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A COHESIVE CONTACT LAW TO MODEL THE INTERFACIAL TRANSITION ZONE IN CEMENTITIOUS MATERIALS.

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The present work is aimed at proving the soundness of a contact numerical algorithm for the correct simulation of the interaction between aggregate and cement paste in the interfacial transition zone (ITZ) that typically characterizes cementitious composites at the mesoscale [1]. The failure of this zone has been characterized by using a new cohesive contact law able to take into account the coupled behaviour between normal/peeling and shear conditions [2]. The present cohesive contact formulation has been specifically calibrated to take into account the different roughness surfaces of various aggregate types [3]. A series of numerical analyses has been carried out considering different material inclusions and distributions within concrete samples, so proving the capabilities of the proposed formulation.

The 3D laser scanner technique might be used to define the outer geometry of inclusions, if combined with a suitable particle distribution algorithm for randomly generating inclusions in agreement with a given granulometric curve. Such algorithm should be based on overlapping criteria of particles of regularly-shaped particles, whose geometry can be considered inscribed in, and on minimum distance criteria, excluding the total penetration of one inclusion into another. The algorithm developed in [4] has, additionally, a “packing” scheme that implements dislocations of the surrounding particles, when a new inclusion overlaps some others, in order to use the available space more efficiently, always checking that no overlapping occurs.

Comparisons between numerical and experimental results confirm the accuracy of the constitutive approach here proposed to evaluate the brittle fracture behaviour of cementitious materials and to satisfactorily simulate damage triggering under generic 3D stress states, also when ITZ is taken into account.

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