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ANALYSIS OF LOCAL PROPERTY WITHIN MASONRY PANELS USING CELLULAR AUTOMATA

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The paper introduces an intelligent method to analyze the behaviors of the laterally loaded masonry panels both with and without openings, based on the existing experiment results of the base panels. Firstly, in comparison with the results from the conventional finite-element analysis (FEA) of the base panels with the experimental results obtained in the tests, local property coefficient is defined as the ratio of the displacement values of the FEA to those of the corresponding zones measured in the experiments to describe the variability of different zones within the base panels. Secondly, using the cellular automata (CA) technique, numerical models are established to calculate the zone state values of the base panels and the unseen panels, which can express the effect of panel boundaries on the zones and the location of doors and windows. Then according to the proposed matching criterion, if a zone state value of the unseen panel is nearly to one state value of the base, they are similar zones, which have the same local property coefficient. Finally, the material properties are corrected by the local property coefficients in different zones. The modified properties are applied in the FEA to predict the behavior of unseen panels. When compared with the experimental results, the application of the local property correctors in the FEA can improve the accuracy of the prediction of displacements of the wall panel by 16%. The case studies also indicate that the proposed method represents the true behavior of the masonry panels very well, as the variation in masonry properties relating to boundary effect is reflected in the FEA. The results indicate that this method is effective for analyzing the deformation of the masonry panels both

with and without openings. Therefore, this study could lead a new way for the application of the existing experimental records in structural analysis. And it improves the FEA analytical methods modified by the local property corrector so that the predicted structural response is more accurate.

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