Multi-component seismic analysis and estimating the results by means of ET method

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Abstract

This study, has focused on 3D structural analysis, using series of preselected records and tries to estimate the average of maximum results by means of simpler methods. ET method is a newly innovated method, which uses some kinds of increasing artificial records. Results gained using ET method in 2D analysis, which have been published in some papers, shows reliability and practicality of the method. In this study, we are going to use ET method as a new, simple and practical method to predict average results of series of records in 3D problems. Several different and major parameters such as stories' drifts and rotations have been investigated and variations for different degrees have been measured. Analyses have made only for elastic materials. Comparison of ET results and average results of the records shows a satisfactory compatibility.

Keywords: 3D seismic analysis; Scaling method; Endurance Time method; Multi-component dynamic excitation

1. Introduction

Today, design of structures is going to reach more advanced levels. Powerful and capable computers have prepared enough facility to prevent us using former rough traditional analysis methods. On the other side, several investigations have showed up deficiencies of former methods such as static lateral load in finding the exact response of structure. Although, some other methods have tried to improve older ones by, for example, taking into account the higher mode effects, but, new methods of structural design such as Performance Based Design need more exact and reliable responses. In this respect, it seems that the time has come to use exact analysis methods such as Time History analysis. But, extreme volatility in seismic excitation nature may produce some major problems here, since, we might need several time history analysis in order to make sure that all aspects of structural responses have been involved. So, the main problem on the way to use time history analysis is the vigorous need to do several analysis. Thus, finding a way to estimate the final values without any need to do such extent of analysis, can be really advantageous and can obviate huge efforts needed to determine structural responses under 3D excitation. Endurance Time methods is a recently developed method to fulfill this desire. In the latter paragraphs, we will talk more about this method and results gained using this method for some type of structures.

One of the major issues using seismic records is finding a method to adjust records' intensities to a definite and reasonable level. Earthquakes' intensities and influences can be attributed to different factors. One of the mostly used parameters to evaluate the intensity of a record is the acceleration spectrum. Since, acceleration is directly correlated to inertial force it seems a wise decision. So, acceleration spectrum have been used, here, to scale different records to a definite intensity. Different scaling methods based on the acceleration spectrum have been used, here. Results for various structures are compared with ET results.

2. ET Method