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MODELLING DAMAGE IN BRICKWORK JOINTS

A. DiCarlo[1], * G. Formica[2] and V. Varano[3]

[1] Università Roma Tre
Via Corrado Segre, 6
I-00146 Roma (Italy)
adicarlo@mac.com

[2] Università Roma Tre
Via Corrado Segre, 6
I-00146 Roma (Italy)
formica@uniroma3.it

[3] Università Roma Tre
Via Corrado Segre, 6
I-00146 Roma (Italy)
v.varano@uniroma3.it

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ABSTRACT

We model masonry as an assemblage of bulky, rigid blocks interacting through thin, compliant interfaces, where all the action takes place. This is independent of whether blocks are dry-stacked or mortar jointed. The constitutive characterization of these two kinds of joints tell them apart—not too much, however, since the mechanics of dry joints provides the appropriate paradigm for the *nonlinear* response of mortar layers sandwiched between rigid blocks. In fact, also mortar joints respond in a drastically asymmetric way to squeeze and dilation, when seriously stressed.

We address, in particular, the response of masonry panels to severe in-plane loading, focussing on joint damage and friction contact, which we model as dissipative evolution phenomena, within the general framework of the theory of material remodelling [1]. A natural coupling between damage and friction emerges, characterized by only a few parameters, which can be tuned quite straightforwardly to match the results of experimental tests performed on single joints.

Our approach lends itself well to a nonstandard *mixed* formulation of the problem to be solved, as is necessary to skirt the computational disaster brought about by compatible formulations when tiny displacements cause major changes of the tangent stiffness [2].

Following [3], we adopt an iterative two-level strategy for solving the problem, where the fine level describes the response of a single joint, and the coarse level provides a finite element approximation to the smoother overall response of a masonry sub-panel. In order to assess our method, we simulate several experimental texts performed on panels and well documented in the literature (see, e.g., [4]).

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