INVESTIGATION OF DETERIORATION BEHAVIOR OF HYSTERETIC LOOPS IN NONLINEAR STATICANALYSIS FOR SCMR FRAMES WITH SHEAR WALL

SalmanR. DEHKORDI
Graduate Student (M Sc.), Dept. of Earthquake Eng., School of Eng.
Science and Research Branch of the Islamic Azad University (IAU), Tehran, Iran
salman.raeisi@gmail.com

AbdolrezaS. MOGHADAM
Assistant Professor, Structural Eng. Research Centerthe International Institute
of Earthquake Engineering and Seismology (IIEES), Tehran, Iran
moghadam@iiees.ac.ir

Keywords: Deterioration Behavior, Nonlinear Static Analysis, Special Concrete Moment Resisting Frame (SCMRF), Shear Wall, Target Displacement

ABSTRACT

One of the shortages of pushover analysis is that it approximately considers the effects of deterioration pertained to hysteretic loops for structural elements. To evaluate this effect, it is necessary to perform nonlinear static and dynamic analyses and compare the results. To this end, six different planar frames, each one being a part of three-dimensional designed structures, have been modeled in OPENSEES software. All of the structures are the same in plan and different in height. Deterioration behavior as well as non-degrading behavior is considered in time history analyses. Also twelve ground motion records which are scaled to 0.35g hazard level have been used. For modeling the structural elements, stresses and strains for each designed section are considered with respect to confinement effects. The required backbone curve includes cracking, yielding and ultimate stress points which are all derived from USC-RC software, and of course with considering elements cross section, arrangement, number and size of reinforcing bars. For accurate calculation of the target displacement and bilinear idealization of capacity curve, a computer program was developed in MATLAB environment to determine the target displacement, strength ratio (R) and etc.
Finally maximum displacement amounts derived from inelastic dynamic analyses for 0.35g hazard level are compared with those obtained from nonlinear static analyses. Results show that with increasing the height of frame, the variance between frame displacements with both deteriorating and non-degrading behavior will be decreased, so that the effect of deterioration behavior could be neglected in target displacement calculation for high-rise frames.

INTRODUCTION

As most of the buildings which have been built in the past years are designed according to the previous codes and/or even the effects of earthquake have not been considered in their design, proceeding to evaluate these structures is necessary. Quantitative evaluation is one of the methods of evaluating structures. It is usually done by analytical methods which include linear and nonlinear static and dynamic procedures. Considering the behavior of structure in the nonlinear zone, linear methods cannot provide us with an accurate evaluation of it against the effects of earthquake that leads it to the nonlinear stage. Nonlinear methods present more realistic results. Nonlinear dynamic analysis (NDA) is more accurate than nonlinear static analysis (NSA). Since this method is so time-consuming and needs many experts to interpret the results and also sensitivity of results to selection of earthquake records, it cannot be vastly used.Therefore due to its simplicity, the structural engineering profession has been using the nonlinear static procedure (NSP) or