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Prototype tests of integrated systems CRM-FBG sensors for civil structural health monitoring

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Preserving the integrity of the built heritage by detecting degradation, as well as monitoring the behavior of civil structures in response to vibrations or seismic phenomena is a challenge that is addressed by proposing different approaches and lines of research.

CRM (Composite Reinforced Mortar) with embedded FBG (Fibre Bragg Grating) sensors was tested in order to guarantee long-term effectiveness end of reinforcement as well as continuous monitoring. Indeed, to measure mechanical parameters for Structural Health Monitoring (SHM) of civil engineering structures, fiber optic sensors based on FBG technology are widely used. These FBG sensors are made in the core of the optical fiber, as a short segment of fiber in which a diffraction grating is produced and are particularly suitable for permanent monitoring applications in civil structures, being able to specifically exploit some unparalleled characteristics of FBG sensors: resistance to atmospheric agents, low invasiveness of both the sensors and the wiring.

A project involving an experimental working group between the DICITA (Department of Civil, Computer and Aeronautical Engineering) of Roma Tre University and the FOS (Fiber Optic Sensors) ENEA laboratory produced prototypes of structural reinforcement. This work presents scientific validation, through laboratory tests consisting of pull-out tests on glass fiber reinforced polymer (GFRP) connector bar samples equipped with FBG sensors housed in optical fibers incorporating FBG sensors. The results underlined the reliability of the proposed CRM-FBG integrated system for combined strengthening and structural health monitoring purposes.

Keywords: Fiber Bragg Grating sensor, Structural Health Monitoring, Optical sensory systems, Data processing methods, Digital Image Correlation.

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