A minimum energy strategy for the in-plane behaviour of masonry

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Abstract

A great part of existing buildings is composed by masonry structural elements such as load bearing walls. Both valuable architectural heritage and simple low rise buildings are diffused all over the world and in particular in seismic areas. In a well engineered and constructed masonry building subjected to earthquake forces out of plane mechanisms can be avoided. In this case the contribution of in-plane shear resistance of the masonry walls is a determinant factor for the stability of the whole structure. A great amount of efforts has been in fact given in recent years to the analysis of the in plane loading behavior [1]. Masonry is a heterogeneous material, in which the two components, blocks and mortar, with different mechanical properties, are arranged in dissimilar textures [2]. Micromechanical models consider different constitutive behaviour for the constituents, with high computational efforts [3]-[5], while macromechanical models consider masonry as an equivalent continuum material for which overall properties are defined [6]-[8]. In this last case the identification of the material parameters is somewhat difficult. In general, simple tools to model the in plane behaviour of masonry are always welcome in order to evaluate the capacity of walls subjected to vertical and horizontal actions, which activate compressive struts in masonry members. Based on this last consideration, this paper presents an approach for the in plane behaviour of masonry walls loaded with in-plane forces, involving a minimum energy procedure. The proposed model combines the ductility of the numerical procedure, applicable to different geometries of the panel and various mechanical properties of the materials, with a moderate computational cost.

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