Title: Multiscale Health Monitoring of Critical Infrastructure Using Fusion Based and AI Assisted Noncontact Sensing Techniques

Duration: April 2024 to March 2026

Objectives:

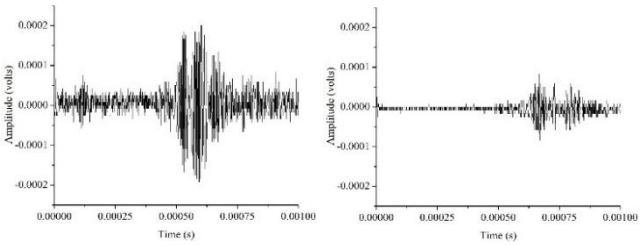
- Rapid detection of damage regions in large (and inaccessible) composite components using infrared thermography and digital image correlation-based processing technique
- Development of robust and efficient tool(s) for early-stage damage detection using high frequency acoustic/ultrasonic technique(s)
- Development of Artificial Intelligence (AI) enabled fusion technique for Structural health monitoring (SHM) of structures
- Demonstration of efficiency of multiscale SHM tool for structures and technology development for early warning system

Progress Highlights:

❖ Investigations towards development of noncontact technique for ultrasonic actuation and sensing

❖ Establishment of appropriate test set-up and methodology for detection of damage in metal components using noncontact ultrasonic sensing techniques

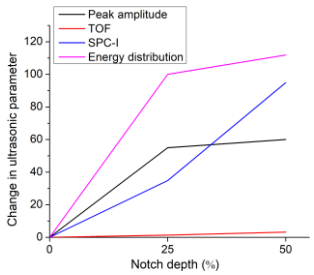
❖ Development of algorithms for damage identification and localization using noncontact measurements



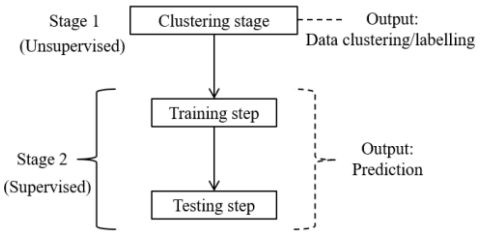
(a) (b)

Effect of notch on received signals
(a) healthy plate; (b) plate with a flaw

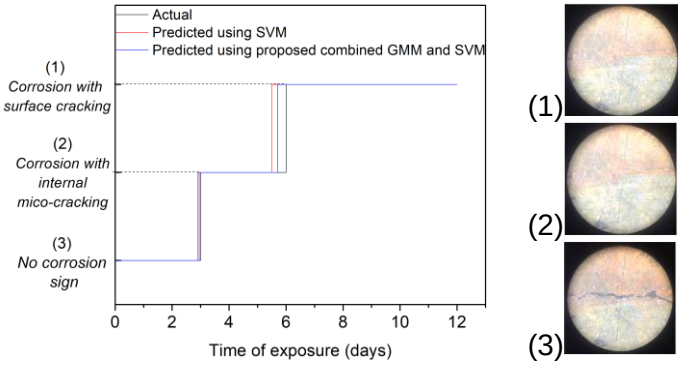
Air-coupled (noncontact) ultrasonic testing set-up



Damage detection using noncontact ultrasonic techniques



Multi-layer method combining unsupervised and supervised



Performance of conventional and proposed multi-layer method

Future Programme:

- Determination of suitable linear/nonlinear ultrasonic parameter to detect damage in multi-layer composites (with various types of flaw) using noncontact ultrasonic techniques
- Efficacy of noncontact infrared thermal (IR) image processing techniques for detecting flaw in composites

PI and Co-PI

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