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Stiffening evaluation of flat elements towards stiffened elements under axial compression

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Abstract. Thin-walled cross-sections can be optimized to enhance their resistance and progress their behaviour, leading to more competent and inexpensive structural system. The aim of this study is to afford a methodology that would facilitate progress of optimized cold formed steel (CFS) column section with maximum ultimate strength for practical applications. The proposed sections are designed to comply with the geometrical standards of pre-qualified column standards for CFS structures as well as with the number of industrialized and practical constraints. The stiffening evaluation process of CFS lipped channel columns, a five different cross section are considered. The experimental strength and behaviour of the proposed sections are verified by using the finite element analysis (FEA). A series comprehensive parametric study is carried out covering a wide range of section slenderness and overall slenderness ratio of the CFS column with and without intermediate web stiffeners. The ultimate strength of the sections is determined based on the Direct Strength Specification and other design equation available from the literature for CFS structures. A modified design method is proposed for the DSM specification. The results indicate that the CFS column with complex edge and intermediate web stiffeners provides an ultimate strength which is up to 78% higher than standard optimized shapes with the same amount of cross sectional area.

Keywords: cold-formed steel; edge stiffener; intermediate web stiffener; finite element analysis; slenderness ratio

1. Introduction

In olden days, cold-formed steel (CFS) cross-sections are employed in the secondary load-carrying members such as roof purlins, wall panels and storage racks. Compared to hot-rolled members CFS members offers many advantages such as high strength to weight ratio, more structural efficiency, elevated strength for a light weight, simple manufacturing process and an ease of handling the process. Due to that, in recent years CFS cross-sections are employed as primary structural elements.

The flexibility of the manufacturing process, CFS section it can easily meet with the structural

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