

FRP Strengthening of URM walls with Openings - Numerical Analysis and Design

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Abstract:

Masonry is a non-homogenous and brittle material composed of aligned, uniformly dispersed units that are intersected by sets of bed and head mortar joints. Hence, the interface of the mortar joints and units is the main plane of weakness. The fracture and crushing of mortar joints and masonry units essentially dominate the performance of unreinforced masonry (URM) subjected to lateral loads. Numerical FEM modeling is a suitable method to effectively simulate the aforementioned mechanical behavior of masonry. The adjustment of contact element parameters is obtained by static uniaxial compression simulations. This paper presents a discrete model of masonry walls using an engineering simulation software, ANSYS, in which each unit is described as an assembly of plane stress elements and mortar joints, which are modeled as zero-thickness contact elements between distinct bodies. The objective of building the finite element model (FEM) was to model the performance of fiber reinforced polymers FRP strengthened masonry walls having an opening subjected to in-plane loads. Numerical calculations are conducted for comparison with experimental results presented in the companion paper to show the robustness and effectiveness of the proposed model. The FEM model satisfactorily fitted the experimental results in terms of cracking pattern, failure mode, and ultimate load, while it tended to underestimate the ultimate lateral displacement.

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