Detection and Sizing of SCC in Seam Welds with IWEX Advanced Ultrasonic Imaging

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As part of the integrity management program, pipelines can be screened for possible damage with efficient in-line inspection (ILI) tools. The type of damage depends on the degradation mechanism such as dents (mechanical damage), wall thickness loss (corrosion) or cracks (fatigue, stress corrosion cracking (SCC)). Although ILI tools have been proven to be adequate for the detection of such damage, accurate characterization and sizing of indications is usually very limited. Therefore, the pipeline can be excavated at suspicious locations identified by ILI tools for confirmation and further investigation with additional non-destructive testing techniques.

For integrity assessment and remaining lifetime analyses, accurate information of the most critical indication or area is required. In case of SCC, the remaining wall thickness between the tip of the largest crack and the surface is most critical. However, SCC often appears as clusters of multiple cracks whereby it is challenging to identify and size the deepest with traditional ultrasonic testing strategies such as the pulse-echo technique, phased array sectorial scanning or the time of flight diffraction (ToFD) technique.

In this paper, we will introduce the latest strategy of ultrasonic inspection based on full matrix capture (FMC) ultrasonic data which is processed in real-time into an image with the IWEX system. With this technique also known as the total focusing method (TFM), it is possible to detect clusters of SCC and to identify and size individual cracks within the cluster.

To demonstrate the performance of the technology, measurements were performed on a test sample. The test sample contained a cluster of SCC in the area of the seam weld of a 10mm thick carbon steel pipe. For reference purposes, the test sample was also inspected with the ToFD technique. Scan results from measurements with IWEX will be presented together with the interpretation. In contrast with traditional technologies, IWEX utilizes multiple ultrasonic travel paths (known as imaging modes) resulting in a comprehensive image which shows the shape of the cracks and its tip which can be used for accurate height sizing. The sizing accuracy will be demonstrated using a reference piece of approximately the same wall thickness containing controlled machined notches at different depths.

The visualization and sizing accuracy are unique for the IWEX system and it facilitates an improved analysis for the pipeline integrity. Furthermore, we will evaluate conditions for adequate use of the technology, and we will discuss practical considerations for use under field conditions.
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