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## Validation of Coupled FDM-DEM Approach on the Soil-Raft Foundation Interaction Subjected to Normal Faulting

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Recent earthquake events have shown that besides the strong ground motions, the coseismic faulting often caused substantial ground deformation and destructions of near-fault structures. In Taiwan, many high-rise buildings with raft foundation are close to the active fault due to the dense population. The Shanchiao Fault, which is a famous active fault, is the potentially dangerous normal fault to the capital of Taiwan (Taipei). This study aims to use coupled FDM-DEM approach for parametrically analyzing the soil-raft foundation interaction subjected to normal faulting. The coupled FDM-DEM approach includes two numerical frameworks: the DEM-based model to capture the deformation behavior of overburden soil, and the FDM-based model to investigate the responses of raft foundation. The analytical approach was first verified by three benchmark cases and theoretical solutions. After the verification, a series of small-scale sandbox model was used to validate the performance of the coupled FDM-DEM model in simulating deformation behaviors of overburden soil and structure elements. The full-scale numerical models were then built to understand the effects of relative location between the fault tip and foundation in the normal fault-soil-raft foundation behavior. Preliminary results show that the raft foundation located above the fault tip suffered to greater displacement, rotation, and inclination due to the intense deformation of the triangular shear zone in the overburden soil. The raft foundation also exhibited distortion during faulting. Based on the results, we suggest different adaptive strategies for the raft foundation located on foot wall and hanging wall if the buildings are necessary to be constructed within the active fault zone. It is the first time that the coupled FDM-DEM approach has been carefully validated and applied to study the normal fault-soil-raft foundation problems. The novel numerical framework is expected to contribute to design aids in future practical engineering.

**Keywords:** Coupled FDM-DEM approach; normal faulting; ground deformation; soil-foundation interaction; raft foundation.