

PROCEEDINGS

Multiscale Modelling of Normal Fault Rupture-Soil-Foundation Interaction

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ABSTRACT

A multiscale approach [1] that couples the finite-element method (FEM) and the discrete-element method (DEM) is employed to model and analyse the earthquake fault rupture-soil-foundation interaction (FR-SFI) problem. In the approach, the soil constitutive responses are obtained from DEM solutions of representative volume elements (RVEs) embedded at the FEM integration points so as to effectively bypass the phenomenological hypotheses in conventional FEM simulations. The fault rupture surfaces and shear localization patterns under normal faults with or without foundation atop have been well captured by the multiscale approach and verified with available centrifuge experimental [2] and numerical results [3]. By examining the responses and microstructural evolutions of local RVE packings, it is found that the RVEs located in- or outside the shear bands behave distinctly, and may change their stress states from initial at-rest to active in the normal fault case. The micromechanics study also sheds lights on the capability of heavy foundations in protecting the superstructure as a result of rupture surface diversion.

KEYWORDS

Multiscale modelling; finite element method; discrete element method; normal fault rupture; soil-foundation interaction

Funding Statement: The study was financially supported by the National Natural Science Foundation of China (Grant Nos. 52078456, 51809229, N. G. Grant No. 52020105003, Z. X. Y. Website: <https://www.nsf.gov.cn/>) and the Fundamental Research Funds for the Central Universities, China (Grant No. 2021FZZX001-14, N.G. Website: <http://rd.zju.edu.cn>).

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

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