Sensitivity-based Structural Damage Identification via Response Reconstruction

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Abstract

The limitation of sensor number and results that the monitored data is difficult to reflect the true state of the structures, which limits the reliability of bridge damage identification and deterioration assessment. There are many full-field response reconstruction methods developed to obtain the complete responses. However, the quality of the reconstructed data is comprehensively affected by finite element model errors, noise interference and strong coupling environmental effects, resulting in the low accuracy of dynamic-based damage indicators. Thus, this paper explores a damage identification method based on static response reconstruction and solve the damage factor using the relationship between the sensitivity matrix and the structural deformation. Taking simply-supported and cantilevered beam as examples, numerical calculations confirm that the method can effectively locate the damage of the structural system.

Keywords: structural health monitoring; damage identification; sensitivity analysis; response reconstruction.

1 Introduction

Damage inevitably occurs in structures during their service life due to a variety of factors such as environmental erosion, operational loads, fatigue, and accidental collisions, and the theory related to damage detection methods (DDM) has attracted extensive attention early on. The current work mainly includes DDM based on vibration data[1] (e.g., inherent frequency[2], vibration type, frequency response function[3], modal flexibility matrix, dynamic response, etc.) and DDM based on

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