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Determination of Stay Cable Force Based on Multiple Vibration Measurements to Consider the Effects of Unsymmetrical Boundary Constraints

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A novel concept of incorporating the mode shape ratios of cable was recently introduced to develop an accurate method for the determination of cable forces. In this method, a key issue in the optimization process of effective vibration length was to describe the sensor locations by selecting the pre-known middle point of cable as the reference origin point. With this choice, it is equivalent to assume the symmetry of mode shape functions with respect to the middle point of cable. In other words, a crucial restriction of practically symmetric boundary constraints at both ends is imposed. To deal with such difficulties, this method is further generalized in the current study by introducing additional shifting parameters of origin point to effectively consider the unsymmetrical boundary constraints. Several numerical problems of the more complicated nonlinear optimization process associated with this new formulation are first discussed, followed by verifications with extensive numerical examples.

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Ключевые слова:

Содержание

Abstract

Introduction

Stay cable and its analysis with a simplified model

Methodology

Numerical verification