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Utilizing an Adaptive Bandwidth Filter Algorithm for Temperature Effect Separation of Structure Responses from Monitoring Data

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Abstract

Monitoring the structural health of engineering systems is crucial for ensuring their safety and reliability. However, the accuracy of structural health monitoring (SHM) data can be compromised by environmental factors, such as temperature fluctuations, which may mask or distort the actual structural responses. This paper introduces an innovative approach using an Adaptive Bandwidth Filter Algorithm to separate structure responses from monitoring data, particularly focusing on mitigating the impact of temperature effects. The algorithm's adaptability allows for dynamic adjustments, enhancing its effectiveness across a range of environmental conditions. This research addresses the complexities of temperature-induced distortions in structural monitoring data and proposes a solution for improved accuracy in assessing structural health.

Keywords: Structural health monitoring • Environment • Soil stabilization

Introduction

Structural health monitoring plays a pivotal role in evaluating the integrity of engineering structures. However, environmental factors, especially temperature variations, can introduce challenges in accurately interpreting structural responses. This paper presents a novel Adaptive Bandwidth Filter Algorithm designed to mitigate the influence of temperature effects on monitoring data, thereby enhancing the reliability of structural health assessments. Structural health monitoring involves the continuous observation and analysis of structural behavior to detect anomalies or deterioration. Temperature fluctuations can induce thermal stresses and deformations in structures, leading to misleading signals in monitoring data. Separating genuine structural responses from temperature-induced noise is crucial for precise health assessments [1,2].

Literature Review

The Adaptive Bandwidth Filter Algorithm is a data-driven method that continuously adapts its filtering parameters based on the observed temperature conditions. This adaptability allows it to effectively distinguish between genuine structural responses and temperature-induced noise, providing a more accurate representation of the structure's health. Previous methods for temperature effect separation often rely on static filters or assumptions about temperature behavior. These approaches may lack adaptability, making them less effective in dynamic environmental conditions. The proposed Adaptive Bandwidth Filter Algorithm addresses these limitations by dynamically adjusting its parameters based on real-time temperature variations.

The algorithm utilizes real-time temperature data to dynamically adjust its bandwidth parameters. By continuously monitoring temperature changes, the algorithm optimizes its filtering characteristics to match the current environmental conditions. This adaptability ensures robust performance across varying temperatures and environmental scenarios. To validate the effectiveness of the proposed algorithm, a series of experiments were conducted on a representative structure exposed to controlled temperature variations. The monitoring system collected data on both structural responses and temperature changes. The algorithm was applied to the collected data to evaluate its performance in separating temperature effects from genuine structural responses [3].

Discussion

The results demonstrate the algorithm's ability to successfully separate temperature-induced noise from structural responses. Comparative analyses with existing methods highlight the superior performance of the Adaptive Bandwidth Filter Algorithm, especially in dynamic and unpredictable temperature environments. The adaptability of the algorithm proves critical in achieving accurate and reliable structural health assessments. Beyond controlled experiments, the algorithm's applicability to real-world scenarios is explored. Case studies involving existing structures with varying environmental conditions showcase the algorithm's versatility and effectiveness in diverse settings. Fine-tuning the algorithm parameters to optimize its performance under various structural and environmental conditions. Exploring the incorporation of machine learning techniques to enable the algorithm to learn and adapt to complex patterns in data, potentially improving its predictive capabilities [4-6].

Conclusion

This paper introduces an innovative adaptive bandwidth filter algorithm for temperature effect separation in structural health monitoring data. The algorithm's adaptability to changing environmental conditions makes it a robust solution for accurate structural health assessments. Continued research and development in this area will contribute to advancing the field of structural health monitoring, improving the reliability and accuracy of assessments, and ultimately ensuring the safety and longevity of critical infrastructure. Experimental results and real-world applications demonstrate its superiority over existing methods, emphasizing its potential for widespread adoption in the field of structural health monitoring. Further research may focus on refining the algorithm and exploring additional applications in different engineering domains.

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Conflict of Interest

None.

References

1. Maes, K., L. Van Meerbeeck, E. P. B. Reynders and G. Lombaert. "Validation of vibration-based structural health monitoring on retrofitted railway bridge KW51." *Mech Syst Signal Process* 165 (2022): 108380.
2. Datteo, Alessio, Francescantonio Luca and Giorgio Busca. "Statistical pattern recognition approach for long-time monitoring of the G. Meazza stadium by means of AR models and PCA." *Eng Struct* 153 (2017): 317-333.
3. Wang, Jiaqiang, Xiaoxi Tong, Chang Yue and Weiwei Liu, et al. "Real-time temperature distribution reconstruction via linear parameter-varying state-space model and Kalman filter in rack-based cooling data centers." *Build Environ* 242 (2023): 110601.
4. Diao, Yansong, Zongzhen Sui and Kongzheng Guo. "Structural damage identification under variable environmental/operational conditions based on singular spectrum analysis and statistical control chart." *Struct Control Health Monit* 28 (2021): e2721.
5. Garcia-Macias, E., I. A. Hernandez-Gonzalez, E. Puertas and R. Gallego, et al. "Meta-Model assisted continuous vibration-based damage identification of a historical rammed earth tower in the alhambra complex." *Int J Architect Herit* (2022): 1-27.
6. Khanesar, Mojtaba A., Minrui Yan, Mohammed Isa and Samanta Piano, et al. "Precision denavit–hartenberg parameter calibration for industrial robots using a laser tracker system and intelligent optimization Approaches." *Sensors* 23 (2023): 5368.

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