Damage Index Implementation for Structural Health Monitoring

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Abstract

Since the requirements for constructing more stable and durable structures are increasing, structural health monitoring (SHM) is getting more importance nowadays. SHM relies on various methods to monitor a specific structure even live online or through direct observation of some structural parameters to decide whether a structure is damaged or not. Besides the need of getting reliable updates about the structure status, the need of making it more affordable for all types of projects is getting decisive. One of the simple implementations that are used for this purpose is to employ wave excitation at certain position of the structural part of interest and to observe the response at another predefined location of this part. After that, the observed wave propagation signal is used to calculate the damage index (DI) parameter which can be implemented in different algorithms for monitoring the current status and possibly predicting the remaining reliable operation of the structure. The signal processing procedure implemented in this work is based on the wavelet decomposition of the wave signal for the purpose of determining the energy of the propagating wave. This research is done as a part of a larger project that will study the possibility of detecting damages in different structures in general and in massive structures in specific. The paper investigates the possibilities and benefits of implementing the DI metric for monitoring the structural condition. The method will be demonstrated through a case study. Several models will be invoked to clarify its applicability. For the sake of clarity, the implementation will be done on 2D models. In addition, a 3D example based on finite element modeling should give the scope of using DI in a general case.