FIRE DESIGN OF UNIFORM AND TAPERED CLASS 4 STEEL MEMBERS

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ABSTRACT

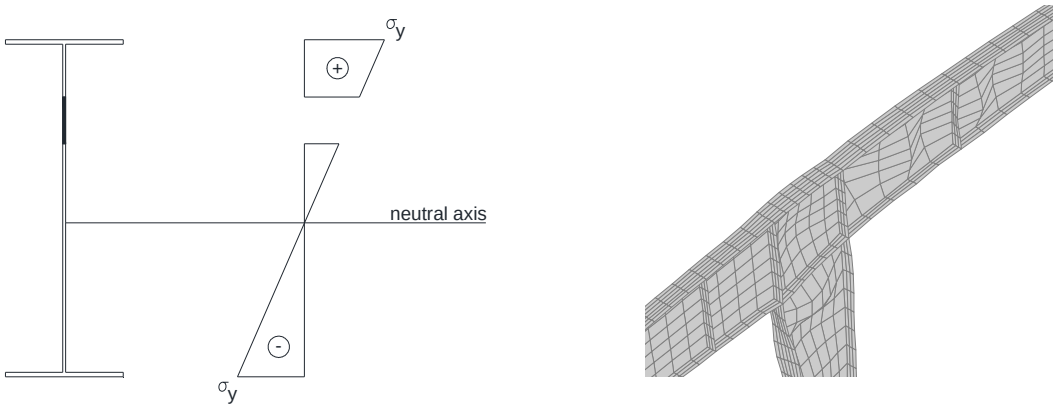
Steel members with H or I shape class 4 cross-sections due to their advantages regarding their lightness and efficiency are widely used in steel constructions. However, the fire design rules of the Eurocode 3 (EC3) [1, 2], have demonstrated to be very conservative thus very uneconomical [3], and in the case of tapered steel members it is not clear if normal temperature design rules can be straightforward adapted for fire design.

In fact, EC3 gives some simple calculation methods for the fire design of class 1, 2 and 3 cross-sections in its Part 1-2 and recommends the same methods to be used with class 4 cross-sections in an informative annex, suggesting that the design yield strength of steel should be taken as the 0.2 percent proof strength instead of the stress at 2% total strain as for the other classes of cross-sections, considering the effective cross section (see Figure 1a). However, it has been demonstrated through numerical investigations [3], that this methodology is conservative and leads to uneconomical results.

On the other hand no specific rules are defined in EC3 for tapered steel members (see Figure 1b) in fire situation, although they are commonly used in steel constructions.

At room temperature, since the stiffness of these non-uniform members varies, the clauses 6.3.1 to 6.3.3 of Part 1-1 of EC3 regarding the stability check of steel members doesn't apply and the stability check should be performed either by a cross sectional verification based on second-order internal forces or by using the "General Method" as given in clause 6.3.4 of Part 1-1 of EC3. However, it worth be noted that the "General Method" is not widely validated [4].

The objective of this work is to study uniform and tapered steel members with welded or hot-rolled H or I shape class 4 cross-sections at elevated temperatures and to propose practical fire design formulae for this type of elements, with special emphasis on beams and beam-columns.



a) b)

Figure 1 – a) class 4 effective cross section submitted to bending about major axis and b) tapered elements.

BIBLIOGRAPHY

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