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DEPARTMENT OF CIVIL, COMPUTER AND AERONAUTICAL ENGINEERING
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MSc Course in Civil Engineering for natural risk protection
Laurea Magistrale in ingegneria Civile per la protezione dai rischi naturali

MSc Degree Thesis
Tesi di Laurea Magistrale

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Stage: INTERNAL

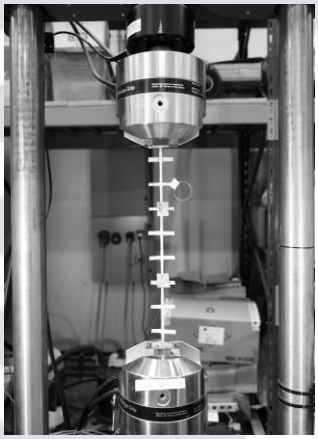
October 2023

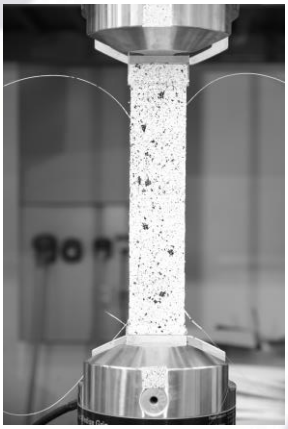
Experimental characterization of an innovative integrated system for reinforcement and monitoring of structures

Motivations and aims

Composite Reinforced Mortar (CRM) is a novel technology for the strengthening of masonry structures. They comprise high Fibre Reinforced Polymer (FRP) meshes, bonded to the outer surface of structural members by means of mortar matrices. CRM provides effective, homogeneous and widespread reinforcement, leading to remarkable upgrade of capacity, Controlling their long-term behaviour is of utmost importance to ensure safety and to enable, enabling timely, focused, and cost-efficient maintenance interventions. To this aim, smart solutions can be implemented by combining CRM and structural health monitoring sensor networks.

Methods and results





This theses aims at investigating a novel integrated technology, in which Fibre Bragg Grating (FBG) sensors are housed CRM composites. CRM-FBG prototypes underwent laboratory development experiments, including direct tensile tests, CRM-to-substrate shear bond tests and pull-out tests. Strains measured by FBG sensors were first validated against those provided by Digital Image Correlation and then analysed for the early detection of mesh sliding, mortar cracking and shear failure.
All experimental activities were carried out in the Laboratory of Structures of Roma Tre University, with the cooperation of ENEA Frascati Research Centre.

Conclusions and future developments

Comparison of the strains measured on bare GFRP specimens showed excellent compatibility between FBG and DIC. Tests on CRM coupons indicated that FBG sensors detected cracking and sliding. In bond tests, the acquired strains provided information on sliding/debonding phenomena. More tests are needed to develop an improved understanding on the reliability of the proposed CRM-FBG self-sensing composite. Despite the research is still at an early stage of development, the new system shows remarkable potential for combined strengthening and SHM purposes.