

# Analytical formulation of the elastic-plastic behaviour of bi-symmetrical steel shapes

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## Abstract

This paper presents the analytical relationships of a non-linear model for the in-plane elastic-plastic analysis of bi-symmetrical steel shapes bent about one of their main axes. The basic variables are the cross-section global deformations from which it is possible to evaluate the internal loads and the cross-section stiffness matrix components by means of simple expressions. Furthermore, the values of stresses and strains at any point of the cross-section may be determined knowing the values of the internal loads, in the elastic and elastic-plastic domains. The effects of progressive yielding spreading, as well as those of material strain-hardening, are taken into account in the evaluation of the cross-section resistance capacity in the elastic-plastic domain. This analytical model represents an efficient, simple and accurate alternative to the elastic-plastic models based on numerical methods.

*Keywords:* Analytical model; Elastic-plastic behaviour; Cross-section; Global deformation interaction; Internal forces interaction; Strain-hardening; Resistance capacity; Deformation capacity; Stiffness

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