

The Engineering Practice of Elasto-plastic Dynamic Time-history Analysis on Complex Building Structures Using Abaqus

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Abstract: Compared with response spectrum method and the pushover method, Elasto-plastic dynamic time-history analysis method is considered to be a more accurate seismic analysis method. Because of Abaqus's strong non-linear calculation function, the software makes it possible for the method mentioned above to be applied. Elasto-plastic dynamic analysis on complex structures using Abaqus has a rapid development in China. In this paper, with CCTV Building, Shanghai World Expo Axis Sun Valley, Dalian Xiaoping island super-high-rise apartment building and many other cases of engineering practice, the problem-solving experience of seismic analysis on major projects is described, which will provide some reference to the analysis method's further development and engineering practice.

Keywords: Elasto-plastic dynamic time-history analysis, Abaqus, complicated building structure, seismic analysis

1. Introduction

China seismic code (GB 50011-2001) adopts applied method to prevent structures from destroy under minor earthquake and collapse under major earthquake, which is doing capacity design and elastic deformation checking under minor earthquake firstly then checking elastoplastic deformation under major earthquake.

Nowadays in the first phase, the elastic static analysis and dynamic time-history analysis method are relatively mature. And in domestic and abroad there is a lot of computing software which can provide good results. But in the second phase of the design the elasto-plastic analysis method is still under developing. Pushover method is a simplified elasto-plastic static analysis method, which is still being improved (Chopra, 2002). This method ignores the dynamic effect of the earthquake and is considered not to be an ideal method (FEMA 273&274, 1998). Elasto-plastic dynamic time-history analysis is to consider internal force and deformation of the structure at every moment during the whole process of earthquake. It can also point out structural cracking and yielding order and discover the concentration zone of stress and plastic deformation, thus help engineers to recognize the yielding mechanism, weak links and the possible failure modes, so the method is regarded as a relatively complete and accurate method.

Dynamic method requires high-speeded computer hardware, well-developed function of software and higher professional skills, which limits the scope of its use. However, the rapid development of high-rise buildings and complicated structures nowadays in China put pressing needs on the Elasto-plastic dynamic time-history analysis method. In particular, in the amending edition of