ADAPTIVE PUSHOVER ANALYSIS OF REINFORCED CONCRETE STRUCTURES

Mohammad Reza AMERI
Ms. In Earthquake Engineering. Kharazmi University, Tehran, Iran
Ameri.m19@gmail.com

Ali MASSUMI
Associate Professor in Structural Engineering, Kharazmi University, Tehran, Iran
massumi@khu.ac.ir

Mohammad HAGHBIN
M.Sc. in Structural Engineering, Kharazmi University, Tehran, Iran
b.haghbin@gmail.com

Keywords: Adaptive Pushover Analysis, Lateral Load Pattern, Incremental Dynamic Analysis,Mid-rise Buildings, Reinforced Concrete Structures

ABSTRACT

Nonlinear static analysis, commonly referred to as pushover analysis, is a powerful tool for assessing the seismic response of structures. A suitable lateral load pattern for pushover analysis can bring the results of this simple, quick and low-cost analysis close to the realistic results of nonlinear dynamic analyses. In this research, four samples of 10- and 15-story [two- and four-bay] reinforced concrete frames were studied. The lateral load distribution patterns recommended in FEMA 273/356 guidelines were applied to the sample models in order to perform pushover analyses. The results were then compared to the results obtained from several nonlinear incremental dynamic analyses for a range of earthquakes. Finally, a lateral load distribution pattern was proposed for pushover analysis of medium-rise reinforced concrete buildings based on the results of nonlinear static and dynamic analyses.

INTRODUCTION

In recent years, performance-based design methods have been proposed as new concepts and have been extensively used in the seismic design and evaluation of structures (Ghaffarzadeh et al., 2013). This design approach is primarily concentrated on meeting various performance objectives matching the desired level of the service of the structure. Among such methods, nonlinear static analysis is considered to be the basic notion of performance based seismic design. The effectiveness of nonlinear static analysis and its computational simplicity brought this procedure in to several seismic guidelines and design codes in last few years. However, many researches have shown that conventional methods which are usually based on load patterns restricted to the fundamental mode shape include many deficiencies that can result in responses totally different from those obtained through dynamic analyses (Paret et al., 1996; Goel and Chopra, 2004).

Therefore, various procedures as well as load patterns have been proposed in order to overcome some of these shortcomings. Moghadam and Tso (2002) provided a multimode approach in which the seismic response of the structure corresponding to each mode was calculated and the overall responses were then obtained on the basis of modal participation factors for each mode. Chopra and Goel (2002) developed another method of analysis named modal pushover analysis. In this method, a series of independent analyses was performed with the lateral load patterns consistent to the mode shapes. The produced modal responses were then combined together using quadratic modal combination rules. Despite the higher mode effect