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The simulation for ultrasonic testing based on frequency-phase coded excitation

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ABSTRACT

Large time–bandwidth product coded signal and pulse compression in radar field have been introduced into ultrasonic testing. Linear frequency modulation (LFM), a frequency coded signal, is usually used to improve the time resolution, but the sidelobe of LFM should be suppressed to detect smaller flaws nearby. Barker coded signal of length 13, a binary phase coded signal, is usually used to suppress the sidelobe, but the wave width of results is larger than LFM. So a frequency-phase coded excitation is proposed to obtain good testing results with higher time resolution and lower sidelobe of. It combines the frequency and phase coded signal. LFM is applied to each subpulse of Barker code, and it is called LFM-B_{13}. The simulations are carried out using K-wave toolbox in Matlab. The results of simulations demonstrate that, when using LFM-B_{13} excitation, the main sidelobe level is suppressed better and the time resolution is improved higher than using LFM excitation. The time resolution of LFM-B_{13} excitation is approximately 40% higher than that of LFM excitation, and the sidelobe of LFM-B_{13} excitation is approximately 4 dB lower than that of LFM excitation, when 60% bandwidth of 5 MHz central frequency transducers are used in penetrating experiments' simulations.

KEYWORDS: simulation, ultrasonic testing, coded excitation, pulse compression, K-wave