

Large Structure Health Dynamic Monitoring Using GPS Technology

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Key words: Large Structure, Health Dynamic Monitor, Global Positioning System (GPS).

ABSTRACT

Structure health dynamic monitoring works, which measure key structure parameters systematically, provide valuable information in current evaluation of structure integrity, durability and reliability. Large structures, such as long bridges, towers and tall buildings, may vibrate and displace during the typhoon, temperature change, load change and earthquake. To measure the structural vibration and displacement some traditional measurement methods, such as accelerometer, laser interferometer and electronic distance measurement instrument, are adopted. These methods have some disadvantages. For example, accelerometer cannot measure the swing of total vibration of structure because acceleration cannot be obtained well and truly when structure moves slowly, laser interferometer and electronic distance measurement instrument are limited by climate condition, i.e. clear line of sight is the basic condition in which they can work.

Global Positioning System (GPS) technology not only overcome the limitation of climate, but also measure the structure displacement in three-dimensional directions. An mm-level accuracy can be obtained by using a differential GPS carrier-phase approach, and the sampling frequency of 10 Hz or even 20 Hz are now available from several GPS receivers. All these improvements provide a great opportunity to monitor dynamic characteristics of large structures in real-time or near real-time.

In this paper, we first briefly outline conventional methods for measuring structural vibration and displacement, then discuss the methodology of monitoring large structures by using GPS technology. Some cases of monitoring structures using GPS, such as long suspension bridges, high building are given. Monitoring data management schema and visualization contents are discussed by some examples. It put forward that the future trend is development ing a structures health monitoring system integrating GPS, Database, and visualization techniques under the Internet or Intranet.

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