Analysis of Lateral Torsional Buckling of Steel I-Beams within Preflexed Beams in Pre-Bending Stage

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Abstract

In order to study the lateral torsional buckling (LTB) law of steel I-beams within preflexed beams in pre-bending stage, the traditional Rayleigh Ritz method was applied, and the modified Rayleigh Ritz method was proposed by considering the restraint effects caused by lateral braces. A large number of finite element models were established by ABAQUS. The theoretical and simulation results show that the modified Rayleigh Ritz method proposed in this paper can reduce the maximum relative error of traditional Rayleigh Ritz method by about 13%. The effects of different parameters on the LTB of steel I-beams were obtained through parameter analysis. The study in this paper can provide reference value for the analysis of LTB of steel I- beams and the parameter selection of preflexed beams in pre-bending stage.

Keywords: lateral torsional buckling; steel I-beam; lateral brace; modified Rayleigh-Ritz method.

1 Introduction

In recent years, with the application of preflexed beam in traffic engineering, the technical standard for preflexed composite beam bridges (CJJ/T 276-2018) issued in 2018 summarized the relevant construction technology of preflexed composite beam: Firstly, prepare a curved steel I-beam, and pour the first stage concrete after the steel I-beam is subjected to pre-bending loads. Secondly, remove the pre-bending loads, and the pre-compressive stress is applied to the first stage concrete which is in the tension zone. Finally, the second stage concrete is poured to form the preflexed composite beam [1-2].

The steel I-beam in preflexed composite beam usually adopts two concentrated loads in pre-bending stage [3-5]. In pre-bending stage, the lateral torsional buckling of steel I-beam is easy to occur. Therefore, it is necessary to arrange lateral

https://doi.org/10.2749/nanjing.2022.1887
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