عنوان مقاله:

Influence of the suspended pendulum on the modal responses of structures

محل انتشار:

تعداد صفحات اصل مقاله: 13

نویسندگان:

Seyed Reza Jafari – Earthquake Engineering, Disaster management Institution, Istanbul Technical University,

Osman Bulut – Associate Professor, Istanbul Technical University, Faculty of Civil Eng,.

خلاصه مقاله:

A high-rise building under dynamic loads reacts to severe deformation. To minimize its vibrational response, adding a pendulum tuned mass damper (PTMD) is a common method to dissipate energy. The primary purpose of this research is to investigate the existence of the PTMD's effects on dynamic responses. To this end, the finite element method (FEM) is employed to simulate and analyze. First, the finite element (FE) model of a solid support body (SSB) is created. In this model, fixed support at the bottom of SSB as a boundary condition (BC) and downward gravity acceleration as a loading to the whole system are considered. The Response Surface Optimization (RSO) method is used to determine the appropriate element size in order to achieve mesh independence analysis. Following that, modal analysis is done and frequency responses are validated. In the second step, an FE model of a suspended pendulum (SP) model as a PTMD system is created. This mechanical system is comprised of a rod and a rigid body suspended from a pivot point. This system can be rotated around the pivot point. The equation of motion (EOM) for a free vibration SP is obtained. From this relationship, the natural frequency equation is extracted. The frequency responses from the FE model for different mass ratios are validated using the relationship. Finally, a combined system of SSB and SP with two degrees of freedom (DOF) is considered. In this system, the first DOF belongs to SSB, a translational type, and another to SP, a rotational type. The frequency responses of the combined system for various mass ratios are obtained.

کلمات کلیدی:

Pendulum tuned mass damper (PTMD), Suspended pendulum (SP), Finite element method (FEM), Response Surface Optimization (RSO), Natural frequency.

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