Nonlinear seismic analysis of unsymmetrical structures

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ABSTRACT

It is well known, within the earthquake engineering community, that the most accurate method of seismic demand prediction and performance evaluation of structures is nonlinear time history analysis. However, this technique requires the selection and employment of an appropriate set of ground motions and having a computational tool able to handle the analysis of the data and to produce ready-to-use results within the time constrains of design offices; clearly, a simpler analysis tool is desirable. One method that has been gaining ground, as an alternative to time history analysis, is the nonlinear static pushover analysis. The purpose of the pushover analysis is to assess the structural performance by estimating the strength and deformation capacities using static, nonlinear analysis and comparing these capacities with the demands at the corresponding performance levels. Although conventional method of pushover analysis provides crucial information on response parameters that cannot be obtained with conventional elastic methods (either static or dynamic), this method is not exempt from some limitations such as the inability to include higher mode order effects or progressive stiffness degradation. Although in adaptive pushover analysis these effects are considered,but as a result of using SRSS & CQC modal rules to combine the contribution from different structural modes, negative signs are eliminated and this method involves inherent limitations. Although one of the reasons for developing adaptive pushover analysis is to improve the deficiencies of conventional methods for evaluating seismic response of irregular and unsymmetrical structures, no serious research for evaluating the accuracy of these methods for unsymmetrical structures has already been done. In this research the results obtained by nonlinear static methods are compared to those from nonlinear time history analysis to verify the accuracy of the different pushover schemes for reinforced concrete setback-frames.