Reinforced Concrete Modelling Using Enriched Finite Elements

J. Retama*, G. Ayala

Instituto de Ingeniería, Universidad Nacional Autónoma de México, Av. Universidad Núm. 3000, Col. Universidad Nacional Autónoma de México, C.U., Del. Coyoacán, México D.F., C.P. 04510, {JRetamaV,GAyalaM}@iingen.unam.mx

Reinforced concrete has become one of the most employed materials in civil engineering works. Its economy, efficiency, and stiffness, make this material an excellent choice for the construction of a wide variety of structures. Unfortunately, due to the complexity of its damage evolution to collapse, its mechanical behaviour is not fully understood. One of the first attempts to simulate this behaviour is presented in the work by Ngo and Scordelis, [1]. Currently, different researchers continuos studying it through experimental tests and numerical simulations. The nonlinear behavior of this composite material, under different conditions, may lead to inelastic response and, eventually, take the structure to the collapse, *e.g.*, [2].

In this work, the variational formulation of the embedded discontinuity model, developed by Retama in his PhD thesis [3], and its approximation by means of the finite element method, to simulate the damage process in structural elements of reinforced concrete is presented. The effect of the reinforcement steel is introduced through truss elements considered to be embedded in the concrete finite element. In the modelling of the concrete behaviour, two dimensional finite element are used; together with a cohesive damage model and the embedded discontinuity approximation, [3]. In this work a perfect bond for the interface concrete-steel bars is considered.

To validate the correctness of this formulation, it is implemented in the finite element program FEAP, [4], and numerical examples are presented; and the results derived are compared with those of existing experimental tests.

References

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