

Generalized Matched Filter for Ultrasonic Signal-to-Noise Enhancement in Piping Components

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This research investigated ultrasonic pulsers and signal processing techniques to improve ultrasonic testing (UT) data quality on metallic materials which are challenging to inspect using UT. Examples of challenging components for inspection are piping welds that are limited to single-side access, or components produced from dissimilar metals or coarse grains such as cast austenitic stainless steel (CASS). Reliable techniques are required for inspection and for improvements to be made to UT data quality. If techniques can be developed that show improvements at the A-scan level then it will aid further UT inspection development. An arbitrary waveform generator was used to produce a linear sine-sweep signal, commonly referred to as a chirp signal, and was post-processed using a pulse compression technique. The signal-to-noise ratio results are compared to mono pulse excitation sources that are used in techniques currently conducted by the industry. The results in this research provide the industry with an assessment of alternative UT pulsers and signal processing techniques. As such the equipment and techniques presented are not meant to emulate any existing ultrasonic procedures. The results can help guide the development and design considerations for emerging UT instruments, transducers, and procedures. Keywords: Chirp, Generalized Matched Filter, Piping, Pulse Compression, Signal Processing, Ultrasonic Testing