

Synopsis

**Thesis Title : IMPEDANCE BASED STRUCTURAL INTEGRITY ASSESSMENT USING
PIEZOELECTRIC TRANSDUCERS**

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To ensure structural integrity and safety of the civil infrastructure facilities, the structures need to be equipped with Active Structural Health Monitoring (ASHM) systems for automated and continuous condition based monitoring, inspection, and damage detection of structures with minimum labour involvement. Impedance based structural health monitoring is a promising technique for ASHM by utilizing the electromechanical coupling property of the piezoelectric materials. Piezoelectric materials can be used as actuators and sensors simultaneously.

Analytical and numerical models are important to characterize the effects of fiber distribution of piezo-patches on electric field. It is necessary to understand the mechanical behavior of the coupled actuator/ structure, sensor/ structure system. It is also useful to understand the constitutive behavior of the piezoelectric composites. The bonding between the PZT patch and structure plays a major role in damage detection. Due to improper bonding, shear lag occurs on the impedance sensor. The effect of the bonding conditions is remarkable, which significantly affect the resonant frequency estimation of the system. It is necessary to carry out micro-mechanical simulation studies to understand the wave propagation of excitation signatures for assessing the damage in the structures by including the bonding effect to obtain more accurate results.

In the proposed study, it is aimed to develop the methodology for assessing the integrity of concrete structures using impedance based measurements from PZT transducers. Based on the literature study, some gaps have been identified on the application of piezo-sensors for structural health monitoring which have been considered in formulating the objectives for the present study as follows:

Objectives of the present study

- Analytical investigations on the application of impedance measurements using Piezo-transducers for integrity assessment of concrete structures
- Numerical investigations for integrity assessment of concrete structures using Piezo based distributed impedance measurements
- Influence of Piezo-structure interface behavior on structural impedance for integrity assessment.