

Active Control of Structure and its Application in Seismic Design Based on Damage Control

Abstract

The huge life and property losses induced by seismic events such as earthquakes and severe wind blows demonstrate shortcomings of the force method in seismic design of structures. In this regard, a new method known as “damage-based design” has made researchers interested in changing the philosophy of seismic design. Through this method, considering a function known as damage index, the design process is adjusted in a way that this index takes a constant and predefined value during potential seismic events. One of the available solutions for implementation of the damage-based design is to apply active structural control, which is discussed in this work. In this research, a set of 3D reinforced concrete frames are selected and a predefined distribution of target damage indices are assigned to the structures by controlling the interstory drift. Next, through a regression analysis between the damage index and the story drift, a relation is developed between the damage index of each story and maximum interstory drift of the same story. Based on the performed verifications, it is found that the developed relation is capable of estimating the damage index with good accuracy. Moreover, by using this relation and adjusting the control algorithm, it is possible to obtain the predefined damage level in each story of different structures under various earthquakes.

Keywords: Active control, damage based seismic design, concrete structure, Park-Ang damage index.