantly affects the behaviour of buildings resting on the soil. Considering the effect of pile foundation embedded up to 12m depth, two different soil domains (soil up to 12m and 60m depth) are analyzed. For both models (soil to a depth of 12m and 60m), it is noticed that soft soil models exhibit greater displacement values than medium and hard soil models. This indicates that the interaction is maximum in soft soil. Also, for hard and soft soil models, an effort has been made to replace the soil strata with equivalent spring stiffness. This shows convergence for hard soil, but there is a difference for the soft soil models.

Keywords: Soil-structure interaction, Deconvolution, Equivalent soil-spring