A Coupled Elasto-Plastic Damage Model for Concrete in a Mesoscale Approach

G. Mazzucco*, C.E. Majorana* and V.A. Salomoni*

* Department of Civil, Environmental and Architectural Engineering (DICEA), University of Padova, Via F. Marzolo 9, 35131 Padova, Italy
e-mail: gianluca.mazzucco@dicea.unipd.it, carmelo.majorana@dicea.unipd.it, valentina.salomoni@dicea.unipd.it.

ABSTRACT

In the last decades the development of numerical models for describing concrete behaviour has shown the relevance of a mesoscale approach to characterize the highly heterogeneous material structure composed by cement past and aggregates in a random distribution. Such an approach has been widely reported in literature to face and investigate some typical concrete phenomena as e.g. mechanical damage [1], thermal spalling [2], alkali-silica reactions [3], chloride penetration [4], etc. Particularly, meso-scale models allows for realistically describing and analysing stress concentrations around aggregates and local confinement effects occurring between aggregates and cement paste under different loading conditions.

In this work a new coupled elasto-plastic damage formulation is carried out specifically for concrete materials in a mesoscale formulation. The yield surface proposed by Willam [5] is coupled with the Mazars' damage model [6], and the plastic potential defined in [7] is assumed to describe the multiaxial compression changes occurring within the composite sample. Some numerical examples are developed to describe the algorithm robustness and further comparisons between numerical and experimental investigations are performed to validate the approach.

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