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Floor vibration control of Nuclear Power Plants under Earthquake Vertical Excitations

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ABSTRACT

Vibration problems caused by severe environmental loads such as seismic excitations pose risks to the functionality of critical facilities in nuclear power plants. Excessive floor vibration may make equipment less reliable and even structures unsafe. Therefore, floor vibration control of nuclear power plants is very essential for assuring structural safety and equipment functionality. In recent years, the authors have developed an optimum design procedure of multiple tuned mass dampers (MTMD) for structural control and verified its control performance through extensive analytical studies and large-scale shaking table tests. In this study, an optimal MTMD system was proposed to mitigate the excessive vibration of floor system in a nuclear power plant under earthquake vertical excitations. The optimal design procedure was employed to determine the optimal location and system parameters of each unit of the MTMD system based on the control of first few dominant coupled modes of the floor structure. Results from numerical analysis show that the proposed MTMD system is effective in mitigating the seismic acceleration responses of the floor system of a nuclear power plant, and thus enhancing the safety and serviceability of critical facilities sitting on the floors.

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