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Influence of shear modulus and drift capacity on non-linear static analysis of masonry buildings

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Abstract

In nonlinear static analysis of masonry buildings, the hysteric behaviour of masonry walls is commonly idealized through a bi-linear resistance envelope defined by the lateral stiffness of the wall, the ultimate shear resistance and the ultimate inter-storey drift. Therefore, it becomes fundamental to properly set the modulus of elasticity and shear modulus for masonry as well as to properly evaluate the drift capacity of the walls.

In the paper, the combined influence of shear modulus and drift capacity definition on the assessment of seismic performance of masonry buildings is investigated in details by means of a simplified non-linear pushover type algorithm developed by the authors. In particular, two different definitions are considered for the drift capacity, in terms of ductility and in terms of percentage of the inter-storey height, while for the shear modulus a reasonable set of values is investigated according a database collected combining masonry test results available in the relevant scientific literature with an in situ experimental campaign carried out by the authors.

The results show how the variation in shear modulus can lead to conflicting outcomes for the evaluation of seismic performance of masonry buildings depending on the assumed definition of drift capacity.

Keywords: Nonlinear static analysis; masonry buildings; shear modulus; drift capacity, seismic risk index.

1. Introduction

Through the centuries, masonry has represented the basic construction material for public and private buildings and most of them are ranked among the highest category of mankind's historical and cultural heritage; the recent seismic events though, reminded us how vulnerable they are and how important is the assessment of their seismic vulnerability with a view to the risk mitigation, in terms of preservation of cultural identity, reduction of damage on constructions and protection of human lives.

The global evaluation of the seismic performance of masonry buildings is commonly obtained through nonlinear static analysis, in which the proper stiffness identification and the definition of the ultimate displacement are a key step for the determination of the capacity curve of masonry walls [1].

For this reason, the proper definition of mechanical parameters is the most important step yet the most critical issue: from a huge database setup combining masonry test results available in the relevant scientific literature with the test results obtained in the framework of the *in situ* experimental campaign carried on by the authors, it becomes quite clear that the results of the analysis highly depend on the choice of the values

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