Abstract

The structural response of reinforced concrete (RC) columns under cyclic loading is investigated. RC elements are presenting very important nonlinearities and in order to be simulated correctly under monotonic and cyclic loading it is essential to account for the nonlinear material phenomena. With this purpose, a state of the art review about the study of the phenomenology and the numerical approaches available to analyze this problem was performed.

In this work is presented a constitutive model for reinforcing steel accounting for the Bauschinger and buckling effects, which are important phenomena that need to be considered in nonlinear cyclic analysis of RC columns. This thesis was centered on the development of an algorithm for the constitutive law of steel. Validation was performed by comparing numerical results with experiments made on bare bars of steel under cyclic loading, available in literature. Afterwards this new algorithm was implemented into an existing FE code CONSHEAR based on the fiber beam formulation with enhanced capabilities regarding accounting for shear effects in the nonlinear response of RC structures. From the preliminary set of examples made to verify the implementation into the FE code, the results are very promising, being able to represent Bauschinger effects in cyclic analysis.

**Keywords:** nonlinear analysis, RC columns, cyclic loading, Bauschinger and buckling effects, Stress - strain relations