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THE EFFECT OF SITE ORIENTATION ON THE SEISMIC RESPONSE OF STEEL SDOF SYSTEMS

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Near fault ground motions have particular characteristics and several destructive effects. Prevention of loss and damage imposed on the structure during such kind of earthquakes seems quite necessary (Bray and Rodriguez, 2004; Khaloo et al., 2015). Because of lack of near-fault data, it would be rational to generate synthetic ground motions using the accredited approach (ASCE-7, 2010). In this paper, the seismological parameters of Kocaeli EQ (Turkey, 1999), which have been introduced by a recent research (Hamidi et al., 2019), have been utilized to regenerate new records using theoretical-based Green's function method. A large number of stations (273) in the vicinity of the causative fault were selected to regenerate new ground motions. Consequently, the effect of site orientation (in the form of structural position) toward the epicenter coordination was investigated using time history SDOF analyses.

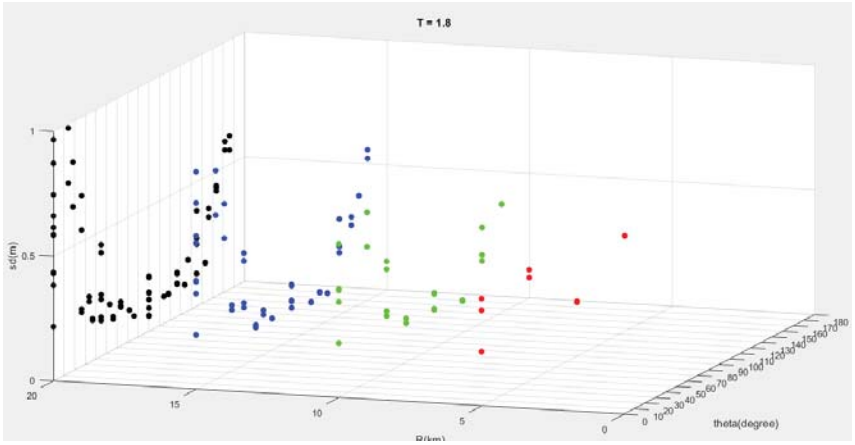

Figure 1. Spectral displacement (S_d) values for T=1.8 sec based on distances and angles.

To this end, the normal components of each record were used. More significant forward-directivity results from smaller angles between the site and fault and for larger fractions of the ruptured fault between the site and hypocenter. These types of ground motions are significantly influenced by a pulse at the beginning of the velocity time history (Somerville et al., 1997; Bray and Rodriguez, 2004; Nicknam et al., 2013; Hamidi et al., 2013). For investigation of site orientation effect on the response spectra, the idea proposed by Somerville et al. (1997) was adopted in this study. This approach can be represented with two parameters: a) angle between the direction of rupture propagation, and b) the direction of waves traveling from the fault to the site. Accordingly, the position of each station in form of site orientation can be interpreted by R and θ versus the earthquake Epicenter (Figure 1). Using OPENSEES software, the generated ground motions were applied to the SDOF systems based on the site orientation and the responses were reported in the form of maximum displacement

and acceleration. Figure 2 shows the S_d values for fundamental period of T=3.6 sec. As can be observed, the values of S_d are higher in the direction of rupture propagation. The variation of such values can be implicitly figured out.

The variation of responses was shown in the form of 2D and 3D colorful contours and diagrams with respect to *R*, *T*, θ, S_d and S_a.

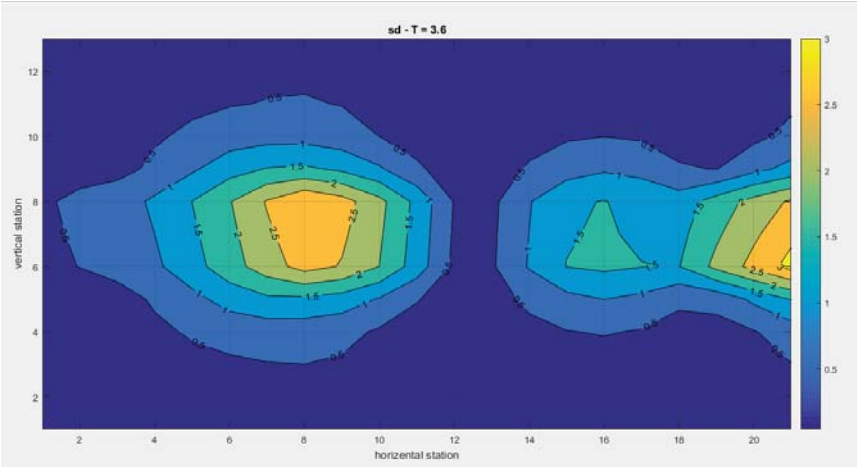

Figure 2. S_d contour for T=3.6 sec.

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