Computational applications in masonry structures: From the mesoscale to the super-large / super-complex

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Abstract

Masonry structures constitutes a large portion of the built heritage around the world, from the past and still today. Therefore, understanding their structural behavior has a crucial role in preserving the historical characteristics of many of those structures and in addressing the requirements for housing and sustainable development. However, due to its composite and highly non-linear nature, it has been a challenge for engineers to analyze masonry structures.

This lecture will provide an extensive overview on computational applications, including the usual micro-modeling approaches (in which masonry constituents, i.e. unit and joint, are represented separately), macro-modeling (in which masonry constituents are smeared in a homogeneous composite), homogenization techniques (in which upscaling from micro to macro is adopted) and structural component models (in which the global behavior of a full structural element is represented). Different phenomena will be addressed including multi-physics and mechanics (statics, slow dynamics or earthquakes, and fast dynamics or impact and blast). Finally, engineering applications will be presented, addressing full scale applications in large monumental structures, regarding safety assessment and strengthening.