A NEW APPROACH FOR TUNING ATMD IN ORDER TO IMPROVE SEISMIC RELIABILITY INDEX OF STRUCTURES

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Active structural control systems are used to protect structures against seismic excitations. One of the difficulties in the design of structures considering protective systems is the explicit consideration of uncertaintyabout the structural model and the potential variability of future excitations (Jensen and Sepulveda, 2011). According to the uncertain nature of the earthquake phenomena, tuning of an active structural control system for a specific seismic record may not necessarily leads to the optimum performance (Soleymani and Khodadadi, 2013).

Figure 1 schematically illustrates a single degree of freedom structure equipped with an active tuned mass damper (ATMD). When, this system is tuned for Manjil earthquake; as shown in Figure 2.a; the system performance is significant just for this record (Manjil), nor to other records; i.e. Chichi earthquake; as shown in Figure 2.b. Subsequently, the reliability of this system for future earthquake may be under question.

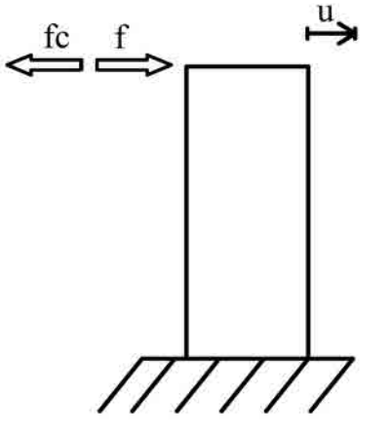
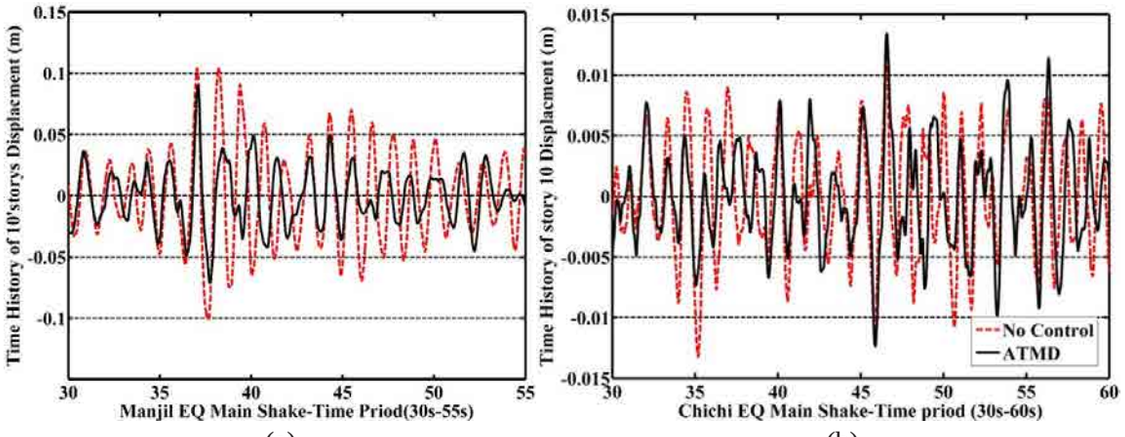


Figure 1. Sample structure



(a) (b)

Figure 2. Time history displacement of top floor with and without ATMD against Manjil and Chichi EQ

Consequently; the current approach of tuning must be improved in order to achieve the maximum reliability in the controlled structure. The tuned system must be fitted for a wide range of seismic excitations. In this paper, a new approach for tuning an ATMD system designated for a tall building is proposed. For this purpose, an 11-stories structure located in vicinity of a certain fault with a characteristic magnitude is considered. According to the assumed site hazard; 1000 physically-based ground motion record is generated. The ground motion records are clustered based on their spectral features. As a result; a representative record is constructed by employing the cluster centers. The constructed record is used for tuning procedure. Results reveal that this method of tuning arises the seismic reliability index; comparing with the other well-known approaches. The robustness of the proposed approach is analyzed with more details.

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