ABSTRACT

Thesis: Structural Damage Analysis Using Matrix Decomposition Method Based On Dynamic Characteristic Changes

xix + 122 pages; 2014; pictures 45; tables 7

Local and global structural damage can be caused by changes in load characteristics, climate, and the influence of the age of the building itself. The damage is expected to be detected as early as possible, so that improvement efforts or retrofitting can be done right on target. A method that has been developed is a method of Vibration-Based Structural Damage Identification, which is non-destructive. This method is based on the idea that modal parameters (notably natural frequencies and mode shapes) are functions of the physical properties of the structure (mass, damping, and stiffness). There will be structural changes when damage occurs in the structure. Therefore, the change of modal properties will indicates the structural damage. On this thesis, structural changes are simulated by reduction of element stiffness on the structure. The effectiveness of the method to identify the location and the extent of damage severity on the structure are analyzed in this thesis. The concept of node residual vector is used to locate the suspected damage elements. Then three damage methods are studied to identify the extent of structural damage. The first method is based on changes in stiffness matrix and mass matrix of the structure. The second method is based on first order sensitivity matrix of natural frequency. And the third method is based on matrix modification of the first method. Analyses were performed with some simulations of structural damage on 2D truss and 2D frame for various parameters, include variation of the damage locations, variation of the extent of structural damage severity, variation of the number of damaged elements, variation in the type of severity, and variation of the type of structure. Based on the variation of the structural damage location, the results showed that the concept of node residual vector is able to predict the location of damage. Then based on the other variations which are studied, better results are obtained by using the third method to identify the extent of structural damage. Moreover, the third method is able to provide a significant improvement in result and application compared with the first method.

Keywords: *structural damage, dynamic characteristic, natural frequency, stiffness, matrix*