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Parametric Study of Base Isolation System for Nuclear Power Plant

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Abstract

Base isolation systems are widely used to protect various types of structures like buildings, bridges, viaducts, industrial plants and are considered one of the most promising technologies to protect nuclear reactors from violent earthquakes. Satisfactory and safe performance of nuclear structures under seismic occurrence is necessary for Nuclear Power Plant (NPP) to avoid radioactive leakage from Nu-clear Reactor Building (NRB). The parametric study presented illustrates how changing a design parameter of the isolation system influences the seismic response of the NPP and also provides guidance on isolation parameters that lead to improved response. The earlier study illustrates that the finite element (FE) model has the same behaviour as of Lumped Mass Stick Model (LMSM) model. Thus, NPP structure analysis is done by LMSM for ease of seismic analysis. The governing equations of motions are formulated and solved in a state-space form using MATLAB/SIMULINK. Further, the study has been carried out of the parameters such as displacements, acceleration, base shear and hysteresis loop of the fixed and isolated NPP structure concerning horizontal earthquake excitation. The various isolation systems considered are Laminated-rubber bearing, Lead-rubber bearing, Pure friction bearing, Friction pendulum system, and Resilient-friction base isolator.

Keywords: Parametric study, Base isolation system, Earthquake, Nuclear power plant, Lumped mass stick model