Minimum weight design of nonuniform steel I-girders and columns

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Abstract

The study describes a direct search iterative algorithm for minimum weight plastic design of nonuniform flexural built-up I-shaped steel members (beams and girders). The web is assumed to have a parabolic profile and the loadings considered are uniformly distributed loads. The beam is symmetric in cross section and optimum cut-off points for flange plate curtailment are determined such as to minimize the weight. The method has been applied for the optimal design of two-span and three-span girders.

A minimum weight design of columns having linearly tapered web depth is also presented on the basis of developing an equivalent slenderness ratio as is used for prismatic compression members.

The proposed method would permit to transform the tapered column to an equivalent uniform column for which the design formulas permitted for prismatic members can be applied to predict the allowable load for the tapered column.

The prescribed methods are computerized to readily obtain solutions for a given design problem within the constraints stated above. The methods are illustrated by design examples.