EFFECTS OF PULSE-LIKE GROUND MOTIONS PARAMETERS ON MAXIMUM INTER-STORY DRIFT SPECTRA

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Drift spectra are suitable tool for defining the local displacement demand, particularly of pulse-like ground motions. In fact, the drift spectra provide important information to near-field ground motions that cannot be obtained from the response spectra. For estimate the maximum inter-story drift demands in multi-story building Miranda and Akkar (2006) using a shear-flexural beam model consisting of two shear and flexural cantilever beams connected by an infinite number of axially rigid members, they proposed the so-called "generalized inter-story drift spectrum". They used the derivatives of the mode shapes of the continuous shear-flexural beams to approximate the drift ratios. The base of this study is compution of drift spectra for shear-flexural beams by (Miranda and Akkar, 2006). Near-field ground motions generally include large amplitude pulses in both velocity and displacement that can cause significant levels of inter-story drift in structural systems (Yaghmaei-Sabegh, 2010). This article attempts to study the effect of various ground motion parameters on the linear response of different multi-story buildings with special shear and flexural behavior. in this study maximum inter-story drift ratio spectra (MIDS), and distribution of the inter-story drift ratio (IDR) along the height of the multi-story buildings are evaluated. These parameters include PGV, PGV/PGA, arias intensity (I), earthquake magnitude (M) and local site conditions.The dynamic response of undamped uniform shear-flexural beams under a horizontal acceleration $\ddot{u}_g(t)$ at the base is expressed as apartial differential equation

$$\frac{\rho}{EI}\frac{\partial^2 u(x,t)}{\partial t^2}+\frac{1}{H^2}\frac{\partial^4 u(x,t)}{\partial t^4}-\frac{\alpha^2}{H^4}\frac{\partial^2 u(x,t)}{\partial x^2}=-\frac{\rho}{EI}\frac{\partial^2 u_g(t)}{\partial t^2} \quad (1)$$

Where ρ denotes the mass per unit length in the model; H is the total height of the building; u(x, t) represents the lateral displacement at the dimensionless height x=z/H, which varies between zero at the base of the building and one at the roof level at time t; EI means the flexural stiffness of the flexural beam and α is the lateral stiffness ratio written as

$$\alpha = H\sqrt{\frac{GA}{EI}} \quad (2)$$

Where GA denotes shear stiffness of the shear beam. A value of α equal to zero corresponds to a pure flexural beam and α equal to infinity represents a pure shear-beam model**.** For this purpose, the threshold value of different ground motion parameters was selected as an average of those calculated using all of ground motions. In this study, the 61 near-fault pulse-like ground motions are divided into two groups, lower and larger than these thresholds, and the corresponding ratio of the maximum inter-story drift spectra (MIDS) for each group is evaluated. The maximum inter-story drift spectra (MIDS) is a plot of the fundamental period T of the building versus the maximum IDR (MIDR) , and MIDR is computed as

$$MIDR = \max\left|\theta(j,t)\right| \approx \max\left|\frac{1}{H}\sum_{i=1}^{m}\Gamma_i\phi_i'(x)D_i(t)\right| \quad (3)$$

The fundamental period T of the building ranged from 0.04s to 5.0s with an incremental of 0.02 (i.e., 249 values of period) and viscous damping ratio ξ assumed 5%. Maximum inter-story drift spectrum computes for five typical values of lateral stiffness ratios (0.01, 5, 10, 25 and 650). The effect of PGV parameter on mean MIDS is presented in Figure1 for pulse-like ground motions as a ratio of results for PGV >65cm/s to those with PGV <65cm/s. Several important remarks can be made from Figure 1, meaning that the mean MIDS for ground motions with PGV >65cm/s has been significantly amplified to those with PGV<65cm/s particularly at medium-long period regions.

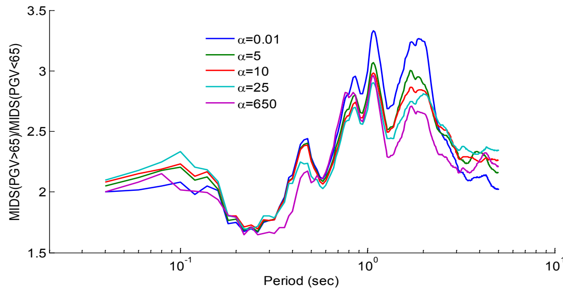

Figure 1. Ratio of MIDS for pulse-like motions with PGV>65 cm/s to those with PGV<65 cm/s

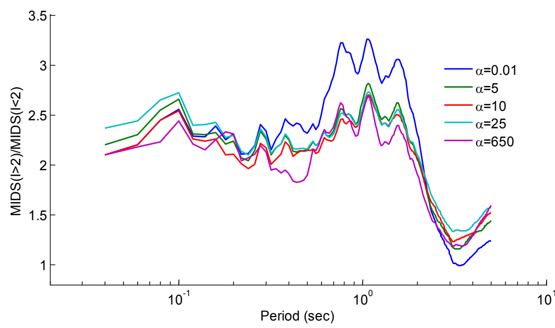

Figure 2. Ratio of MIDS for pulse-like motions with Arias intensity (I)>2 to those with Arias intensity (I)<2

The results in Figure 2 indicate that the ratio of mean MIDS for ground motions with $I \geq 2$ *m/s* is larger than those with $I < 2$ *m/s*. It was revealed from comparative analysis that the arias intensity (I) and PGV has a significant effect on MIDS, therefore on the maximum inter-story drift of multi-story buildings under pulse-like motions, in particular for multi-story buildings with low lateral stiffness ratio (flexural-type buildings) and should be considered in seismic design of the structures constructed in near-field areas.

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