Images of Cracks using a Localized Nonlinear Ultrasonic Parameters

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Nonlinear acoustic effect is a sensitive tool to detect a micro-scale crack or early stage of cracking in a fatigue process. The damage produces a nonlinear stress-strain relationship and the nonlinearity can be measured by a higher harmonic component in the frequency domain. The 2nd harmonic component and higher harmonic components are measured by using a laser Doppler vibrometry. Because the laser beam can be focused to a smallest spot, localized nonlinear acoustic parameters can be determined. The more damage, the larger is the level of a nonlinearity, and it can be used to for diagnosis of micro-cracks. By a scanning the laser beam, localized nonlinear acoustic parameters can be mapped around a cracked specimen. Various nonlinear parameters are chosen and tested around the crack tip and the most sensitive nonlinear parameter for micro-crack or closed crack are optimized

Keywords: Nonlinear Acoustics parameter, Diagnosis of micro-crack, fatigue process, Laser vibrometry

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