



H. Huang, Z. Wu, C. Yang

An Integrated Monitoring System for Damage Detection by Carbon Fibers and Optical Fibers

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An integrated real-time continuous monitoring system is proposed with two types of sensors to detect damage through global and local monitoring of structures in this paper. This method combines a fast-response and easy-to-operate carbon fiber (CF) sensor and an optical fiber (OF) sensor with long-distance monitoring capacity and high spatial resolution. The distributed CF sensor monitoring system can undertake global and local monitoring, and the OF sensor monitoring system with a long sensing distance can monitor full-scale and local strain response. The measured signals of the CF and OF sensors include the strain response, the external condition response and the monitoring system noise. Towards the measuring capability in detecting low-level strain, the static measured signal of CF and OF sensor in a variable external condition is compared. Based on the relationship between sensing performance and monitoring numbers, a similar true value analysis method was developed from the measured signal, and then a wavelet transform based de-noising method was also developed. The effective high-confidence integrated monitoring system of CF and OF sensors is established and discussed along with the similar true value and the de-noised signal. Finally, this integrated system was installed on a concrete beam to determine its damage detection capability. It is found experimentally that the integrated monitoring with CF and OF sensors achieved high-confidence signals in detecting the damage location.

Ключевые слова:

Содержание.

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