Geophysical Research Abstracts
Vol. 14, EGU2012-10289, 2012
EGU General Assembly 2012

Thermographic inspection of bond defects in Fiber Reinforced Polymer applied to masonry structures

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Nowadays, externally bonded Fiber Reinforced Polymers (FRP) are extensively used for strengthening and repairing masonry and reinforced concrete existing structures; they have had a rapid spread in the area of rehabilitation for their many advantages over other conventional repair systems, such as lightweight, excellent corrosion and fatigue resistance, high strength, etc.
FRP systems applied to masonry or concrete structures are typically installed using a wet-layup technique.The method is susceptible to cause flaws or defects in the bond between the FRP system and the substrate, which may reduce the effectiveness of the reinforcing systems and the correct transfer of load from the structure to the composite. Thus it is of primary importance to detect the presence of defects and to quantify their extension in order to eventually provide correct repair measurements. The IR thermography has been cited by the several guidelines as a good mean to qualitatively evaluate the presence of installation defects and to monitor the reinforcing system with time.The method is non-destructive and does not require contact with the composite or other means except air to detect the reinforcement. Some works in the literature have been published on this topic. Most of the researches aim at using the IR thermography technique to characterize quantitatively the defects in terms of depth, extension and type in order to have an experimental database on defect typology to evaluate the long term performances of the reinforcing system. Nevertheless, most of the works in the literature concerns with FRP applied to concrete structures without considering the case of masonry structures.
In the present research artificial bond defects between FRP and the masonry substrate have been reproduced in laboratory and the IR multi temporal thermography technique has been used to detect them. Thermographic analysis has been carried out on two wall samples having limited dimensions (100 x 70 cm) both with and without plaster, reinforced with basalt and glass fiber strips for full height. Beneath FRP strips were simulated defects such as poor bonding or lack of adherence
By statistical and algebraic operations, performed on thermographic multitemporal dataset, an attempt was made both to reduce the uncertainties of a typical IR active and passive test, but also to reconstruct exact geometrical shape of the simulated defects that characterize wall samples examined. Results are encouraging but more research is needed on this topic to establish a correct protocol to monitor the FRP performance with time and to quantitatively asses the presence and type of defect in the reinforcing system.