ON THE ROUGHNESS-BASED DAMAGE DETECTION METHOD IN CRACKED BEAMS

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Details of a new damage detection technique using roughness profile of structural mode shape are presented in this paper. To simulate a damaged beam numerically, a simplified solution of free vibration of a multi-cracked beam is obtained using general function. Numerical filter is used to extract the roughness profile from the mode shape of cracked beams. The location of a crack in the beam is then determined by a sharp peak value appearing on the roughness profile. The size of the crack is also determined by the peak roughness value at the location of the crack. Specifically, two types of numerical filters, i.e., triangular and Gaussian, are examined. It has been found that the former filter is more effective in damage detection than the latter one. Numerical calculations indicate that a relatively low measurement resolution is required by the roughness-based method. Noise stress tests are also carried out to demonstrate the effectiveness and robustness of this method under the influence of noise. As a validation, the proposed method is applied to the experimentally measured curvature mode shapes to detect crack damage in an E-glass/epoxy laminated composite beam. The successful detection of crack in the composite beam demonstrates that the roughness-based method is capable of assessing both the location and size of the crack and can be used efficiently and effectively in damage identification and health monitoring of beam-type structures.

Keywords: Damage; Dynamics; Composites.