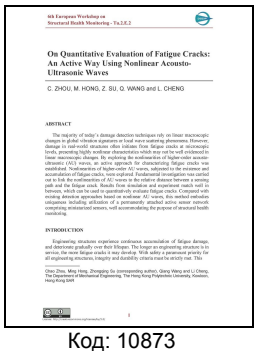

Код: 10873

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On Quantitative Evaluation of Fatigue Cracks: An Active Way Using Nonlinear Acousto-Ultrasonic Waves

Дрезден, Германия, 2012 год

8 стр; формат: 23,5 x 16 см; библиографический список: 8 единиц

The majority of today's damage detection techniques rely on linear macroscopic changes in global vibration signatures or local wave scattering phenomena. However, damage in real-world structures often initiates from fatigue cracks at microscopic levels, presenting highly nonlinear characteristics which may not be well evidenced in linear macroscopic changes. By exploring the nonlinearities of higher-order acousto-ultrasonic (AU) waves, an active approach for characterizing fatigue cracks was established. Nonlinearities of higher-order AU waves, subjected to the existence and accumulation of fatigue cracks, were explored. Fundamental investigation was carried out to link the nonlinearities of AU waves to the relative distance between a sensing path and the fatigue crack. Results from simulation and experiment match well in between, which can be used to quantitatively evaluate fatigue cracks. Compared with existing detection approaches based on nonlinear AU waves, this method embodies uniqueness including utilization of a permanently attached active sensor network comprising miniaturized sensors, well accommodating the purpose of structural health monitoring.

Доклад. 6-я Европейская конференция по мониторингу технического состояния сооружений, 2012. Редакция Кристиана Боллера.

Ключевые слова:

Содержание