ANALYTICAL MODEL FOR NON-LINEAR ANALYSIS OF STEEL CROSS-SECTIONS

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Most of steel structures present non-linear behaviours before reaching their ultimate limit states and, occasionally, before their serviceability limit states. Consequently, an efficient analysis of a steel structure should take into account all the relevant factors contributing to this non-linearity.

A good estimation of the non-linear behaviour of materials should allow the evolution of plasticity along the cross sections and along the length of the structural members to be followed, to take into account the influence of the residual stresses, and to make a correct evaluation of the materials hardening influence on the structures' behaviour.

Usually, this type of analysis is based on numerical models founded on the division of the cross-section into a large mesh of subareas. The internal forces and stiffness matrix are obtained by numerical integration of each subarea average stress and stiffness, over the whole cross-section area. This method is time consuming and requires stocking of a large number of data during the successive iterations of the non-linear process.

Alternatively, the analysis may be carried out by analytical models on the cross-section level. These "*cross-section models*" are usually based on interaction curves for the cross-section internal forces, assuming an ideal elastoplastic behaviour without hardening .

This paper presents a new cross-section model, based on the analysis of the global deformations. It is able to take in account the material deformation capacity, the influence of yielding spreading and the effects of hardening, residual stresses, and bending - axial deformation interaction.