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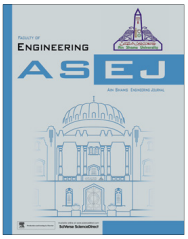

CIVIL ENGINEERING

Resistance of cold-formed steel sections to combined bending and web crippling

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Design codes

Abstract Web crippling is a common failure mode in cold formed sections. Interaction between bending and web crippling reduces the load carrying capacity and may control the design. In this research, numerical study on web crippling and interaction between bending and web crippling are performed considering the material and geometric nonlinearities. The study is performed on channel sections subjected to web crippling under interior one flange (IOF) loading conditions. Finite element models are verified against experimental tests, and then extended to predict the web crippling strength of the studied channel sections. FE is used to investigate the interaction between bending and web crippling in C-sections. FE results are employed to investigate the effect of different parameters on sections resistance. It was found that, the strengths predicted by design codes are generally inadequate for channels with a practical web slenderness range. Therefore, modifications were proposed to improve the strength predicted by codes.

1. Introduction

Cold formed steel sections are special sections which have high strength to weight ratio. The cold-formed steel C- and Z-sections are the most common sections used in building construction. These sections can be used as secondary beams (purlins) to support the light weight roof covering systems, also can be used as side girt, cassettes, etc. Many criteria govern the design of such sections such as, moment capacity, deflection, web shear resistance, web crippling, combined bending and shear and combined bending and web crippling.

Flexural capacity of a cold-formed steel beam in general is limited either by the effective section capacity or the lateral buckling capacity, especially when supported laterally at large intervals. On the other hand, web crippling of such beams depends on the cross section parameters (web slenderness ratio, web thickness and inside bend radius to thickness ratio) in addition to the material yield stress and the bearing length to web thickness ratio. Although, the webs of such sections have high depth to thickness ratio, using stiffeners under the concentrated loads is not practical in this type of construction.

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