Semnan University
Faculty of Civil Engineering

Detection and Determination of Damage in RC Frames Using Signal Processing

A Thesis Submitted in Partial Fulfillment of the Requirement for the Degree of Master of Science in Civil Engineering

By:
Amir Ezzodin

Supervisors:
Dr. Hosein Naderpour
Prof. Ali Kheyroddin

Advisor:
Prof. Gholamreza Ghodrati Amiri

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Abstract

In recent years, the damage detection and structural health monitoring to reduce maintenance costs and improve the safety and reliability of structures is regarded. Structural health monitoring and damage detection is the ability to show the performance of structure and identify and assess any damage in the structure at early stages. Recent developments in the field of sensors and other electronic technologies, makes the non-destructive methods effective, easy and advantageous procedure for damage detection. These methods are usually based on collecting information which is obtained from the structural behavior that identified any change in the structural response as a result of changes in environmental conditions (eg. changes in temperature, displacement, velocity, acceleration, strain, tension, curvature, etc.). Signal based dynamic methods assessed the changes in the characteristics of time-series measured from the structure obtained using signal processing. In other words, the purpose of signal processing is to survey the changes in properties not obtained directly from the time-history and corresponding spectrum. The main objective of this dissertation is evaluation of the methods and the algorithms corresponding to damage detection and structural health monitoring. Then using transformation functions and signal processing method, a model-free output-only procedure is investigated in which with details function of structural responses derived from wavelet decomposition, the structural damage can be evaluated. For this reason, first the RC frame was modeled in OpenSees and a nonlinear time-history finite element analysis was performed and acceleration and displacement time history response was derived. Then applying Wavelet and Fourier transform and the time and location of damage in RC frame could be identified.

Keywords: Damage Detection; RC Frame; Transformation Function; Finite Element Method.

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