EVALUATION OF THE EFFECT OF PGV/PGARATIO OF STRONG GROUND MOTIONS ONRESPONSES OF SOIL STRUCTURE SDOFSYSTEMS

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ABSTRACT

Generally, in order to evaluate the seismic demand of structures, it is assumed that the structure is located on a rigid soil. However, with increasing the soil flexibility there will be significant variations in the structural response, i.e. the effects of Soil-Structure Interaction (SSI). Furthermore, in the near-field zone, pulse-like motions play crucial roles in the design of structures. This paper addresses the effects of Peak Ground Velocity to Peak Ground Acceleration ratio (PGV/PGA) of near-fault ground motions as a compound intensity index that can describe the frequency characteristics of ground motion on response of various soil-structure SDOF systems. A total 49 near-field ground motions records were selected which have been classified into two categories: first, records with a strong velocity pulse, (i.e. forward-directivity); second, records with a residual ground displacement (i.e. fling-step).

Parametric studies between PGV/PGA ratio of pulse-like ground motions and maximum relative displacement (U_{max}) indicate that with increase in structure-to-soil stiffness ratios($\bar{S}$), earthquakes with higher PGV/PGA ratio produce greater responses. Moreover, increasing in slender ratios ($\bar{h}$) and decreasing in mass ratios ($\bar{m}$) result in the responses of soil-structure SDOF systems become greater in all structure-to-soil stiffness ratios.

INTRODUCTION

In the near-field zone, pulse-like motions play crucial roles in the design of structures. In order to find a dependable intensity measure for design of civil structures, much effort has been devoted to analysis and to evaluate seismic performance of various systems subjected to such excitations. In some studies, the role of high ground velocities was accentuated to the extent that peak ground velocity (PGV) is often considered as the effective indicator of damage potential (Hall etal., 1995). On the other hand, some other studies indicated that acceleration pulses are in general leading engineering demand parameters for most civil structures than velocity pulses (Makris and Black, 2004).

It is worth to note that, Although PGA and PGV are very useful intensity measures for seismological studies, none of them can provide any information on the frequency content or duration of the motion. While, there is the agreement among the researchers concerning the influences of frequency content on seismic responses of civil structures. Consequently, PGA and PGV have to be completed by additional information for the proper characterization of a ground motion (Kramer, 1996). The ratio of PGV to PGA (ratio) is a ground motion parameter which provides information about frequency content of the input motion. Since PGA and PGV are usually associated with motions of different frequencies (Kermani et al.,