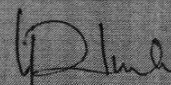Suresh Chandra Satapathy · K. Srujan Raju ·
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Nonlinear Dynamic Analysis

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Abstract. To determine the performance of structures facing earthquakes the method which is becoming increasingly significant is nonlinear dynamic analysis. To perform nonlinear dynamic analysis the method used here is incremental dynamic analysis. Range of structural response from elasticity to yielding is being covered and further extended up to dynamic instability. A 10 story reinforced concrete building frame structure was developed. The computational model was analyzed. For simulation software used is Opensees - Open System for Earthquake Engineering Simulations. High Performance Computing facility of C-DAC is used for simulations. The results indicate the probability of yield and collapse of the structure when subjected to a series of earthquakes.

Keywords: Ground motion · Peak ground acceleration · Inter storey drift · IDA

1 Introduction

Collapse of numerous RC frame buildings during recent earthquakes has emphasized the need of earthquake analysis of buildings which are in existance to protect them from future damage. To identify the seismic vulnerability of a structural system Seismic risk analysis of a building is important. For retrofitting decisions and disaster response planning it is important to know seismic vulnerability estimation.

There are different methods used for determining seismic vulnerability. Those methods can be summarized as Static and dynamic methods. Out of which nonlinear dynamic analysis is the one which gives most realistic results. It studies elastic response of the structure through yielding and nonlinear response right up to the dynamic instability. Thus it covers overall behavior of the structure. To perform nonlinear analysis, incremental dynamic analysis-IDA has been proved to be one of the powerful means. In IDA a set of selected ground motions is applied to the structure various times. Each time the ground motion is scaled with increasing scale factor. Response of the structure is counted in terms of inter story drift. A series of dynamic analyses is performed until structure reaches its ultimate capacity. The results are plotted in the form of graph with intensity measure and damage measure as two axes. Meaningful statistical averages are obtained using the plots.