Electromechanical Impedance Method applied to Debonding Identification of NSM FRP Strips in Concrete

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ABSTRACT

In the last few decades, strong research efforts have been devoted to the continuous structural condition assessment for the civil engineering infrastructure. Structural Health Monitoring (SHM) traditionally refers to the process of implementing monitoring systems to measure structural responses in real-time and to identify anomalies and/or damage at early stages.

Within the field of strengthening of reinforced concrete (RC) structures with fiber reinforced polymer (FRP) composite materials, some previous studies have been devoted to the identification of damage at their earliest stages on externally bonded (EB) FRP reinforcement. However, until now, to the knowledge of the authors, no previous SHM work was focused on the near surface mounted (NSM) technique using FRP. In the NSM-FRP methodology, the FRP reinforcement is installed into slits cut into the concrete cover using cement mortar or epoxy as bonding materials. Its use has several advantages over the EB FRP technique such as protection, improved bond, better aesthetics and surface preparation; because of it, it has become an attractive method as an effective alternative for strengthening RC structures.

Clustering is an interesting technique within the domain of unsupervised learning which can become very useful for anomaly detection. By using a clustering approach, data points that are similar tend to be grouped in different subsets in such a way that the normal condition of a structure is characterized as clusters and the damage detection strategy is based on an outlier detection approach.

In this work, some relevant cluster-based methods and their adaptation to electromechanical impedance (EMI) based damage detection in NSM FRP strengthened structures SHM are developed.