## A NEW DISCONTINUUM FINITE ELEMENT MODELLING APPROACH FOR MASONRY STRUCTURES

## \*Davide Rapone<sup>1</sup>, †Giuseppe Brando<sup>1</sup> and Enrico Spacone<sup>1</sup>

<sup>1</sup>Department of Engineering and Geology, University "G. d'Annunzio" of Chieti-Pescara, Italy.

\*Presenting author: nguyettnmail@gmail.com †Corresponding author: liugr@uc.edu

## Abstract

This paper defines an innovative approach for modelling masonry walls subjected to in-plane vertical and lateral loads.

Such an approach aims at providing a calculation tool that allows to model the non-linear behaviour of masonry structures with a reduced computational effort, but, however, without jeopardizing the accuracy of obtained results.

The proposed model is a typical D-FEM (Discontinuum-Finite Element Model) that, differently by the most traditional methodologies, is composed by deformable elastic blocks, which incorporate a large number of units and that are separated by interface elements arranged according to pre-established surfaces of potential cracks. Along this cracks the "Combined Cracking-Shearing-Crushing" model, proposed by Lourenco (1996) for the FEM analysis with the so called "simplified micro-modelling" approach, is used for simulating the cracking mechanisms. However, the original formulation, thought for a model configuration where units are fully modelled and mortar is simulated by means of interface elements characterized by the aforementioned "Combined Cracking-Shearing-Crushing", is properly modified in order to consider the simplifications used in defining the cracking surfaces.

In a first stage, the model is described. Then the reliability of the proposed formulations is proved by comparing the obtained results with the ones of some experimental tests.

These formulations have been obtained by applying an advanced regression technique, known as Evolutionary Polynomial Regression (EPR), which has been used in order to capture the responses given by a parametric analysis carried out on of 65 masonry panels that differ in terms of geometry, vertical loads, as well as in terms of the most significant mechanical parameters. This parametric analysis has been carried out on the basis of the "simplified micro-modelling" approach mentioned above, once that its validation has been checked through some experimental tests taken by literature.

Keywords: Seismic Vulnerability, Masonry Structures, Discontinuum Finite Element Model, Combined Cracking-Shearing-Crushing model.