Internal Corrosion Monitoring in Pipelines by using Helical Ultrasonic Waves

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Main Objective

This project was awarded to Professor Salvatore Salamone in order to design, implement and validate a nondestructive evaluation (NDE) technology for detecting, evaluating and monitoring the progression of internal corrosion in pipelines. it is proposed to use a novel class of sensing system, helical guided ultrasonic waves (HGUW) and advanced data processing techniques for supporting corrosion diagnosis and decision-making.

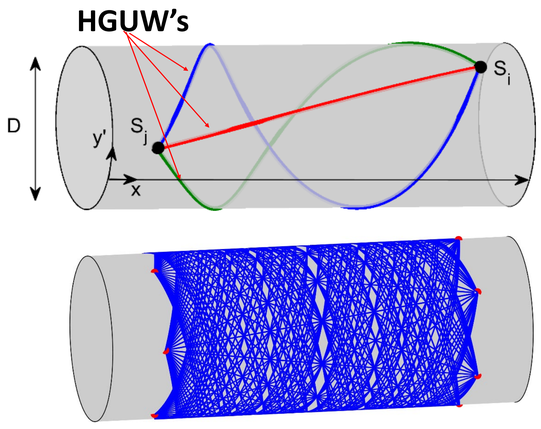

Figure 1. Helical guided ultrasonic waves

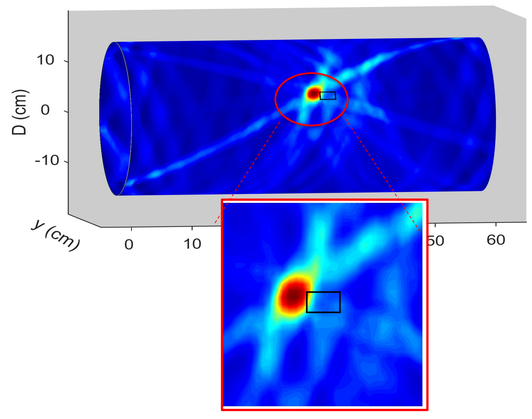

Figure 2. Damage localization using the algebraic reconstruction technique (ART)

Methodology

- Permanently attached network of (PZT) sensors
- Active (HGUW) and passive (AE) health monitoring
- Localization of various types of defects in steel pipes
- Finite element modeling
- Experimental validation and correlation with numerical models

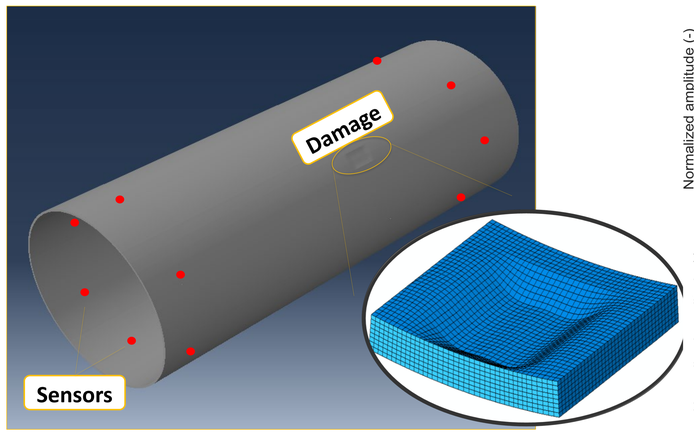

Figure 3. Numerical model with simulated damage

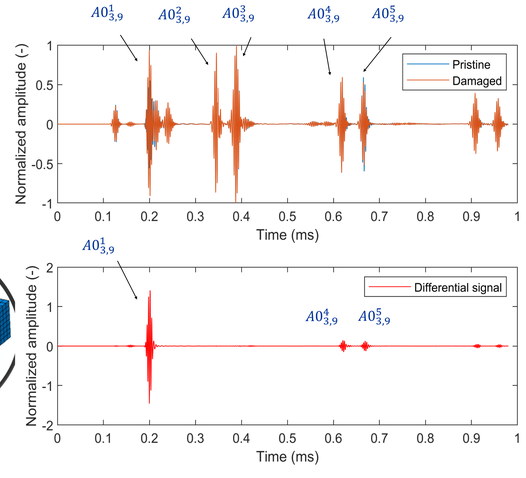

Figure 4. Baseline subtraction

Results

- Corrosion-like damage was simulated externally on the surface of the pipe in order to verify the effectiveness of the proposed methodology.
- An accelerated corrosion test was carried out inside the pipe. Work is now underway and targets on quantifying the corrosion progress.

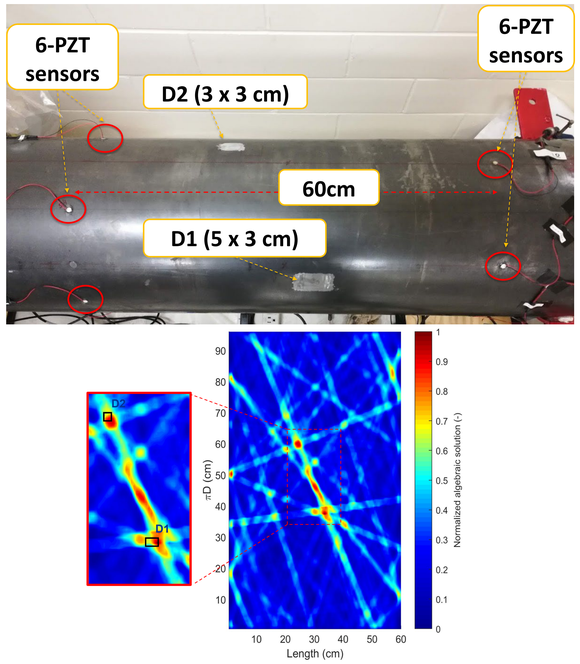

Figure 5. Experimental setup

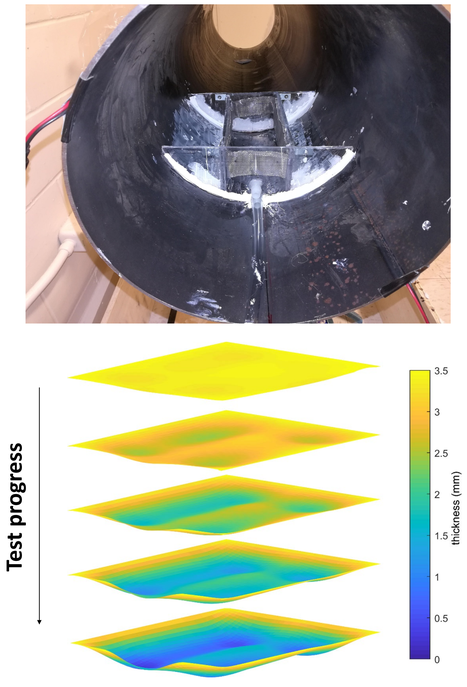

Figure 6. Accelerated corrosion inside the pipe

Acknowledgments

This project is funded by DOT/PHMSA's Competitive Academic Agreement Program (#693JK31850004CAAP).

References

Livadiotis, S., Ebrahimkhanlou, A., & Salamone, S.. An algebraic reconstruction imaging approach for corrosion damage monitoring of pipelines. Smart Materials and Structures, 28(5). (2019)

S. Livadiotis, A. Ebrahimkhanlou, and S. Salamone, "A helical-based ultrasonic imaging algorithm for structural health monitoring of cylindrical structures," Proc. SPIE. Denver, 2019, vol. 1, no. 1, pp. 2–8, 2019.

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