Nonlinear static analysis of steel frames with semi rigid beam to column connections using cruciform element

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ABSTRACT

In the steel frames, beam-column connections are traditionally assumed to be rigid or pinned, but in the steel frames, most types of beam-column connections are semi-rigid. Recent studies and some new codes, especially EC3 and EC4, include methods and formulas to estimate the resistance and stiffness of the panel zone. Because of weaknesses of EC3 and EC4 in some cases, Bayo et al. proposed a new component-based method (cruciform element method) to model internal and external semi-rigid connections that revived and modified EC methods. The nonlinear modelling of structures plays an important role in the analysis and design of structures and nonlinear static analysis is a rather simple and efficient technique for analysis of structures. This paper presents nonlinear static (pushover) analysis technique by new nonlinearity factor and Bayo et al. model of two types of semi-rigid connections, end plate connection and top and seat angles connection. Two types of lateral loading, uniform and triangular distributions are considered. Results show that the frames with top and seat angles connection have fewer initial stiffness than frames with semi-rigid connection and P-Δ effect more decreases base shear capacity in the case of top and seat angles connection. P-Δ effect in decrease of base shear capacity increases with the increase of number of stories.

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