On the collapse conditions of the masonry arch with shape uncertainties

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ABSTRACT

The present contribution is aimed at assessing the effect of the shape irregularities on the collapse conditions of circular masonry arches. Actually, historical constructions often present structural elements characterized by irregular shapes, which could affect their bearing capacity if calculated considering their nominal geometry. Some of these irregularities can be ascribed to the arising of deformed states developed over time, or, in other cases, directly to technological construction processes. In this sense, the literature present a lack of studies about the influence of such geometrical irregularities on the strength of masonry structural elements. In previous papers [1,2], the role of geometrical uncertainties on the structural behavior of masonry arches have been already investigated. More in detail, in these studies the uncertainties have been related to the voussoirs' stereometry, considering a deterministic line of the arch axis. Nevertheless, it is well known that actual structures are generally characterized by irregular shapes related to several reasons, as stated before [3].

In this paper the shape uncertainties are introduced in the geometrical description of the arch shape through a probabilistic approach, by using the polycentric arch as a reference geometry and introducing random properties to the variables which deline the final arch shape. A limit analysis based procedure is used to solve the structural problem by considering vertical and/or horizontal actions. The random geometrical sampling determines the loss of symmetry of the masonry arch, affecting the collapse condition in terms of collapse load and the associated kinematic mechanism. The aim of the research is to investigate the effects of such uncertainties on the collapse conditions, also considering several types of masonry arches, i.e. by varying the thickness and the angle of embrace of the reference nominal geometry.

REFERENCES

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