The role of seismic metamaterials in Soil-Foundation-Structure Interaction

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Abstract

The response of a structure to earthquake shaking is affected by interactions between three linked systems: the structure, the foundation, and the soil underlying and surrounding the foundation [1, 2]. Soil-structure interaction analysis evaluates the collective response of these systems to a specified ground motion. The terms Soil-Structure Interaction (SSI) and Soil-Fondation-Structure Interaction (SFSI) are both used to describe this effect. A seismic soil-structure interaction analysis evaluates the collective response of the structure, the foundation, and the geologic media underlying and surrounding the foundation, to a specified free-field ground motion. The term free-field refers to motions that are not affected by structural vibrations or the scattering of waves at, and around, the foundation. SSI effects are absent for the theoretical condition of a rigid foundation supported on rigid soil. However, in the case of structured soils and, among them, seismic metamaterials [3], we are specifically looking to interact, by means of diffraction and local resonance effects, with high concentration of foundations in the soil (piles, retaining walls, inclusions, etc.). This is the reason why the recent studies on meta-structures and metamaterials [4 – 8] can improve the seismic building codes in the future.

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