Computer-Aided Civil and Infrastructure Engineering,
Vol. 26, No.3, pp. 154-172.

Vibration-Based Damage Localization in Flexural Structures Using Normalized Modal Macrostrain Techniques from Limited Measurements

A. Philips Adewuyi; Zhishen Wu

Abstract

This article presents damage locating indices based on normalized modal macrostrain (MMS) as improvement on the typical curvature-dependent methods. Vulnerability to noise and the use of numerical differentiation procedures are the key factors for the poor performance of many curvature-dependent methods using displacement mode shapes. Whereas dynamic distributed strain measurement data from long-gauge FBG sensors have significantly improved the performance of many damage identification methods, the sensitivity to local damage diminishes as the gauge length increases. The proposed model-free damage identification techniques based on normalized MMS vectors are successfully implemented to locate damage in beam-like structures through numerical simulations and experimental verifications. The unique advantages of the techniques are their simplicity, robustness to noise, ability to precisely identify small damage extents, and localize single and multiple damage states using limited measurable modes from few sensors.