Building TFM Procedures for ERW Hook Crack, Girth Weld, HTHA, and Other Challenging Inspections

Emilie Peloquin[1]

[1]Global Support, Olympus Scientific Solutions Americas, USA

Full matrix capture (FMC) and the total focusing method (TFM) have shown improvement in specific applications in the past few years. However, inspectors using this method are still subject to trial and error to achieve good results. Challenges with TFM inspection include selecting a propagation mode to minimize blind spots, confirming the angle of reflection, and optimizing for preferential gain direction. In particular, choosing the most appropriate mode of propagation (i.e., the imaging path) is critical for an effective TFM inspection, and it requires extensive procedure development on simulation software to help ensure proper detectability and perpendicularity of the beams with the reflectors (defects). The Acoustic Influence Mapping (AIM) simulator is a theoretical amplitude representation (color map) of the region, mode of propagation, and type of reflector selected. With this tool, multiple imaging paths can be combined to obtain the optimal probability of detection (POD) for a given indication or damage mechanism. In this paper, we describe a wave propagation modeling technique that calculates the predicted signal response in the TFM zone for both pulse-echo and self-tandem modes of propagation. We also highlight how the AIM tool improves challenging inspections, such as identifying hook cracks in electric resistance welding (ERW) where defects can appear parallel to the scanning surface and in high-temperature hydrogen attack (HTHA) where micro-fissuring can occur in different directions and location within the part.