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RESPONSE OF HIGH-RISE BUILDINGS TO TRANSLATIONAL AND ROCKING COMPONENTS OF MOTION ASSOCIATED WITH SURFACE WAVES

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ABSTRACT

The response of high-rise buildings to the translational components of seismic excitation has been extensively investigated. Considerably less so is their response to the rotational components of seismic motion. Probably the main reason for this disparity is the few commercially available instruments that can record directly the rotational components of seismic motion.

By now it is well understood that a component of rotational ground motion can be estimated by scaling the appropriate component of translational velocity by the 'apparent velocity'. For dispersive waves (such as surface waves) the apparent velocity is a frequency dependent parameter. Evidently, the reliable estimation of rotational motions depends decisively on the ability of the analyst to separate effectively the surface waves from the body waves. In the recent past we have proposed an effective technique for identifying and extracting the various surface wave phases (Meza-Fajardo et al. 2015). We have also proposed an effective method for estimating the rotational motions associated with the extracted surface waves (Meza-Fajardo and Papageorgiou 2016).

In the present work we select a number of recorded seismic motions which include surface waves from recent well recorded earthquake events. Then using realistic analytical models that have been proposed in the published literature for the high-rise buildings, we study their response to surface (Rayleigh) waves as they respond to both translational and rocking motion. Of particular interest is to compare the response of such structures with and without the presence of surface waves.

Keywords: Surface waves; rocking motions; high-rise buildings

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