Adhesive debonding detection of FRP reinforcement by the ultrasonic non-destructive technique

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Fiber reinforced polymer (FRP) composite systems are extensively used for repairing and reinforcing structurally inefficient concrete structures. The performance of an FRP rehabilitation system is highly influenced by its integrity. In particular, the presence of defects, e.g. voids, inclusions, debonds, improper cure and delaminations, caused by an inaccurately manufacture and installation, may affect the capability of the rehabilitated structure. For this reason, non-destructive (ND) methods could be used to assess the quality of the reinforcement [1,2].

In this work an ultrasonic ND technique for detecting delamination defects in FRP reinforcement is presented. The technique couples the Akaike information criterion (AIC), used as automatic starting time signal detection [3] and the equivalent time-lenght (ETL) of the signal, used as indicator of the energy distribution of the signal with respect to the beginning of the signal [4].

When a perfect bonding between FRP and concrete substrate exists, the acoustical impedance mismatch is small, as both the FRP and the underlying material are dense solids, so the energy is almost transmitted to the concrete. On the other hand, when the adherence between FRP and concrete is compromised by the presence of a thin air gap, the acoustical impedance mismatch is bigger and a great amount of energy is reflected back. The results show that the energetic indicator ETL is particularly sensitive to the quality of the bonding of the FRP-concrete substrate.

The proposed technique has been tested in pitch-catch mode on FRP reinforcements bonded to concrete substrates, both *in vitro*, using samples with imposed well-known defects, and *in situ*, on reinforced concrete beams included in a floor slab.

References

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