Cable tension force estimate using novel noncontact vision-based sensor

Dongming Feng, Thomas Scarangello, Maria Q. Feng, Qi Ye

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Dongming Feng[1†], Thomas Scarangello[1], Maria Q. Feng[2] and Qi Ye[1]

[1] *Thornton Tomasetti, Inc., New York, US*

[2]*Department of Civil Engineering and Engineering Mechanics, Columbia University, New York, US*

Abstract

Cable is the most important component in cable-supported bridges and roof structures. Existing vibration methods for cable tension estimates are mainly based on measured acceleration responses. Such practice is relatively expensive and time-consuming due to the required installation of contact-type sensors and data acquisition systems. In this study, the novel noncontact vision-based sensor is proposed as an accurate and cost-effective alternative for the determination of cable tension forces. The noncontact measurement capacity of the vision sensor eliminates the need to access the cable to install conventional sensors, which may be highly difficult and risky. The proposed method is applied to measure cable forces for the cable-supported roof structure of the Hard Rock Stadium in Florida. To ensure that cable forces reach their design values, a series of field tests have been carried out during different roof erection stages. Satisfactory agreements are observed between measured cable forces by the vision-based sensor and the reference readings from load cells. The proposed method represents a convenient and low-cost method for either periodic or long-term monitoring of cable-supported structures.

Keywords*:* Cable tension force; Vision-based sensor; Vibration method; Noncontact; Image processing

† Corresponding author, former Ph.D. student at Columbia University. Tel: +1 917 834 4717
Email: df2465@columbia.edu (D.M. Feng)