NONLINEAR ANALYSIS OF SLENDER HOLLOW STEEL SECTIONS BASED ON THE GLOBAL DEFORMATIONS ANALYSIS

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Rectangular and square hollow sections are commonly used as compressed structural members, namely for the fabrication of large steel trusses. Many of them are made of very thin cold-formed steel sheets.

Furthermore, the use of thin plates made of high-strength steels, in the fabrication of large-size box columns, has become a common solution for modern steel structures.

The large ratio between the width and thickness of these cross sections' walls make these plate components susceptible to local buckling, which may be coupled to global buckling of the compressed member to produce its failure.

The application of tridimensional numerical models, using plate finite elements for the modelling of cross section's walls, make these calculations rather heavy. Therefore, some simplified methods have been proposed to include the local buckling effects in the methods of analysis based on bar finite elements.

The account for the effects of residual stresses, material's hardening, and the spreading of plasticity along the cross sections of these elements is essential for a realistic study of the compressed member's behaviour. It is usually achieved by the division of each cross section into a mesh, generating a great number of subareas.

The evaluation of stresses and stiffness relationships is carried on at the level of each one of these subareas, and the efforts are obtained by numerical integration of these stresses over the whole cross section's area. This integration technique may lead to very heavy computations, specially in the case of large structures containing many structural members.

This paper presents a geometric and material nonlinear model based on the analysis of the cross section's global deformations. The efforts and corresponding stiffness terms are calculated by analytical expressions, which allow a very fast analysis of the structure's behaviour at the cross section's level. Its application to slender steel box sections is based on simplified methods for local buckling allowance, proposed by other authors.

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