Multi-modal NDE Assisted Probabilistic Pipeline Performance Evaluation under Interactive Anomalies

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Main Objective

This project was awarded to "The University of Akron" in order to develop probabilistic pipeline performance evaluation framework based on multi-modal NDE assisted by physical and mechanical modeling under interactive anomalies.

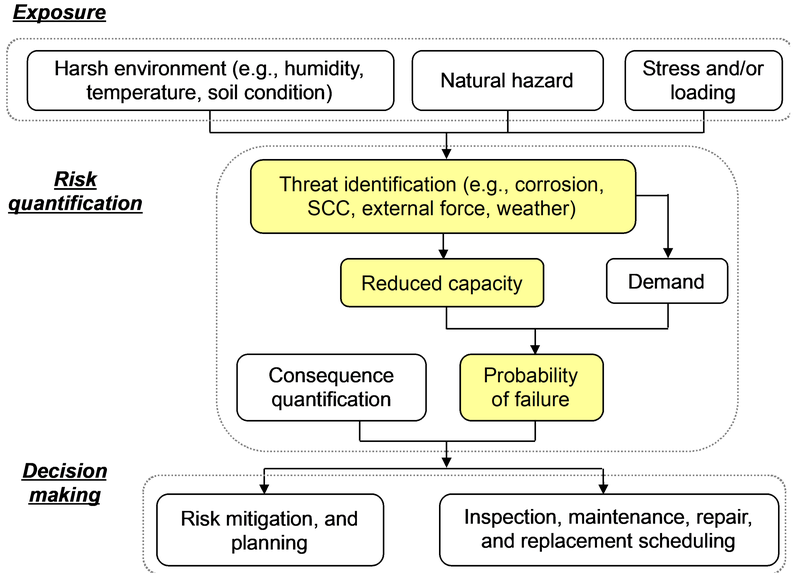

Figure 1. Quantitative Risk Management for Pipeline

Corrosion defects

SCC defects

Figure 2. Anomalies Considered in this Study

Project Approach/Scope

This study will focus on three types of anomalies: isolated corrosion defect; isolated crack-like defect; colony corrosion defects; colony crack-like defects.

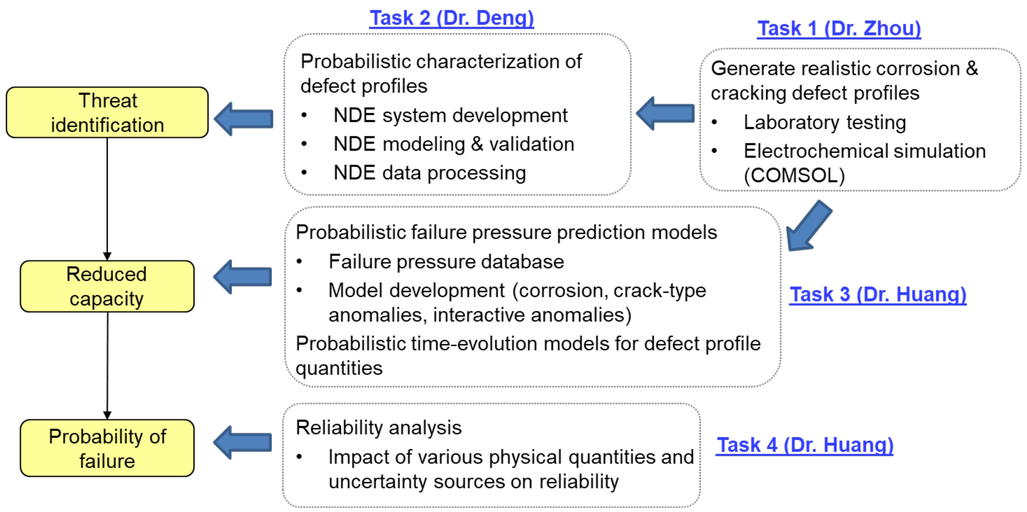

Figure 3. Proposed Major Tasks

Expected Results or Results to Date

- **Pitting corrosion was modeled as hemispherical cavities in COMSOL Multiphysics®.**
- **Guided waves were simulated in time domain and showed clear response due to variation in corrosion depths and number of corrosion pits. Monotonic increase in amplitude of reflected wave from the pits was observed as the pit depth increased.**
- **A total of 525 different burst test results for isolated defect are collected; and additional numerical analysis conducted from this study using ABAQUS.**
- **Probabilistic model formulation is constructed using existing deterministic prediction models currently adopted in practice as independent variables.**

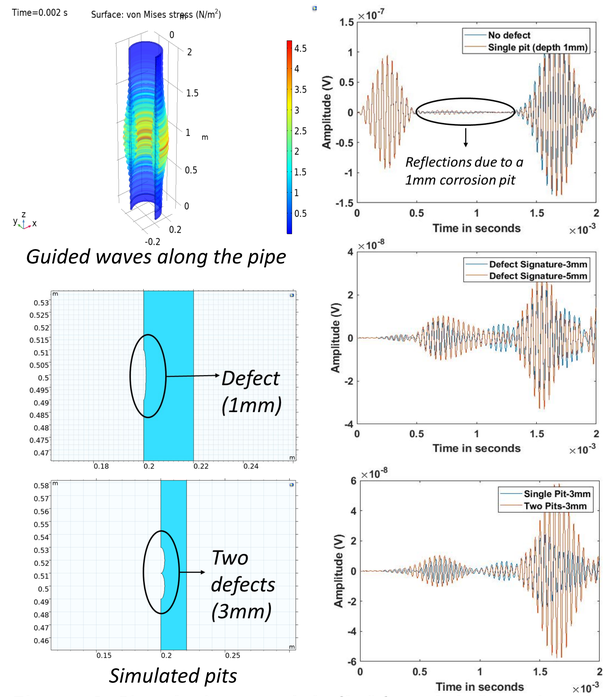

Figure 4. Simulation models (left) and defect signals (right) showing effect of pit depth and number of pits

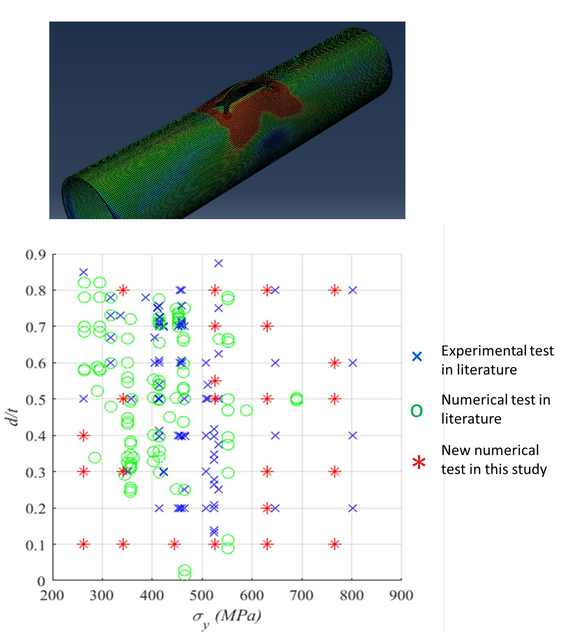

Figure 5. Numerical analysis for isolated corrosion defect: FE Analysis in ABQUS (top); new FE cases added to database (bottom)

Acknowledgments

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References

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[2] A. Demma, P. Cawley, M. Lowe, A.G. Roosenbrand, B. Pavlakovic, The reflection of guided waves from notches in pipes: a guide for interpreting corrosion measurements, NDT and E Journal

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