A.N. Ede, B. Bonfiglioli, G. Pascale Guidotti Magnani, E. Viola, (2004) "Dynamic assessment of damage evolution in FRP strengthened RC beams**"**, *International Conference on Restoration, Recycling and Rejuvenation Technology for Engineering and Architecture Application, RRRTEA04, June 7-11, 2004, Cesena, Italy, pp. 155-163, (Sih& Nobile edd., Aracne ed.)*, **[**Cl. Oss. Ric.**C4]**.

Abstract: The importance of structural damage assessment is generally known all over the world. The ability to monitor a structure and detect damage at the earliest possible stage has been of great interest to the engineering communities because it permits the safety of valuable human lives and the conservation of economic resources. The most diffused damage detection methods for civil structures are either visual inspection or local non-destructive techniques. These methods require that the vicinity of the damage is known *a priori* and that the portion of the structure being inspected is readily accessible. Because of these limitations, these experimental methods can detect damage on or near the surface of the structure. The need for global damage detection methods, which can be applied to complex structures, has led to the development of methods that examine changes in the vibration characteristics of structures. The base for the application of vibration monitoring is that each structure has its typical dynamic behaviour, which is often referred to as vibration signature. Any change in a structure, such as all the damages that lead to a decrease of the load carrying capacity, is reflected in the dynamic response. This justifies the use of the dynamic response characteristics for the evaluation of structural quality and integrity.

The externally bonded fibre reinforced polymer (FRP-EBR) composites, which have been used in the aerospace industry for several decades, are becoming increasingly popular in the construction industry for strengthening purposes. They are emerging as alternatives to the traditional strengthening materials because of their non-corrosive property and ease of applications. The material system is commonly adopted for repairs, rehabilitation or strengthening of deficient structures before cracks reach critical stage.

In view of the growing need to obtain at any given time the effective properties of civil structures, this paper uses a vibrationally-based NDT technique to assess different damage scenarios of flexural RC beams strengthened with externally bonded fibre reinforced polymer (FRP-EBR) systems.
Modal tests were performed on flexural RC beams in four different damage scenarios: virgin or reference state (D1), fairly damaged (D2), severely damaged (D3) and severely damaged-FRP strengthened (D4). Damages on the tested beams were induced with a four point static load cycles with increasing amplitude. The tests were validated with finite element models. The numerical model uses Young's modulus updating to account for different damage scenarios verified in the modal testing. This model-based damage detection method deals with global response characteristics. Sets of data from the analysis model are compared to sets of data from the physical structures. The presence of damage is detected when the features of the model do not match the reference virgin state of the experiment.

Keywords: RC beams, Modal Parameter Identification, FRP, Cracks, Damage Assessment