Master's Thesis

A Numerical Simulation of Fiber Reinforced Paint Retrofitted Masonry Behavior using 3-Dimensional Extended Discrete Element Method

3 次元拡張個別要素法を用いた繊維強化塗料補強組積造の破壊挙動に関する数値解析的研究

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Abstract

This research incorporates the 3-Dimensional Extended Discrete Element Method (3D EDEM) as a basis for modeling the masonry structure, with additional paint elements that are represented by elastoplastic springs between the edges of the masonry elements. The developed 3D EDEM model allows us to simulate the total behavior of retrofitted masonry structures until collapse stage and it was used to compare non-retrofitted brick masonry structures with retrofitted ones using fiber reinforced paint to understand the effects of retrofitting under seismic loading. Numerical results were verified using the previous experimental results that employed 1/4 scaled burnt brick masonry wallette models with and without retrofitting and satisfactory results were obtained. The current study employs a relatively simple paint element that assumes perfect adhesion between the masonry surfaces and paint. As such, for cases involving insufficient paint application, peeling-off phenomenon should also be considered in future models. Similarly, failure of paint in cohesion is not considered in the current model, which also needs to be addressed in subsequent modeling procedures. In near future, with the incorporation of paint adhesive and cohesive properties, and proper parametric testing to determine the suitable model parameters, the model demonstrates potential to be extended to simulation of the behavior of large-scale fiber reinforced paint retrofitted masonry structures as well.