Wireless Sensor Network Based Cable Tension Monitoring for Cable-stayed Bridges

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Abstract—Cable tension force is one of the most important criteria for assessing the work condition of a cable-stayed bridge. As a result, it is necessary to be monitored during operation. Rapid development of wireless sensor network (WSN) technology makes it possible to realize cable tension monitoring conveniently. In this paper, a wireless sensor network based monitoring system was proposed for cable tension force measurement of a cable-stayed bridge. In order to verify the feasibility and reliability of the proposed system, laboratory experiments were conducted at first. Two different wires with diameter of 5mm and 7mm respectively and with different lengths were tensioned to different force levels to simulate different cases. Then, the monitoring system was deployed on Ronghu Bridge, a cable-stayed bridge in Wuxi, Jiangsu Province, China. According to experimental results and field measurements, the difference between the measured cable tension forces and the design values is less than 5%.

Keywords—Cable-Stayed Bridge, Structural Health Monitoring, Wireless Sensor Network, Tightening String Model, Vibration Frequency Method.