ASSESSMENT OF DISPLACEMENT-BASED ADAPTIVE PUSHOVER (DAP) CAPABILITY TO ESTIMATE SEISMIC INELASTIC DEMANDS OF SMRF'S

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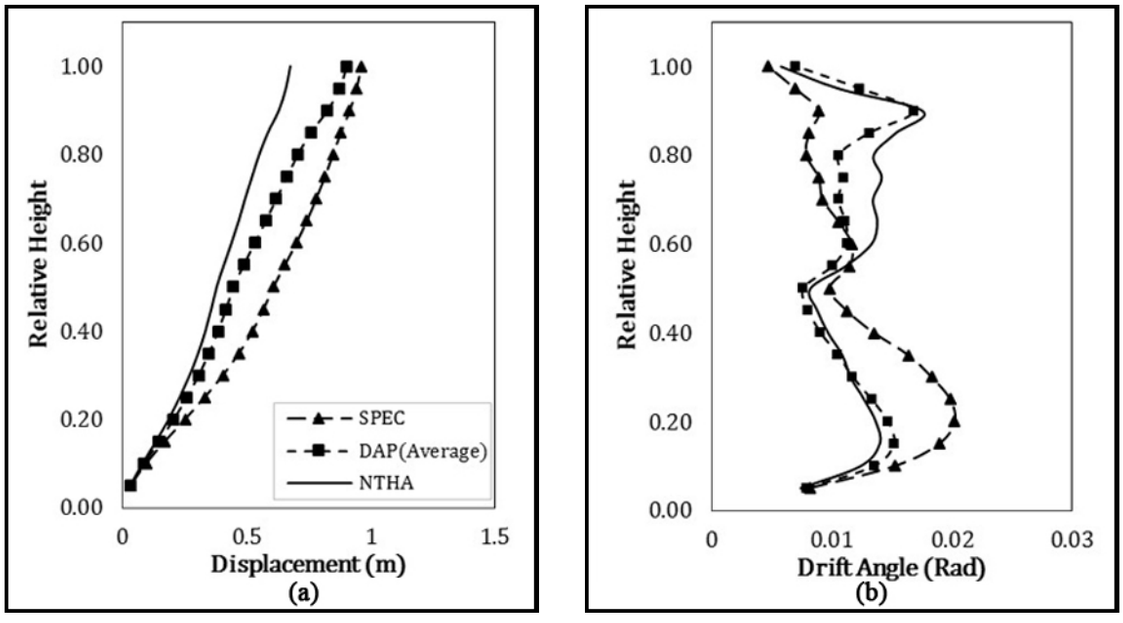
A nonlinear static analysis, which is known as Push-Over, has been extended in the last decades. This procedure is used in seismic evaluation as an alternative method for nonlinear dynamic analysis. This procedure amplifies lateral forces in structure height with the specified load pattern distribution to reach prescribed target displacement. In the conventional nonlinear static procedures while the structure reaches the nonlinear region, load pattern is still uniform. This is a limitation of these procedures because in reality the nonlinearity changes the load pattern in each step of loading regarding to inelastic stiffness matrix. To overcome this defeat of conventional methods, advanced nonlinear static analysis methods have been proposed to consider higher mode effects and adapted load pattern.

Several advanced Pushover procedures have been proposed recently. The Adaptive Pushover proposed by Pinho.et.al is one of the practical one. This procedure is divided into Displacement and Force-Based procedures. Evaluating the Displacement-based Adaptive Pushover (DAP) method in estimating seismic demands (displacement and inter-story drift angle) for steel moment frames is the main purpose of this research. In order to perform inelastic analysis, intermediate steel moment resistant frame with 10, 15 and 20 story and 5-span have been designed according to AISC05. In order to evaluate the DAP method capability, 10 Far-field time history accelerations have been selected. Finally, results have been compared with conventional nonlinear static analyze (using spectral load pattern) and Nonlinear Time History Analyze (NTHA) to detect its accuracy.

To scale the records, an innovative method has been proposed and named as "limiting the rotation of structural nodes to prescribed value". In this method, the total node rotation is limited to 0.02 rad to meet the medium ductility according to Iranian building code specifications. This criterion is agreed with the lower limit of collapse prevention performance level according to SEAOC instruction. To compare the results of all Pushover with NTHA, the roof displacement increases till the maximum rotation of node reaches 0.02 rad. At this stage, the roof displacement is known as target displacement. According to Iranian building code of steel structure design, the node rotation is equal to the inter-story drift angle. To perform all aforementioned nonlinear analysis, the Opeensees has been used. This software is unable to perform adaptive nonlinear static procedures. Thus the special code was developed by the authors in the Matlab to run DAP.

Results of NTHA and DAP for all records have been calculated and compared with the traditional Pushover procedure using spectral load pattern. Following figure shows the displacement and drift angle for each story of 20-story model.



Fiqure 1. a) Story displacement profile, 20-story b) The variation of inter-story drift angle, 20-story structure

The results show that DAP method can superlatively estimate the displacement demand and intersory drift angle especially for high-rise buildings. Also it is able to consider higher mode effects in tall buildings. With the increase in the structure height, the accuracy of DAP methods increases in comparison with traditional Pushover procedure using spectral load pattern.

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