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Suitability of Direct Strength Method-Based Approach for Web Crippling Strength of Flange Fastened Cold-Formed Steel Channel Beams Subjected to Interior Two-Flange Loading: A Comprehensive Investigation

Authors : Hari Krishnan K. P., Anil Kumar M. V.

Abstract : The Direct Strength Method (DSM) is used for the computation of the design strength of members whose behavior is governed by any form of buckling. DSM based semiempirical equations have been successfully used for cold-formed steel (CFS) members subjected to compression, bending, and shear. The DSM equations for the strength of a CFS member are based on the parameters accounting for strength [yield load (Py), yield moment (My), and shear yield load (Vy) for compression, bending, and shear respectively] and stability [buckling load (Pcr), buckling moment (Mcr), and shear buckling load (Vcr) for compression, bending and shear respectively]. The buckling of column and beam shall be governed by local, distortional, or global buckling modes and their interaction. Recently DSM-based methods are extended for the web crippling strength of CFS beams also. Numerous DSM-based expressions were reported in the literature, which is the function of loading case, cross-section shape, and boundary condition. Unlike members subjected to axial load, bending, or shear, no unified expression for the design web crippling strength irrespective of the loading case, cross-section shape, and end boundary conditions are available yet. This study, based on nonlinear finite element analysis results, shows that the slenderness of the web, which shall be represented either using web height to thickness ratio (h=t) or Pcr has negligible contribution to web crippling strength. Hence, the results in this paper question the suitability of DSM based approach for the web crippling strength of CFS beams.

Keywords : cold-formed steel, beams, DSM-based procedure, interior two flanged loading, web crippling
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