The 2023 World Congress on
Advances in Structural Engineering and Mechanics (ASEM23)
GECE, Seoul, Korea, August 16-18, 2023

Vibration-based Autonomous Cable Monitoring System based on Domain Knowledge

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ABSTRACT

This study presents a fully-automated peak-picking method for vibration-based autonomous cable monitoring to extract the modal frequencies reliably and flexibly without any prior setting and human manipulation. In a vibration-based method, peaks in Power Spectral Density (modal frequencies) are extracted by a peak-picking method. Then, tension force and damping ratio are estimated based on the extracted peaks. In this regard, several methods for automated peak-picking are implemented by selecting (1) peaks larger than a predefined threshold values from the PSD, (2) local maxima point a PSD within pre-defined frequency intervals, and (3) peaks detected by deep-learning-based objective detection. However, these methods still require human intervention and their optimal setting is case-dependent. To develop a fully-automated peak-picking method, the proposed method exploits a domain knowledge based on the cable dynamics of stay-cables. The experimental study was performed using real field data and it shows that the proposed method outperforms other methods in terms of accuracy, robustness and computational efficiency.

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