Damage detection in structures subjected to ground motion excitation (abstract)

F. Cavalieri & M. Imbimbo
Department of Mechanics, Structures and Environment, University of Cassino, Cassino (FR), 03043, Italy

R. Betti
Department of Civil Engineering and Engineering Mechanics, Columbia University, New York, NY, 10027, USA

ABSTRACT

In this paper the results of an experimental campaign concerning the process of the vibration-based damage detection are presented. Two case studies are analysed: a) a four-story scaled steel frame tested on a shake-table and b) a seven-story reinforced concrete building subjected to the 1999 Chi-Chi (Taiwan) Earthquake main shock and numerous fore- and aftershocks. Different damage detection indexes, based on assumed structural models or on statistical and nonlinear data-driven analyses, have been tested. The model based damage indexes, looking for changes in the modal or physical parameters, as well as the statistical approaches, which set the damage detection process in the context of a statistical pattern recognition paradigm, require two sets of records, one corresponding to the undamaged state and one corresponding to the damaged one. One of the main advantages of the data-driven indexes is that they do not require any assumption about the structural model but only the knowledge of the output signals. In addition, some of these data-driven approaches can deal even with data sets that correspond to a nonlinear response of the structure within a given excitation. The sensitivity of these different indexes to the presence of structural damage and their accuracy in locating damaged areas have been tested using recorded data from a laboratory test and from a real building.