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# Dynamic responses of vertical transportation systems in tall buildings under seismic excitations

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**Abstract:** Tall buildings are susceptible to the significant lateral sway in the events of earthquake. Seismic ground motions generally contain low-frequency waves which resonate with the fundamental mode of the buildings. This affects vertical transportation systems, such as lifts, installed in the buildings. Resonance interactions between the building structure and lifts arise then. This can induce the lateral motions of the car/ counterweight, and consequently lead to severe damage in the lift installations. This paper aims to present a detailed Finite Element (FE) model that can predict the dynamic responses of the car/ counterweight system installed in the tall building structures under seismic excitations. An analytical model is also developed based on the structural dynamics theories, and the results are then compared with those obtained from the FE models. The results of this study should prove useful for the mitigation of earthquake damage in the vertical transportation systems.

**Keywords:** Dynamic responses, seismic ground motions, lift, Finite Element (FE) analysis, tall buildings