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Numerical analysis of dry-stack stone masonry walls subjected to lateral monotonic load

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ABSTRACT

Historical unreinforced masonry (HURM) structures are vulnerable to seismic actions and should be adequately strengthened. Understanding their mechanical behavior by evaluating the structural resistance and failure mechanisms is needed for rehabilitation and retrofitting process. In light of the importance of these structures, physical interventions should be minimized, and accurate numerical simulation can effectively assist in this matter.

Unreinforced stone masonry walls had been widely used in ancient monumental and traditional buildings worldwide. In this study, mechanical behavior of URM walls with dry-stack joints was numerically investigated by ABAQUS (2020) software. The experimental results of monotonic tests conducted by Vasconcelos (2005) were selected for the validation of numerical models under four pre-compression levels. By calibrating a set of parameters, including penalty stiffness factor, mesh size, and friction coefficient, the validity of the numerical model was checked. The mechanical behavior was then investigated in terms of stiffness, strength, and failure mechanism according to pre-compression level. The overall behavior of the wall under pushover load was in the form of elastic-perfect plastic behavior, which was highly influenced by the level of pre-compression load. The results also showed that the simulated model had a good agreement with the experiment.

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