DICA DIPARTIMENTO DI INGEGNERIA CIVILE E AMBIENTALE

SAFERUP! Thinking Beyond the Pavement

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UNIVERSITÀ DEGLI STUDI DI PERUGIA

PRIN SMARTBRICK

Novel strain-sensing nanocomposite clay brick enabling self-monitoring masonry structures

SMART BRICKS FOR EARTHQUAKE-INDUCED DAMAGE DETECTION AND LOCALIZATION IN MASONRY STRUCTURES

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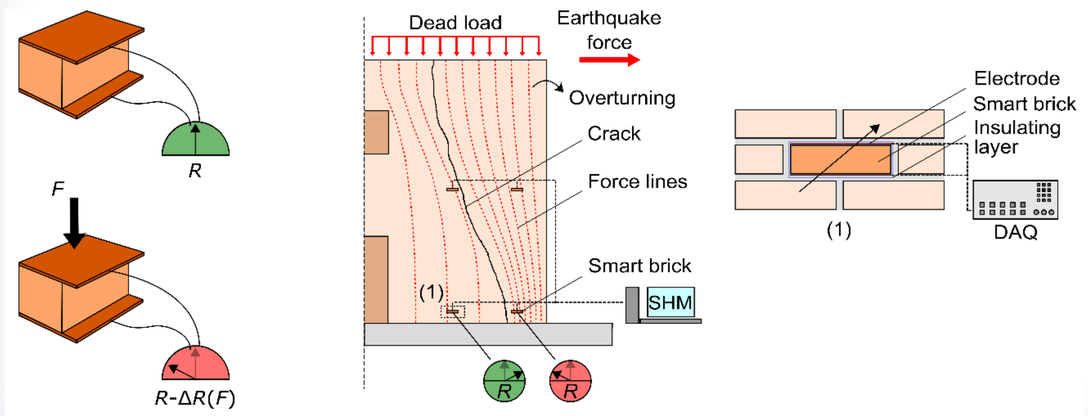
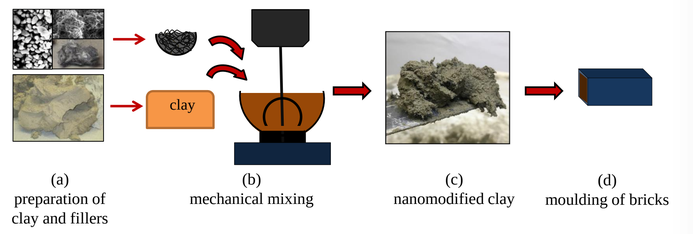
Abstract

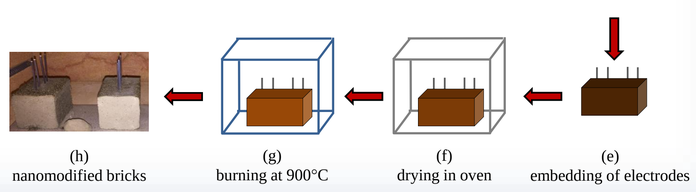
Structural health monitoring can be a powerful tool enabling detection of anomalies in the in-service conditions of a structure, as well as quick post-earthquake structural assessment. Its applications to masonry structures are still scarce as a consequence of the severe limitations affecting off-the-shelf sensing technologies, in terms of local nature of the measurements, costs, as well as long-term behavior, installation and maintenance. To overcome some of these limitations, the authors have recently proposed a new sensing technology, called "smart brick", that is a clay brick doped with conductive nano- or micro-fillers, working as a smart strain sensor for masonry buildings. The research work concerned investigations at various levels: from the implementation and the analysis of the materials, to the electrical and mechanical tests of samples and full-scale structural elements. Recent researches consisted in a full-scale application, for detecting and localizing progressive earthquake-induced damage in an unreinforced masonry building subjected to shaking table tests. Experimental results were validated using a 3D Finite Element model. Overall, the results demonstrate that the smart bricks can effectively reveal local permanent changes in structural conditions following a progressive damage, therefore being apt for earthquake-induced damage detection and localization.

Concept



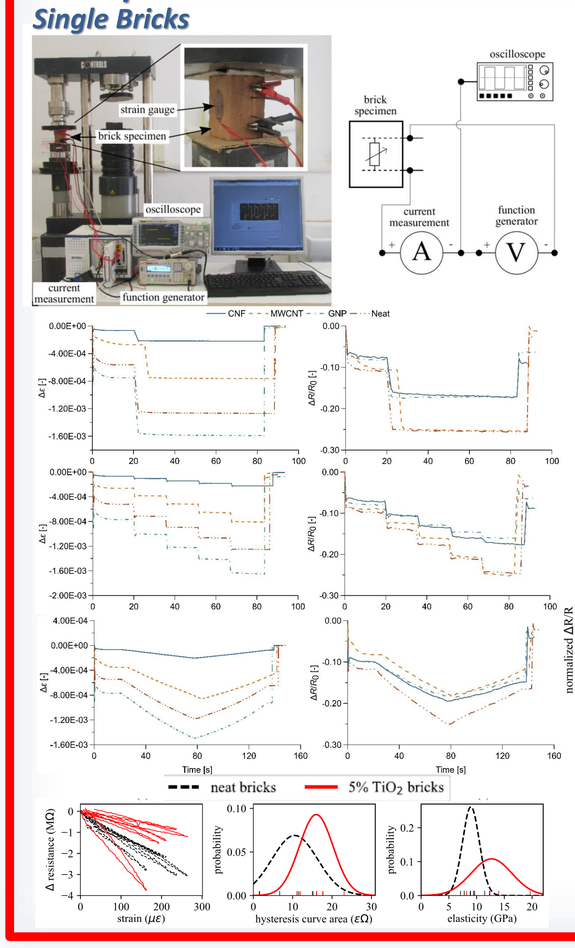
Preparation of SMART BRICKS



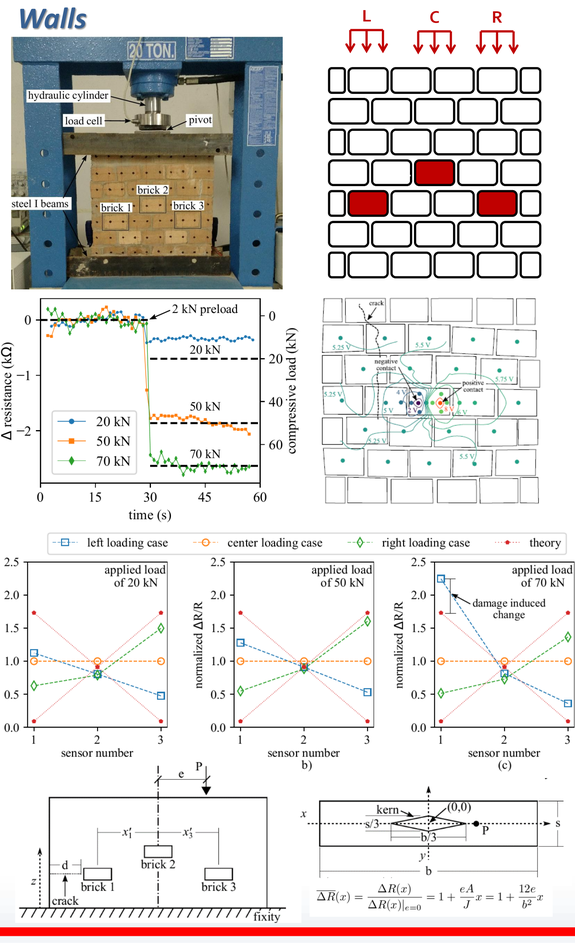


Experimental Results

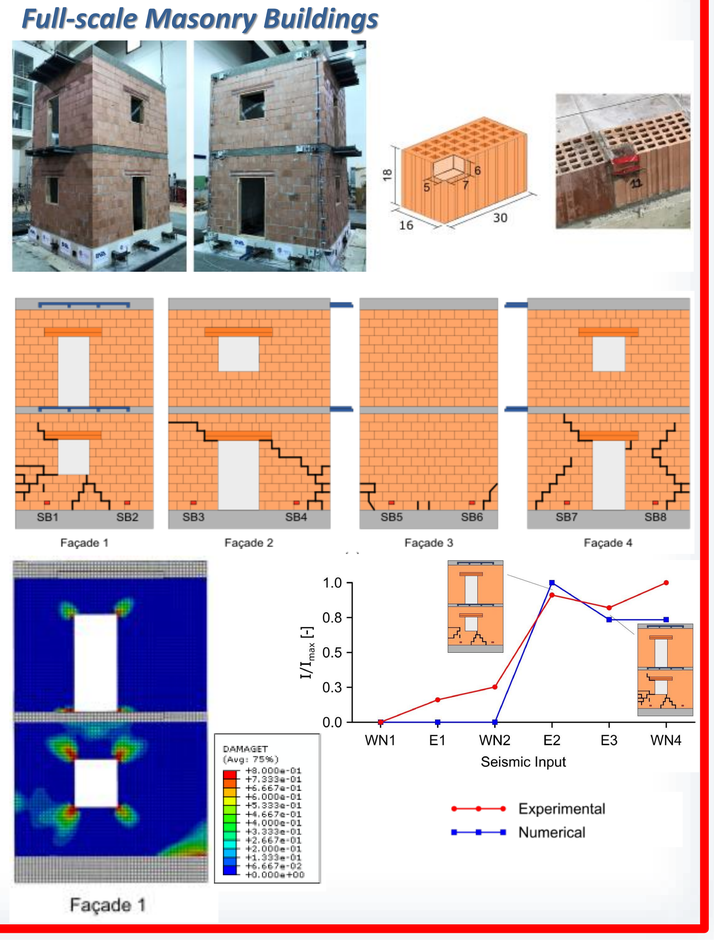
Single Bricks



Walls



Full-scale Masonry Buildings



Partners

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