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# Theoretical investigation of damage detection in composite structures using harmonic response technique

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**Abstract :** Nowadays the fiber-reinforced composite materials have used widely in the construction of aircraft structures; these structures are subjected to different excitations which may cause serious failure. For this reason our research presents a technique aimed to identify the damage in fiber-reinforced composite beam subjected to harmonic load using analytical model. The presence of a crack in structural elements leads to an energy concentration near to the crack region and introduce a local flexibility which affects its dynamical characteristic. Due to this fact, the harmonic response technique assumed to be reasonable technique for damage identification in cracked beam through the evaluating of its dynamic response to harmonic excitation. The discrete spring model has been used for modeling the crack, including the stress intensity factors, in which the composite beam is assumed to be divided into two sub-beams at the crack position, connected together by the additional equivalent spring. Euler-Bernoulli beam and the modal expansion theories are used in this study for solving the differential equation related to forced vibration. A parametric study has been carried out in order to investigate the influence, of crack depth and crack location on the transverse displacement of cracked composite beam under harmonic excitations. The obtained results show that the response amplitudes of a cracked beam changes with the varying of crack depth and location, and therefore, it can be used as a crack detection criterion. The dynamical behavior of composite beam with a lower flexural rigidity is more sensitive to presence of a crack. The vibration amplitudes are more sensitive when the crack depth increases. As aconsequence, the evaluation of dynamical response of cracked beam subjected to moving harmonic excitation can be used as an appropriate technique for damage detection in composite structures

**Keywords :** Composite beam, Damage detection, harmonic excitation, Transverse displacement