Experimental characterization of the variability of joint behavior in masonry structures by noninvasive techniques

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Being composed of large collections of blocks assembled by dry or mortar joints, masonry structures are characterized by a large variability in their macroscopic properties. This macroscopic variability reflects the variability at the scale of the elementary constituents (geometry and behavior of the block and of the joints) but also heterogeneity of the mechanical fields developed in the structure (which is amplified by complex boundary conditions).
In order to propose numerical models that are representative of real structures, it is necessary to have a fine understanding of the joints' response. In this work, we propose to determine the variability of the cohesive response on simple systems composed of a limited number of parallelepiped blocks assembled by calibrated joints with "calibrated" initial heterogeneity.
The challenge is here to non-invasively determine the intrinsic properties of the joints from the overall response of the system. To that purpose, we will use two complementary investigation techniques based on active vibrations and thermal imaging.
Different systems with increasing complexity (from 1D bars to 2D thin walls then 3D situations) will be investigated using different types of blocks and joints (marble with mortar joints and glued alveolar brick).
The mechanical properties of the joints and their variability will be investigated under mechanical loading.
If possible, variability of the joints' properties will be correlated to the one of the fracture properties.
The main location for the student will be at the Mechanics and Civil Engineering Laboratory (LMGC) in Montpellier. Short time periods (1 or 2 days) will be planned at the LMA in Marseille for specific training on acoustic measurements.