6th International Conference on Advances in Experimental Structural Engineering
11th International Workshop on Advanced Smart Materials and Smart Structures Technology
August 1-2, 2015, University of Illinois, Urbana-Champaign, United States

Strain Response Measurement-based Damage Identification in Building Frame Structures

Mahendra P. Singh*, Saurabh S. Bisht.

* *Presenting Author*

Corresponding Author: Mahendra P. Singh
Contact Email: mpsingh@vt.edu

ABSTRACT

For response-based health monitoring of civil structures, linear acceleration response measurements are commonly used. These measurements provide good information to extract dynamic characteristics of structures such as modal properties that are commonly used for damage identification. However, they do not provide adequate information about rotational deformations associated with bending of the structural elements which are often the cause of structural damage due to excessive bending. In this paper we present an approach to utilize strain response measurements for localization and quantification of structural damage. It is observed that strain responses measured at appropriate structural locations are relatively more sensitive to damage than the acceleration and displacement responses. Although not entirely necessary, the easier-to-collect acceleration response measurements can also be used in combination with the strain responses to get additional data to enhance structural health monitoring. The approach presented in the paper utilizes the measured strain responses to extract dynamic characteristics in terms of the modal properties associated with the model degrees of freedom. They are then used to locate and quantify the damage expressed as a reduction in the stiffness of the damaged elements. The paper describes the methodology and presents the numerical results that demonstrate its effectiveness in identifying the damage at multiple locations on the structure. The damage identification effectiveness of this approach is also compared with the approach that only rely on the acceleration response measurements. The robustness and limitations of the methods for damage identification in the presence of measurement noise is also examined.

KEYWORDS: *measured strain responses, dynamic properties, damage identification,*