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Comparative study of damage identification algorithms applied to a bridge: I. Experiment

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Abstract

Over the past 30 years detecting damage in a structure from changes in global dynamic parameters has received considerable attention from the civil, aerospace and mechanical engineering communities. The basis for this approach to damage detection is that changes in the structure's physical properties (i.e., boundary conditions, stiffness, mass and/or damping) will, in turn, alter the dynamic characteristics (i.e., resonant frequencies, modal damping and mode shapes) of the structure. Changes in properties such as the flexibility or stiffness matrices derived from measured modal properties and changes in mode shape curvature have shown promise for locating structural damage. However, to date there has not been a study reported in the technical literature that directly compares these various methods. The experimental results reported in this paper and the results of a numerical study reported in an accompanying paper attempt to fill this void in the study of damage detection methods. Five methods for damage assessment that have been reported in the technical literature are summarized and compared using experimental modal data from an undamaged and damaged bridge. For the most severe damage case investigated, all methods can accurately locate the damage. The methods show

varying levels of success when applied to less severe damage cases. This paper concludes by summarizing some areas of the damage identification process that require further study.

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