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A LCP FORMULATION FOR THE FRACTURE ANALYSIS OF CONCRETE USING ZERO-THICKNESS INTERFACE ELEMENTS

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In the meso-structural study of concrete fracture, concrete is treated as a heterogeneous material composed of aggregates surrounded by a cement matrix. In order to carry out a finite element analysis of this type of problem, it is possible to use zero-thickness interface elements, which are pre-inserted within the mesh. These elements constitute the weakest part of the meso-structure and represent the possible fracture lines [1]. Fracture capability is concentrated in the interface elements, so there is no need of localised deformation capabilities in the continuum elements and the a-priori insertion of these elements makes remeshing unnecessary. However, through these elements a duplication of nodes occurs along those surfaces where they are inserted.

Although the inclusion of interface elements leads to very realistic results in the study of concrete fracture, at the same time it involves a very high computational effort. Indeed, in the process of fracture and its propagation, not all interface elements can be involved or employed from the beginning. In view of this, the present work aims to study a method that allows to analyse step by step only the involved interface elements.

A Linear Complementarity Problem (LCP) [2,3] has been formulated for 2D analysis which, through the use of interface elements characterised by a rigid-plastic law, allows to reduce the degrees of freedom of the system by considering only those elements that participate in the fracture process. This procedure can be carried out without losing the advantages provided by the interface elements, including the possibility of not modifying the topology of the system. This method enables larger problems to be analysed without affecting the optimal from a numerical point of view.

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