8th. World Congress on Computational Mechanics (WCCM8)
5th. European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008)
June 30 – July 5, 2008
Venice, Italy

DEVELOPMENT OF A BEAM-COLUMN FINITE ELEMENT FOR NONLINEAR ANALYSIS OF REINFORCED CONCRETE FRAME STRUCTURES CONSIDERING FLEXURE-SHEAR COUPLING

***João P. Almeida[1], António A. Correia[2] and Rui Pinho[3]**

[1] ROSE School
jpacheco@roseschool.it

[2] ROSE School
aaraujo@roseschool.it

[3] University of Pavia
rui.pinho@unipv.it

ABSTRACT

During the last three decades experimental testing and numerical modelling of different reinforced concrete resisting mechanisms have progressed to the point where it can be considered that they are adequately identified and described. On the other hand, over half a century after its first introduction in the aircraft industry, the finite element method is now firmly established as the most powerful modelling technique available to structural engineers. The two previous vectors can be combined, in the context of nonlinear modelling of reinforced concrete structures, to provide reliable and robust simulations. However, some researchers believe that its practicality is questionable, especially due to the high computational burden associated to fully 2D or 3D refined finite element models and their inherent complexities involved in developing the model and interpreting the results.

Thus, beam-column type finite elements developed in the framework of distributed plasticity, where the nonlinear response of the basic system is found from the integration of the response at control sections along the element axis, seem to provide the best compromise between the desired accuracy and computational efficiency.

In the present work, one of such elements is developed with a view to the seismic assessment of entire reinforced concrete frame structures. The proposed model is able to deal with arbitrary loading conditions and involves the interaction of axial force, shear and bending moment. Since longitudinal normal stress and shear stress interaction is explicitly included, the current model is deemed suitable for shear critical member analysis. Finally, a comparison with the main features of other state-of-the-art and promising distributed inelasticity beam theories including the effect of shear is presented.