Discrete and continuous models for the estimation of the seismic vulnerability of masonry church

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Abstract

The aim of this paper is to show to what extent a simple constitutive model can adequately describe the collapse mechanisms of masonry structures under horizontal seismic loads. Referring to block masonry, the paper presents the formulation and the numerical implementation of a constitutive relationship for modeling masonry structures regarded at a macroscopic scale as homogenized anisotropic media. The macroscopic model originally proposed in [1] is shown to retain memory of the mechanical characteristics of the joints and of the shape of the blocks. The overall mechanical properties display anisotropy and singularities in the yield surface, arising from the discrete nature of the block structure and the geometrical arrangement of the units. The model is formulated in the framework of multi-surface plasticity. It is implemented in a FE code by means of a minimization algorithm directly derived from the Haar-Karman principle.
The model is then used for the analysis of a case study, the church of San Nicolò in Capodimonte (GE) subject to horizontal seismic action. The result of the model will be compared with those obtained by a DE model [2] of the same building. In the paper, the results of the two models are discussed and analyzed in the way to highlight the weakness and the potentiality of the two different approaches.

Keywords: **Masonry, Church, FEM, DEM**

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