World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:11, No:08, 2017

Probability-Based Damage Detection of Structures Using Model Updating with Enhanced Ideal Gas Molecular Movement Algorithm

Authors : M. R. Ghasemi, R. Ghiasi, H. Varaee

Abstract : Model updating method has received increasing attention in damage detection structures based on measured modal parameters. Therefore, a probability-based damage detection (PBDD) procedure based on a model updating procedure is presented in this paper, in which a one-stage model-based damage identification technique based on the dynamic features of a structure is investigated. The presented framework uses a finite element updating method with a Monte Carlo simulation that considers the uncertainty caused by measurement noise. Enhanced ideal gas molecular movement (EIGMM) is used as the main algorithm for model updating. Ideal gas molecular movement (IGMM) is a multiagent algorithm based on the ideal gas molecular movement. Ideal gas molecules disperse rapidly in different directions and cover all the space inside. This is embedded in the high speed of molecules, collisions between them and with the surrounding barriers. In IGMM algorithm to accomplish the optimal solutions, the initial population of gas molecules is randomly generated and the governing equations related to the velocity of gas molecules and collisions between those are utilized. In this paper, an enhanced version of IGMM, which removes unchanged variables after specified iterations, is developed. The proposed method is implemented on two numerical examples in the field of structural damage detection. The results show that the proposed method can perform well and competitive in PBDD of structures.

Keywords : enhanced ideal gas molecular movement (EIGMM), ideal gas molecular movement (IGMM), model updating method, probability-based damage detection (PBDD), uncertainty quantification
Conference Title : ICCBE 2017 : International Conference on Civil and Building Engineering
Conference Location : Copenhagen, Denmark
Conference Dates : August 17-18, 2017