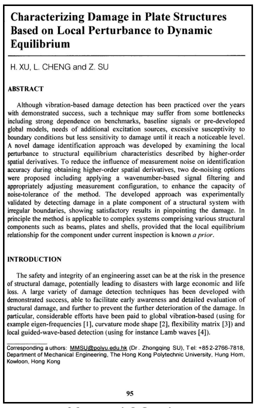

Characterizing Damage in Plate Structures Based on Local Perturbance to Dynamic Equilibrium

H. XU, L. CHENG and Z. SU

ABSTRACT

Although vibration-based damage detection has been practiced over the years with demonstrated success, such a technique may suffer from some bottlenecks including strong dependence on benchmarks, baseline signals or pre-developed global models, needs of additional excitation sources, excessive susceptivity to boundary conditions but less sensitivity to damage until it reach a noticeable level. A novel damage identification approach was developed by examining the local perturbance to structural equilibrium characteristics described by higher-order spatial derivatives. To reduce the influence of measurement noise on identification accuracy during obtaining higher-order spatial derivatives, two de-noising options were proposed including applying a wavenumber-based signal filtering and appropriately adjusting measurement configuration, to enhance the capacity of noise-tolerance of the method. The developed approach was experimentally validated by detecting damage in a plate component of a structural system with irregular boundaries, showing satisfactory results in pinpointing the damage. In principle the method is applicable to complex systems comprising various structural components such as beams, plates and shells, provided that the local equilibrium relationship for the component under current inspection is known *a prior*.

INTRODUCTION

The safety and integrity of an engineering asset can be at the risk in the presence of structural damage, potentially leading to disasters with large economic and life loss. A large variety of damage detection techniques has been developed with demonstrated success, able to facilitate early awareness and detailed evaluation of structural damage, and further to prevent the further deterioration of the damage. In particular, considerable efforts have been paid to global vibration-based (using for example eigen-frequencies [1], curvature mode shape [2], flexibility matrix [3]) and local guided-wave-based detection (using for instance Lamb waves [4]).

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Ключевые слова:

Содержание.