<u>Synopsis</u>

Thesis Title : Nonlinear Parametric Identification of Engineering Structures

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Batch : 2012- 2014

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The process of implementing a damage detection strategy for civil engineering infrastructure is referred to as structural health monitoring. Here damage is defined as changes to the material and/or geometric properties of the systems, including changes to the boundary conditions and system's connectivity, which adversely affect the system's performance. In many cases damage causes a structure that initially behaves in a predominantly liner manner to exhibit nonlinear response when subject to its operating environment. Hence structural damage often introduces extra nonlinearities, aging aggravates these nonlinearities. The damage detection process can be significantly enhanced if one takes advantage of these nonlinear effects when extracting damage-sensitive features from measured data.

In my thesis, Characteristic evaluation of nonlinear detection techniques using numerical and experimental simulations has been investigated. An appropriate technique based on Null subspace analysis for detection of nonlinearity is implemented and evaluated for practical applications. The proposed Null subspace analysis is found to be ideally suitable for online monitoring of engineering structures with ambient measurements. The theoretical formulation based on the reverse path analogy has been done and investigated with several examples to demonstrate the effectiveness of this technique for spatial location of nonlinearity. Further the techniques such as time and frequency domain reverse path methods and time and frequency analysis and volterra series has been attempted and reviewed for parameter estimation.