4.5.10. APPLICATION OF SIGNAL PROCESSING TECHNIQUES TO ULTRASONIC TESTING OF AUSTENITIC WELDS

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Welded austenitic materials have columnar grains, anisotropic elastic properties, and a heterogeneous structure. The structure of austenitic welds may distort and scatter the ultrasonic beams. Beam skewing and beam scattering are the main reasons for attenuation of signals in the ultrasonic examination of austenitic welds. They can lead to low signal to noise ratio and make the interpretation of results quite difficult. There are two methods for improving the signal to noise ratio in the ultrasonic inspection of austenitic welds. The first method is choosing the optimized inspection parameters such as wave mode, frequency, angle, etc., and the second is using signal processing techniques.

In this paper, the ultrasonic Time-of-Flight Diffraction (ToFD) technique is used for inspection of austenitic welds. Special signal processing techniques are implemented to improve the signal to noise ratio and time resolution of the ToFD signals. A flawed mockup of austenitic weld made from AISI 316L is prepared using shielded Metal Arc Welding (SMAW). An artificial defect (notch) machined by electro discharge machining process is implanted in the weld. This sample is then tested by both radiography and ToFD techniques. The ultrasonic ToFD signals are deconvolved by Wiener filtering followed by autoregressive spectral extrapolation. The results show that this filtering can improve signal to noise ratio and time resolution of signals. Using these two factors, it is expected that the ToFD technique could be a good alternative for conventional radiography for testing of thick austenitic welds.