Brain-Inspired Learning Framework to Bridging Information, Uncertainty and Human-Machine Decision-Making for Decoding Variance in Pipeline Computational Models

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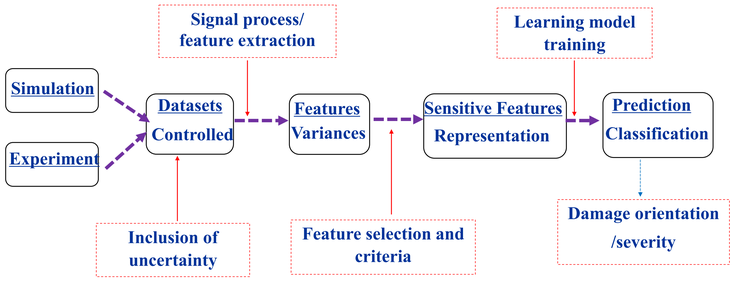
Main Objective

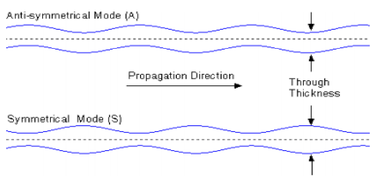
This study is to develop and implement new learning framework to bridge information, uncertainty and human-machine decision making to meet pipeline environments that are becoming increasingly complex and demanding because of the high uncertainty, and heterogeneous data.

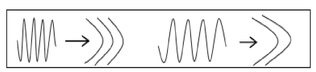


Project Approach/Scope

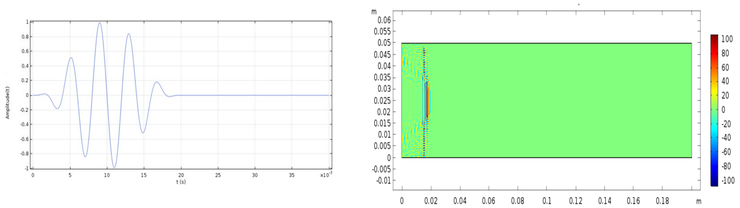
The current work mainly focuses on the variance widely ranging from material/structural integrity (e.g., damage types, damage size and morphology) using experimental and numerical studies through different datasets:

- ***Simulation of different scenarios with damage***
- ***Experimental validation and verification***
- ***Characterization of damage features***
- ***Identification of unique features***

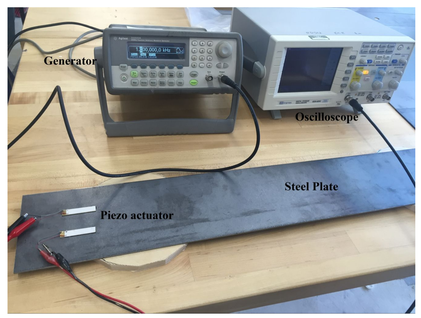




Lamb wave propagation



Excitation signal and simulation (Multiphysics software COMSOL®)



Test setup

Samples with damage types and size

Results to Date

The inclusion of damage/cracks experienced in the structure (see Fig. 1) into the model provided change of signals in time-domain (DWT), frequency domain (FFT), or time-frequency domain (CWT), as shown in Figs. 2 and 3.

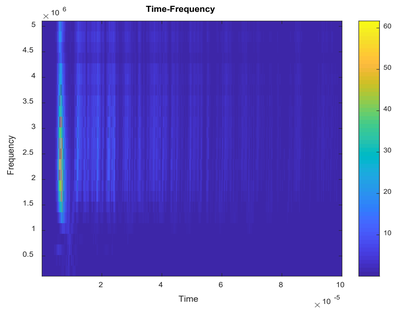
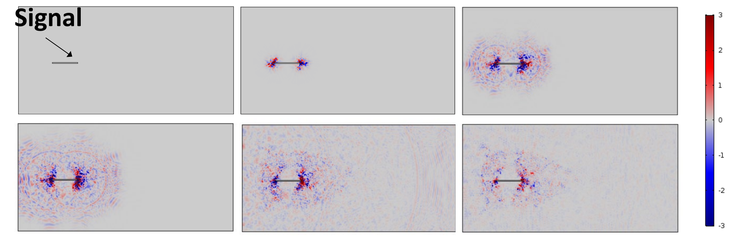
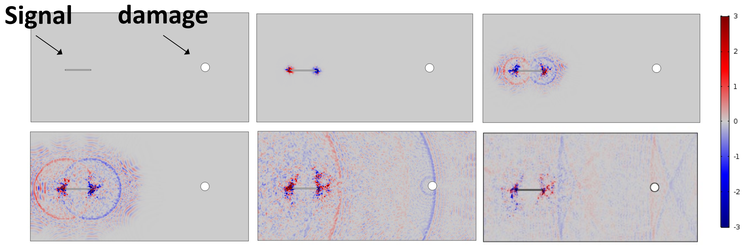


Figure 2. Signals in the CWT



(a) Undamaged state



(b) Undamaged state

Figure 1. Lamb wave propagation (a) and (b)

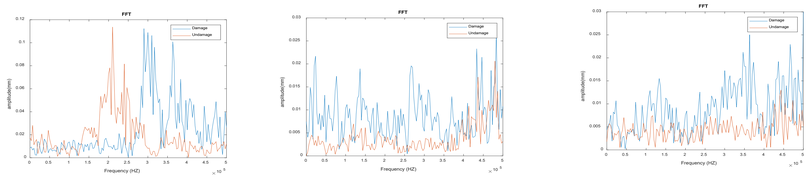
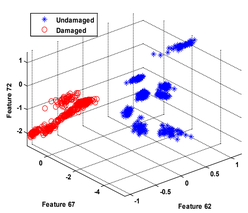
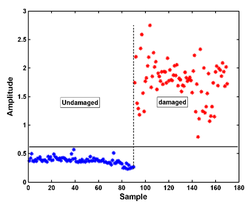


Figure 3. Signals and FFT in three locations

- ***work on the data on specified mechanical damage (type and size) will be analyzed as training features, while the lab data are used for calibration and training sets.***





Acknowledgments

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Public Project Page

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