



Research on Identification of Time-Varying Cable Force

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Abstract

Cables have been widely used in the construction of cable-supported bridge due to their light weight and high strength mechanical properties. As the key component of cable supported bridge, real-time monitoring of the time-varying cable force of cable is very important for the construction, operation and maintenance of long-span bridges. Based on the time-frequency analysis method of multisynchrosqueezing transform, a new identification method of time-varying cable force is proposed. First, the theory of time-varying modal parameter identification based on time-frequency analysis method is studied. On this basis, the relationship between the time-varying cable force and the instantaneous natural frequency is obtained. Finally, the accuracy of the proposed method under different conditions is studied. The results show that the proposed time-varying cable force identification method has good accuracy and robustness.

Keywords: cables and hangers of bridge; time-varying cable force; time-frequency analysis; multisynchrosqueezing transform.

1 Introduction

In recent years, cable-supported bridge, as the main choice of long-span bridge, has developed rapidly [1]. As the key component of cable-supported bridge, the internal force state of the bridge structure is affected by the cable force directly. Real time monitoring of the dynamic cable force in the process of tensioning, use and replacement is of great significance for the construction, operation and maintenance of long-span bridges.

The frequency method based on vibration has the advantages of simple, convenient, fast and low cost.

It has become the most popular cable force test method at present. In principle, higher natural frequency identification accuracy requires a longer cable vibration response data block, which means that the identified cable force is at the midpoint of the data block, and there is still a delay of half a data block compared with the current time [2]. Therefore, the traditional identification method of cable force based on vibration can only identify the average cable force in a period of time, and can't obtain the time-varying cable force.

The identification of time-varying cable force is essentially an inverse problem of structural dynamics, that is, the modal parameters or physical parameters of the structure are identified