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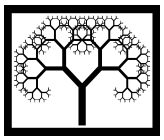

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Numerical Modelling and Seismic Assessment of the Basilica of San Francesco in Arezzo

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Abstract

The paper discusses the static behaviour and the seismic vulnerability of the Basilica of San Francesco in Arezzo (Italy). The vulnerability assessment of the Basilica was evaluated according to the provisions of the Italian "Guidelines for the assessment and mitigation of the seismic risk of the cultural heritage" (DPCM 2011) that identifies a methodology of analysis based on three different levels of evaluation (LV1, analysis at territorial level; LV2, local analysis and LV3, global analysis), according to an increasing level of knowledge. A detailed and careful knowledge process, which included an experimental in-situ investigation, enabled the characterization of the geometric and mechanical parameters required to perform a reliable structural analysis. The finite element modelling technique was employed to perform the global analysis (LV3), where the non-linear behaviour of masonry was taken into account by proper constitutive assumptions. Discussing the capacity of the Basilica to horizontal loads (evaluated together with the seismic expected demand), the paper critically discusses the employability of pushover global analysis for the seismic assessment of Basilica-type churches.

Keywords: seismic vulnerability, local analyses, global analyses, masonry, church, finite element, modelling, pushover.

1 Introduction

Masonry churches represent a hallmark of many Italian and European town centres. As also shown by the dramatic recent earthquakes in Italy, these buildings are particularly susceptible to damage and prone to partial or total collapse under earthquake loads [1]. The high seismic vulnerability of this type of building is due to both the specific mechanical properties of masonry materials (characterized usually by a very small tensile strength) and the particular configuration of the buildings itself that are characterized by an open plan layout often with perimeter slender walls. In