Heterogeneously resistant elastic–brittle solids under multi-axial stress: fundamental postulates and bounding theorems

Abstract

The paper focuses on the problem of developing a reliable theoretical model for representing the bodies that exhibit a heterogeneous mechanical behaviour in tension and in compression. The proposed phenomenological model is characterized by an evolutionary tensile stress that is ruled by a decay law depending on the loading path. Such model is of particular interest, since it may be successfully employed, after suitable calibration of the tensile stress, for assessing a class of materials that includes masonry bodies. In the paper, the fundamental postulates under multi-axial stress states are formulated and proved to hold at any stage of the loading path. The relationships of the solution of the instantaneous elastic–brittle model with solutions relevant to other more classical and well-established theoretical models are analytically investigated. Finally, two original theorems are announced that allow to identify upper and lower bounds on the solutions, in agreement with some experimental results.