Yield stress independent column buckling curves

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Using GMNIA and shell finite element modelling of steel columns it is ascertained that the buckling curves for given imperfections and residual stresses are not only dependent on the relative slenderness ratio and the cross section shape but also on the magnitude of the yield stress. The influence of the yield stress is to some inadequate degree taken into account in the Eurocode by specifying that steel grades of S460 and higher all belong to a common set of “raised” buckling curves. This is not satisfying as it can be shown theoretically that the current Eurocode formulation misses an epsilon factor in the definition of the normalised imperfection magnitudes. By introducing this factor it seems that the GMNIA analysis and knowledge of the independency of residual stress levels on the yield stress can be brought together and give results showing consistency between numerical modelling and a simple modified Ayrton-Perry formulation. In this paper magnitudes of imperfections and residual stresses in relation to the Eurocode will be discussed. It will be shown that the use of equivalent imperfections may be very conservative if considered by finite element analysis as described in the current Eurocode code. A suggestion is given for a slight modification of the Eurocode formulations of imperfections leading to adequate inclusion of modern high grade steels within the four bucking curves.

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