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3D MESOSCALE MODEL FOR CRACK PROPAGATION IN CONCRETE

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Abstract. In this research a technique based on the use of interface finite elements high aspect ratio is proposed to simulate crack initiation and propagation in concrete. The strategy proposed is called a Mesh Fragmentation Technique which allows the construction of 3D models to better understand the influence of the concrete mesoscopic structure, translated macroscopically in the form of loss of stiffness and energy dissipation. The concrete is modeled as a heterogeneous three-phase material composed of coarse aggregates, mortar matrix and ITZ. This technique eliminates the necessity of the widely used crack tracking schemes, since the crack process occurs along the interface elements inserted between all regular finite elements of the mesh. An appropriate continuum tension damage model is used with a special implicit-explicit integration scheme to describe the complex nonlinear behavior of concrete due to the crack phenomenon. The results showed that the proposed mesoscale model presents the same kinds of characteristics that real concrete shows, considering the effects of the mesostructure constituents.