EFFECTS OF FLING STEP AND FORWARD DIRECTIVITY ON SEISMIC RESPONSES OF SOIL SITES

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ABSTRACT

It is observed that ground motions in the near source zone of large earthquakes are significantly affected by tectonic fling (in this paper called fling step effect) and rupture directivity. In this paper effect of different types of ground motion on response spectra of soil site was evaluated. For this purpose, according to geotechnical and geophysical studies across the Iran, two models for two common soil types in Iran (B and C based on ASCE-07 code classification) were extracted. Equivalent-linear earthquake site response analysis was implemented with simplified assumptions of soil condition like horizontal soil layer in infinite extent. Furthermore record processing effects were considered in this study especially in near field records (fling step records) where conventional record processing can't fully recover near field effects like residual displacement in displacement time series. It is observed that applying different types of ground motion can change the shape of design spectra especially in short and long periods, so they can have significant impact on engineered structures. Computed site spectral responses show a peak in short periods and long periods for far fault and near fault records, respectively.

INTRODUCTION

Near field and far field ground motions can cause significant changes in the shape and frequency content of recorded waves in seismic stations. Near field records have two known effects that are rupture directivity and fling step. The characteristics of near field ground motions surprisingly differ from those of far-field ground motions. When the rupture propagates towards the site and the direction is aligned with it, large amplitude pulses with short durations and long periods emerge in recorded ground motions (Somerville et al., 1997). This phenomenon is called the forward directivity effect and usually occurs where the velocity of rupture propagation is close to the shear wave velocity.

Fling step is the other effect of near field ground motions that is recognized from the residual ground displacement as a result of tectonic deformation. It is generally characterized by a large amplitude velocity pulse and a monotonic step in the displacement time history (Ghodrati et al., 2011). The residual displacement is a consequence of wave propagation from a finite dislocation and is not related to any other physical process (Somerville et al., 1997). As it is in the direction of the fault slip, the occurrence of fling step does not coincide with the forward directivity effect (Abrahamson, 2001). It is observed specially in