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Proposal and application of the Incremental Modal Pushover Analysis (IMPA)

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Abstract

In recent years, many research activities were undertaken to develop a reliable and practical analysis procedure to identify the safety level of existing structures: Incremental Dynamic Analysis (IDA) is considered to be one of the most accurate methods to estimate the seismic demand and capacity of structures. However, the executions of many complex and computationally heavy nonlinear response history analyses (NL_RHA) are required. This paper deals with the proposal of an efficient Incremental Modal Pushover Analysis (IMPA) to obtain capacity curves by replacing the nonlinear response history analysis of the IDA procedure with Modal Pushover Analysis (MPA). In this work, the MPA is extended and applied to three-dimensional asymmetric structures and finally it is used in order to obtain a "multimodal" capacity curve: therefore MPA method is used to evaluate both displacements, as in the standard method, and base shear (this is a novelty). According to this approach the proposed procedure (IMPA) is defined and applied to estimate the structure's seismic response and capacity for given seismic actions. This new procedure is finalized to obtain a capacity curve, as commonly done performing pushover, but it accounts also higher modes effects. Finally IMPA is applied to an existing irregular framed building and compared with NL_RHA.

Keywords: modal pushover analysis; pushover; incremental analysis; existing irregular framed building; capacity curve; fragility curve

1 Introduction

The existing building stock has been realized before that seismic engineering has became part of the technical codes. Therefore, in order to execute a diffuse seismic analysis of buildings, the development of fast and reliable analysis procedures is necessary. At present incremental dynamic analysis (IDA) is considered as the most accurate method for estimating the seismic response and capacity of structures over the entire range of structural responses, from elastic

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