CHARACTERIZATION AND MODELLING OF FRP-REINFORCED MASONRY TRIPLETS

R. Fedele[1], N. Cefis[1], C. Tedeschi [1], G. Fava[2], M. Cucchi[3]

[1]*Department of Civil and Environmental Engineering (DICA), Politecnico di Milano, Milan, Italy, Email: roberto.fedele@polimi.it ; nicola.cefis@polimi.it ; cristina.tedeschi@polimi.it*

[2]*Department of Architecture, Built Environment and Construction Engineering (ABC), Politecnico di Milano, Milan, Italy. Email: giulia.fava@polimi.it*

[3]*Laboratorio Prove Materiali (LPM), Politecnico di Milano. Email: marco.cucchi@polimi.it;*

This study concerns the experimental characterization and the mechanical modelling of masonry triplets reinforced by means of Fiber-Reinforced Polymer (FRP) strips. A wide experimental campaign was carried out on masonry triplets subjected to shear tests: both unreinforced and reinforced specimens were considered, the latter with faces partially or totally covered by a transversal FRP strip. Moreover, the bulk response of the mortar phase was assessed through three point bending experiments, under monotonic and cyclic loading conditions.

During the tests, conventional data from the point sensors (load cell, clip gauge) and full field kinematic measurements were provided [1]. Sequences of digital pictures, acquired at suitable instants during the experiments, were processed through a Digital Image Correlation procedure (2D DIC), apt to detect the in plane displacements of flat surfaces. Recourse was made to a multiscale DIC code, based on a Galerkin discretization of the displacement field [2].

To better interpret the experimental observations and correlate them to processes at the microscale, heterogeneous finite element models were developed in an Abaqus environment, enriched with user subroutines (Vumat) for the constitutive behavior [3]. As an alternative to the assumption of perfect adhesion [4], the multiple interfaces active within the triplets (between brick and mortar, and between the FRP strip and the support) were modelled as zero-thickness joints.

References

[1] Fedele, R., Scaioni, M., Barazzetti, L., Rosati, G., Biolzi, L.: "Delamination tests on CFRP-reinforced masonry pillars: optical monitoring and mechanical modelling. *Cem. Concr. Comp*, 45, 243–254, 2014.

[2] Fedele, R.: "Simultaneous Assessment of mechanical properties and boundary conditions based on Digital Image Correlation", *Exp. Mech.*, Special Issue, 55(1), January 2015

[3] Lee J., Fenves G.L.: "Plastic-Damage Model for Cyclic Loading of Concrete Structures. *Engn. Mech.*, (1998) 124(8), 892– 900.

[4] Fedele, R, Milani, G.: "A numerical insight into the response of masonry reinforced by FRP strips. The case of perfect adhesion". *Comp. Struct.*, (2010), 92(10), 2345–2357.