ABSTRACT

This dissertation compiles the development of an automated structural health monitoring (SHM) for a cantilever structure. Three methodologies for the structural health monitoring have been developed and validated. The first technique includes fiber optic sensors integrated with the neural network method. This part of the research involves the collection of data received from the fiber optic signal and integration of various optical parameters with neural network for the strain determination. The strain is determined for both static and dynamic loadings. Extension of work includes damage location in cantilever beam structure.

Second technique uses wavelet-based diffuse wave signals along with the neural network method. In this section of the study, a wavelet-based diffuse zone selection method is developed. The wavelet parameters are used in the developed neural network for damage location in the structures.

The third methodology is purely wavelet-based diffuse wave analysis which can be used structural health monitoring. This part of the research includes the development of a new wavelet-based residual energy method for damage analysis. Results of the developed methodology are compared with pre-existing techniques namely time-domain differencing and spectrogram differencing and found in good agreement.

The study addresses issues related to smart structural health monitoring and proposes the integrated approach for developing advanced measurement systems. It has also been shown that integrated methods using artificial intelligence can be successfully used for better and accurate structural health assessment.