Analysis of partially concrete-filled steel tubular columns subjected to cyclic loadings

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Abstract

A one-dimensional model is proposed for numerical analysis of partially concrete-filled steel tubular (PCFST) columns subjected to cyclic loadings. The present formulation does not require experimental results nor shell analysis to obtain the constitutive equation of the model. The material properties and dimensions of PCFST columns are required for numerical analysis of the present model. The PCFST columns are assumed to consist of elastic beam and base plastic-hinge region in which steel local buckling is observed. Two parameters are introduced in order to express hardening phenomena of PCFST columns subjected to cyclic loading. Resisting forces due to concrete filled in the elastic beam are defined by using the present parameter. The other parameter is used to define an effective area of concrete filled in the base plastic-hinge region. The hysteretic rules for two parameters are proposed to model the hardening phenomena. For overall analysis, steel plates at the base plastic-hinge region are discretized along circumferential direction by using fiber elements, while layer elements are employed for concretes at the base plastic-hinge region. The validity of the present model has been confirmed through comparisons with existing experimental results.

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