Structural performance of frames with concrete-filled steel tubular columns and steel beams: Finite element approach

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Abstract

Composite columns such as concrete-filled steel tube (CFST) were adopted in many building constructions in recent years because of carrying high loading with the ability to resist buckling and small cross-sectional area. The high behavior of the CFST columns is due to the interaction between steel and concrete which called the composite action. This type of composite column without main and tie reinforcements embedded in concrete gives high axial compression strength to resist the external loadings with the economic sectional area. The work presented in this article includes simulation models that tested by other researchers and a parametric study on the performance of frames that connected steel beam by composed columns of circular CFST that subjected to lateral loading. A finite element (FE) approach is adopted to simulate the models by ANSYS software. All models consider the linear and nonlinear material analysis of the concrete and steel. The validity of the developed model was examined by comparing with the experimental data founded in the literature. Different parameters such as the ratio of the axial load, the slenderness ratio of CFST column, the linear stiffness ratio of the beam– column, the steel yield strength of the beam, the steel yield strength of the tube, and concrete strength on the performance of the composite frames were also studied and the load-deformation performance was obtained over the different cases of the study. Analysis results by FE modeling were in good agreement with the experimental results.