Lateral Torsional Buckling Behaviour of Steel Beams – On the Influence of the Structural System

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Lateral torsional buckling behaviour of steel beams – On the influence of the structural system

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Highlights

- Lateral torsional buckling behaviour of cantilever and two-span beams
- Effect of yielding on the failure modes (cross section failure, eigenvalue failure of the partially plastic system and elastic system and limitation of the rotation around the longitudinal axis)
- Influence of structural system, member slenderness and cross section on decisive failure mode and LTB behaviour

Abstract

This paper analyses the lateral torsional buckling (LTB) behaviour of cantilever and two-span steel beams. The structural behaviour in terms of load-deflection curves, plasticisation of the cross section, ultimate capacities and failure modes of these beams is compared to the corresponding behaviour of simple beams, which are often considered as a basis for developing simplified models for design purposes. The results of the numerical study show that the ultimate capacity of steel beams is strongly affected by the yield-zone development and limited by four different failure criteria, namely the cross section failure, the eigenvalue-failure of the partially plastic system, the rotation limit and the eigenvalue-failure of the elastic system. Different ranges of slenderness are crucial for each failure criteria and these ranges vary for the different structural systems.

Keywords

Lateral-torsional buckling, failure criteria, eigenvalue-failure of the partially plastic system

1 Introduction

Simplified analytical models used for the prediction of member buckling resistances of steel beams are commonly based on the results of experimental and numerical studies on simple beams, e. g. [1-4]. For lateral-torsional buckling the models often use reduction factors originally developed for flexural buckling. However, the lateral torsional buckling behaviour of a cantilever beam or a multi-span beam may be different from the behaviour of a simple beam or even the flexural buckling behaviour of a hinged column. The simple relative