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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

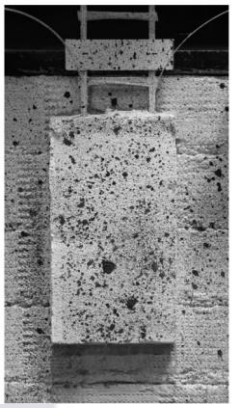
July 2025

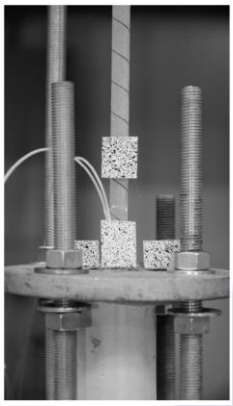
Prototype development of integrated CRM-FBG strengthening/monitoring systems

Motivations and aims

Existing structures, especially those belonging to the cultural heritage, for their intrinsic characteristics and vulnerabilities, often need continuous structural monitoring and reinforcement to preserve them over time. A promising technology is the combination of CRM reinforcement systems with Fiber Bragg Gratin sensors (FBG), in order to get an intelligent integrated system that can dynamically monitor the structural behavior and predict damage. The theses aims to develop prototype CRM-FBG for structural reinforcement and monitoring, to test them in the laboratory comparing results with other data acquisition methods such as the DIC.

Methods and results





All the experimental activities were carried out in the Laboratory of Structures of Roma Tre University, with the cooperation of ENEA Frascati Research Centre. The CRM-FBG prototypeswere subjected to direct tensile tests, CRM-to-substrate shear bond tests and pull-out tests. Strains measured by FBG sensors were validated against those provided by Digital Image Correlation (DIC). FBG sensors provided useful and reliable information for the study of structural degradation by recording consistent deformations with the stress state of the tested specimens.

Conclusions and future developments

Tests on coupons showed that FBG values correspond to the values recorded by MTS and DIC in the absence of sliding. For bond tests, FBG sensors have shown that initially the most loaded part of the mesh is the one near the end of the free part of textile and that gradually the stress involves the lower textile portions. This also applies to pull-out tests, where the local deformations of the FBG were also compared with the elastic deformations of the unbonded bar portion, obtained by DIC, showing a compatible trend. One promising development of this research could be the use of CRM systems pre-fabricated directly integrated with FBG sensors, to ensure greater reliability, ease of installation and reduction of packaging errors. Despite the research is still at an early stage of development, the new system shows remarkable potential for combined strengthening and SHM purposes.