

Ultrasonic Signal Characteristics in Pre- and Post-yield Steel Structures

Y. Bingol
A.M. Okeil

Louisiana State University, Baton Rouge, Louisiana, USA

ABSTRACT

The theory of acoustoelasticity has been the main concept behind most studies investigating the stress level in different structural materials. In this paper, an alternative approach for stress assessment is investigated whereby signal characteristics are identified under different stress levels. The results of an experimental investigation on longitudinal waves propagating perpendicular to the applied stress are presented. Ultrasonic signals were acquired from steel specimens subjected to different uniaxial tensile stress levels. Two well known Digital Signal Processing (DSP) methods; the Fast Fourier Transform (FFT) and Chirp-Z Transform (CZT), were used to analyse the signals in the frequency domain. Two other techniques; peak amplitudes and signal energies, were used for investigating the acquired signals in the time domain. This study confirms that the acoustoelastic effects on ultrasonic signals are miniscule within the elastic range for longitudinal signals travelling perpendicular to the applied stress. However, the results show a clear distinction between signal characteristics prior to and post yielding.
