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An Approximate Lateral-Torsional Buckling Mode Function for Cantilever I-Beams

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Abstract : Lateral torsional buckling is a global stability loss which should be considered in the design of slender structural members under flexure about their strong axis. It is possible to compute the load which causes lateral torsional buckling of a beam by finite element analysis, however, closed form equations are needed in engineering practice. Such equations can be obtained by using energy method. Unfortunately, this method has a vital drawback. In lateral torsional buckling applications of energy method, a proper function for the critical lateral torsional buckling mode should be chosen which can be thought as the variation of twisting angle along the buckled beam. The accuracy of the results depends on how close is the chosen function to the exact mode. Since critical lateral torsional buckling mode of the cantilever I-beams varies due to material properties, section properties, and loading case, the hardest step is to determine a proper mode function. This paper presents an approximate function for critical lateral torsional buckling mode of doubly symmetric cantilever I-beams. Coefficient matrices are calculated for the concentrated load at the free end, uniformly distributed load and constant moment along the beam cases. Critical lateral torsional buckling modes obtained by presented function and exact solutions are compared. It is found that the modes obtained by presented function coincide with differential equation solutions for considered loading cases.

Keywords : buckling mode, cantilever, lateral-torsional buckling, I-beam
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