A Simplified Soil-Structure Separation Case Study for a Nuclear Power Plant Auxiliary Building

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A soil-structure separation case study is presented for a nuclear power plant auxiliary building. The simplified separation investigation evaluated the forces developed in interface springs included in a traditional equivalent-linear soil-structure interaction (SSI) analysis. The interface spring properties are calibrated such that the springs have an equivalent stiffness as that of the surrounding soil. Displacements for end nodes of springs are extracted directly from the SSI model and used to calculate the spring forces. The resulting spring forces approximate the physical response of the soil/structure interface and can be used for separation assessment analysis.

To capture the global trend of the dynamic soil force and minimize the local spikes, a polynomial curve is fitted to the jagged dynamic force profile. The at-rest pressure of the soil is calculated and added to the dynamic force to calculate the total soil force. The separation elevation is calculated as the first point with a positive (tension) total force scanning from the bottom of the soil column to the top. The duration of an individual separation event is too short to cause the building to dynamically behave as it were separated from the soil for that maximum separation depth. Therefore, a statistical interpretation of separation depth is more relevant. The median separation depths and corresponding standard deviations are calculated for multiple locations on the east, west and north sides of the structure. A visual inspection of the total force time history profiles is performed to assure that calculated medians and standard deviations are physically meaningful.