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IMPLEMENTATION OF A DYNAMIC MONITORING SYSTEM FOR AN BUTTERFLY ARCH FOOTBRIDGE

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Summary

A new footbridge with butterfly arch was contructed at Peaking University (Shenzhen Campus). To investigate its long term dynamic behavior during operational condition, a continuous dynamic structural health monitoring system is implemented.

A Finite Element Model is developed based on both ANSYS and MIDAS software, which further is calibrated by a ambient vibration test. A dynamic monitoring system, consisting of 4 accelerometers in deck and arch, 7 strain gauge and 4 thermal sensors in deck, is developed in order to track the variation of long term dynamic properties. The accumulated huge amount monitoring data are processed automatlly and the long term dynamic behaviour is reported.

Keywords: dynamic monitoring system; butterfly arch footbridge; long term dynamic behavior; finite element analysis

1. Variations of temperature and frequency

As the numerical simulation of the first 10 order maximum frequency does not exceed 5HZ (Table 1), so the sampling frequency is 50HZ, which not only ensures the authenticity of the signal, but also reduces the amount of data to facilitate processing. To ensure a good performance of the stabilization diagram, the data of 10 minutes is merged into one hour which is used for automatic identification of the natural frequencies, mode shapes and modal damping ratios based on Covariance-driven Stochastic Subspace Identification (SSI-COV) methods (Peeters 2000) [1].

As shown in Figure 1, the frequency has a negative correlation with the temperature, and when the temperature reaches the maximum value, the frequency reaches the minimum. Although the temperature changed only 4 degrees in 8 days, the change of frequency was 0.063Hz. So the influence of temperature is enough to cover the early structural changes which is also reported by Harsh Nandan, Mahendra P. Singh. [2]. Therefore it is necessary to investigate on the mechanism of temperature on the structural frequency and the method to find out the early structural changes that covered by temperature.

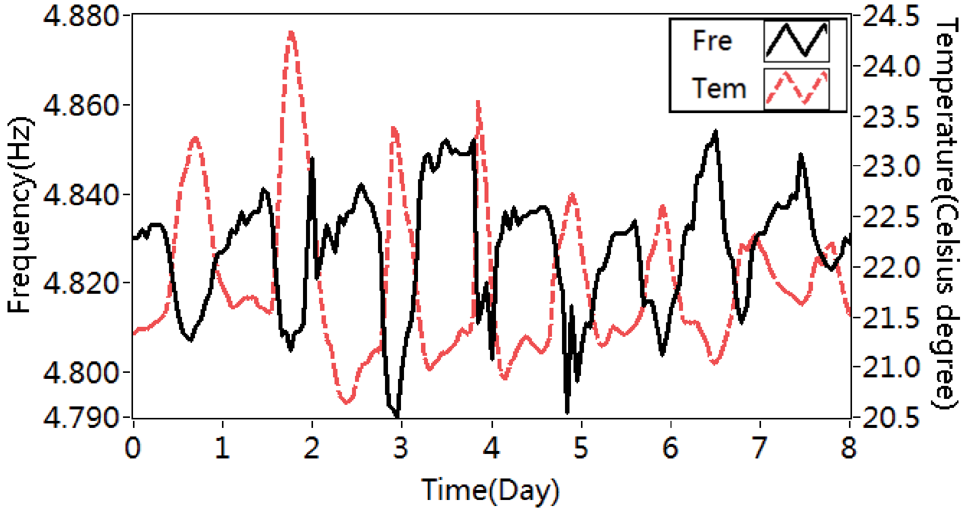

Fig. 1. The variation of temperature acquired by T2 and 11th frequency in 8 days

2. Conclusion

This paper briefly describes the Dasha River Bridge, its monitoring system layout and principle of the layout. In addition, the paper also describes the variation of structure temperature and frequency in the construction period and their related relations.

A systems analysis of all data during 8 days (March 1st to May 2017 March 8) shows that there is a negative correlation between temperature and frequency structure

3. References

[1] PEETERS, B., “System Identification and Damage Detection In Civil Engineering”, Department of Civil Engineering, Katholieke Unversiteit Leuven, Belgium., 2000.

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