World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:10, No:03, 2016

Non-Destructive Static Damage Detection of Structures Using Genetic Algorithm

Authors : Amir Abbas Fatemi, Zahra Tabrizian, Kabir Sadeghi

Abstract : To find the location and severity of damage that occurs in a structure, characteristics changes in dynamic and static can be used. The non-destructive techniques are more common, economic, and reliable to detect the global or local damages in structures. This paper presents a non-destructive method in structural damage detection and assessment using GA and static data. Thus, a set of static forces is applied to some of degrees of freedom and the static responses (displacements) are measured at another set of DOFs. An analytical model of the truss structure is developed based on the available specification and the properties derived from static data. The damages in structure produce changes to its stiffness so this method used to determine damage based on change in the structural stiffness parameter. Changes in the static response which structural damage caused choose to produce some simultaneous equations. Genetic Algorithms are powerful tools for solving large optimization problems. Optimization is considered to minimize objective function involve difference between the static load vector of damaged and healthy structure. Several scenarios defined for damage detection (single scenario and multiple scenarios). The static damage identification methods have many advantages, but some difficulties still exist. So it is important to achieve the best damage identification and if the best result is obtained it means that the method is Reliable. This strategy is applied to a plane truss. This method is used for a plane truss. Numerical results demonstrate the ability of this method in detecting damage in given structures. Also figures show damage detections in multiple damage scenarios have really efficient answer. Even existence of noise in the measurements doesn't reduce the accuracy of damage detections method in these structures.

Keywords : damage detection, finite element method, static data, non-destructive, genetic algorithm
Conference Title : ICCASE 2016 : International Conference on Civil, Architectural and Structural Engineering
Conference Location : Paris, France
Conference Dates : March 14-15, 2016