Estimation of plastic hinge properties in RC beams using 3D nonlinear finite element analysis

Maria K. Kardala* and Konstantinos V. Spiliopoulos

Institute of Structural Analysis and Antiseismic Reasearch
School of Civil Engineering
National Technical University of Athens (NTUA)
e-mail: marikard@hotmail.gr, kvspilio@central.ntua.gr

ABSTRACT

The aim of this work is to investigate the properties of the plastic zones in reinforced concrete (RC) structural elements with the use of 3D nonlinear finite element analysis.

The zones, in which the plastic deformation and cracking in RC members develops, normally referred to as plastic hinge length, is a complicated subject and still remains an open issue.

The analyses are performed with the use of the software FE77, which is a three dimensional finite element code, developed in [1].

Twenty seven-node Lagrangian brick elements with 3×3×3 Gauss points are used for the finite element implementation of the concrete behaviour, whose the only required material parameter is the uniaxial compressive strength.

Steel bars are modelled as three-noded uniaxial truss elements and the Menegotto-Pinto model is adopted for the stress-strain behaviour.

After the results of the software have been validated by experimental ones, an attempt is performed for the determination of the length of the plastic hinge and its behaviour, through a parametric study, carried out on beam prototypes. In this study, parameters which affect the plastic hinge will be taken into consideration such as: shear span of beam, compressive strength of concrete, yield strength of reinforcing steel, tensional and compressional reinforcement ratios.

Through the comparison of the results of the parametric study, useful conclusions will be drawn concerning important items such as: the rotation of the cross section, the length of the zone of the yielding of the tensile reinforcement and the length of the crushing zone.

REFERENCES

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