Estimation method for Tensile force on Wire of Suspension Bridge using Vibrational Behavior

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The main cable of a suspension bridge is installed between the pylon and anchorage, and between pylons, and supports all loads acting on the deck with the tensile force of the main cable. The main cable is composed of strands, and since a strand is made by gathering one wire, abnormal conditions can be detected by the tensile strength of each wire. The tensile force acting on a main cable is closely related to the stabilization of the structure, measuring the tensile force of the wire, used as the key members of main cable, is critical to the securing of the structural safety. In this study, we propose a method to measure the tension of a steel wire by observing cross-sectional resonance. The resonance frequencies of the longitudinal wave mode and flexural wave mode were observed according to the change in tension using resonance ultrasound spectroscopy. The measured frequency spectrum was classified and analyzed for each mode. In the measurement results, the resonance frequencies measured without any change in the test environment have poor repeatability and reproducibility. Several estimation strategies are used for accuracy. When the estimated tension force is over 5 kN, the maximum relative error is 2.8% and the average relative error is 0.98%. The results show promising feasibility on the measurement of tensile forces in the wire.