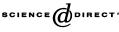


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## Simplified design approach for cold-formed stainless steel compression members subjected to flexural buckling

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## Abstract

The design criteria of stainless steel compression member are more complicated than those of carbon steels due to the nonlinear stress strain behavior of the material. In general, the tangent modulus theory is used for the design of cold-formed stainless steel columns. The modified Ramberg–Osgood equation given in the ASCE Standard can be used to determine the tangent modulus at specified level of stresses. However, it is often tedious and time-consuming to determine the column buckling stress because several iterations are usually needed in the calculation. This paper presents new formulations to simplify the determination of flexural buckling stress without iterative process. Taylor series expansion theory is utilized in the study for numerical approximations. The proposed design formulas are presented herein and can be alternatively used to calculate the flexural buckling stress for austenitic type of cold-formed stainless steel columns. It is shown that the column strengths determined by using the proposed design formulas have good agreement with those calculated by using the ASCE Standard Specification. A design example is also included in the paper for cold-formed stainless steel column designed by using the ASCE Standard specification.

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*Keywords:* Cold-formed stainless steels; Compression members; Specification; Tangent modulus; Flexural buckling; Numerical approximation

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Notation	
Α	Area of the full, unreduced cross section
$A_{\rm e}$	Effective area of the cross section
b	Effective design width of compression element
С	Slenderness ratio, KL/r
$C_{\rm o}$	Specified slenderness ratio at $F_n = F_y$
$C_1$	Limiting slenderness ratio at $F_n = F_1$
$E_{\rm o}$	Initial modulus of elasticity
$E_{\rm t}$	Tangent modulus
f	Nominal stress
$F_{\rm y}$	Specified yield strength
$F_1$	Specified buckling stress with respect to $C_1$
$F_{n}$	Nominal buckling stress
$F_{n,ASCE}$	Nominal buckling stress determined from ASCE Standard Specification
$F_{n,prop}$	Nominal buckling stress determined from the proposed design formulas
$I_x$	Moment of inertia of x-axis
$I_y$	Moment of inertia of y-axis
k	Plate buckling coefficient
Κ	Effective length factor
L	Unbraced length of member
п	Coefficient used for determining the tangent modulus
$P_{n}$	Nominal axial strength of member
r	Radius of gyration
t	Thickness of the section
W	Flat width of element exclusive of radii
α	$E_{\rm o}/E_{\rm t}-1$
eta	Constant
$\phi_{ m c}$	Resistance factor for axial strength
λο	Parameter used for determining buckling stress
$\lambda_1$	$1-\lambda_{o}$
ρ	Reduction factor
λ	Slenderness factor

## 1. Introduction

For the design of cold-formed stainless steel compression members, the ASCE Standard Specification can be used to determine the design axial strength. The current specification was published in 2002 by ASCE as SEI/ASCE 8-02 [1]. This updated edition of the Specification is a revision of the ASCE Standard published in 1991 [2]. Due to

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