

Analytical formulation for the deformations of I-shapes and RHS at the plastic strain ultimate limit state

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Abstract

The development of “full plastic hinges” in the most stressed cross-sections is a common hypothesis considered in the elastic-plastic design of steel structures. The equations for the internal forces at the plastic limit state are then based on equilibrium conditions only, and they do not allow the global deformations corresponding to each combination of internal forces at this ultimate limit state to be estimated.

This paper presents a simplified analytical model for the elastic-plastic analysis of rectangular hollow sections and bi-symmetrical I-sections bent about their strong axis. This model states the relations between the global deformations (axial deformation and bending curvature) and the corresponding internal forces (axial force and bending moment) at the cross-section plastic strain ultimate limit state. It allows a realistic evaluation of the cross-section ductility, based on a relevant strain limitation at the most strained cross-section fibres .

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