

Flange/Web Distortional Buckling of Cold-Formed Steel Beams with Web Holes under Pure Bending

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Abstract : The cold-formed steel beams with web holes are widely used as the load-carrying members in structural engineering. The perforations can release the space of the building and let the pipes go through. However, the perforated cold-formed steel (PCFS) beams may fail by distortional buckling more easily than beams with plain web; this is because the rotational stiffness from the web decreases. It is well known that the distortional buckling can be described as the buckling of the compressed flange-lip system. In fact, near the ultimate failure, the flange/web corner would move laterally, which indicates the bending of the web should be taken account. The purpose of this study is to give a specific solution for the critical stress of flange/web distortional buckling of PCFS beams. The new model is deduced based on classical energy method, and the deflection of the web is represented by the shape function of the plane beam element. The finite element analyses have been performed to validate the accuracy of the proposed model. The comparison of the critical stress calculated from Hancock's model, FEA, and present model, shows that the present model can provide a splendid prediction for the flange/web distortional buckling of PCFS beams.

Keywords : cold-formed steel, beams, perforations, flange-web distortional buckling, finite element analysis

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