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A MULTISCALE DAMAGE ANALYSIS OF PERIODIC COMPOSITES USING A COUPLE-STRESS/CAUCHY MULTIDOMAIN MODEL: APPLICATION TO MASONRY STRUCTURES

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Abstract. *A novel multiscale strategy is proposed for the damage analysis of masonry structures modeled as periodic composites. Such a computational strategy, whose aim is to reduce the typically high computational cost exhibited by fully microscopic numerical analyses, is based on a multiscale/multidomain model equipped with an adaptive capability, which allows to automatically zoom-in the zones incipiently affected by damage onset. The associated model refinement criterion requires the determination of microscopically informed first failure surfaces, which take into account both classical and bending deformation effects, by taking advantage of a couple-stress based homogenization technique. In order to assess the efficacy of the proposed multiscale modeling strategy, some numerical simulations are presented, involving a medium-sized wall test subjected to combined shear and flexure loading conditions. The related accuracy and computational performances of this methodology are investigated via suitable comparisons with a purely discrete model of masonry. Special attention is devoted to the analysis of the bending macroscopic deformation effects. Further comparisons with experimental results taken from the literature are carried out in order to validate its predictive capability in terms of peak and post-peak mechanical behavior.*