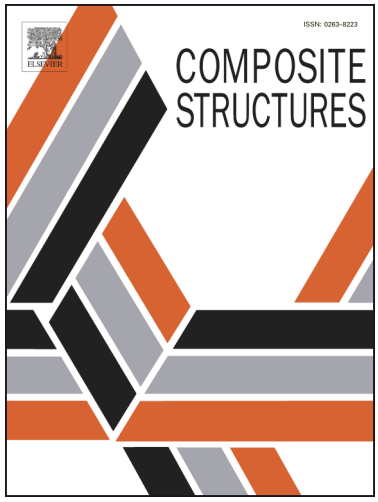

Coupled interface-based modelling approach for the numerical analysis of curved masonry specimens strengthened by CFRP

Ernesto Grande, Mario Fagone, Tommaso Rotunno, Elisa Bertolesi, Gabriele Milani

PII: S0263-8223(18)31285-6
DOI: https://doi.org/10.1016/j.compstruct.2018.05.118
Reference: COST 9757

To appear in: *Composite Structures*

Received Date: 7 April 2018
Revised Date: 19 May 2018
Accepted Date: 28 May 2018

Please cite this article as: Grande, E., Fagone, M., Rotunno, T., Bertolesi, E., Milani, G., Coupled interface-based modelling approach for the numerical analysis of curved masonry specimens strengthened by CFRP, *Composite Structures* (2018), doi: https://doi.org/10.1016/j.compstruct.2018.05.118

Coupled interface-based modelling approach for the numerical analysis of curved masonry specimens strengthened by CFRP

Ernesto GRANDE[(1)], Mario FAGONE[(2)], Tommaso ROTUNNO[(3)], Elisa BERTOLESI [(4)], Gabriele MILANI [*(5)]

(1) Department of Sustainability Engineering, University Guglielmo Marconi, Via Plinio 44, 00193 Rome (Italy)

(2) Dipartimento di Ingegneria Civile e Ambientale (DICA), Università degli Studi di Firenze, Piazza Brunelleschi 6, 50121 Florence (Italy)

(3) Dipartimento di Architettura (DiDA), Università degli Studi di Firenze, Piazza Brunelleschi 6, 50121 Florence (Italy)

(4) ICITECH, Universitat Politècnica de Valencia, Camino de Vera s/n 46022, Valencia (Spain)

(5) Department of Architecture, Built environment and Construction engineering (ABC), Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133, Milan (Italy)

* corresponding author, e-mail: gabriele.milani@polimi.it

Abstract

Aim of the present paper is to numerically study the bond behavior of curved masonry specimens externally strengthened by Carbon Fiber Reinforced Polymer systems (CFRP). A simple 1D-modeling approach is presented to this aim, where the coupled behavior between shear and normal stresses developing at the reinforcement/masonry interface level is specifically introduced to properly account for the role played by the curvature radius. The model is indeed enriched by the introduction of shear stress-slip laws able to account for the beneficial friction effect, when compression normal stresses develop at the interface level and the reduction of the slip strength corresponding to the de-cohesion in presence of normal stresses in tension. Considering some case studies derived from the current literature, consisting of shear-lap bond tests of curved masonry specimens characterized by different curvatures of the bonded surface and different strengthening configurations, the validation of the proposed approach is carried out. In particular, two modeling strategies are considered and critically compared: the first one, denoted as approach (A), where the presence of the mortar joints is neglected, and the second one, denoted as approach (B), where mortar joints are specifically introduced in the model. Finally, the results obtained by using the proposed simple approach are compared with those obtained from both sophisticated FE numerical models and theoretical formulas deduced form the current literature.

Keywords: FRP; masonry curved structures; FE modeling; delamination; 1D coupled interface model.

1 Introduction

A large amount of the recent literature points out the centrality of the bond mechanism for studying the performance of fiber reinforced polymer systems (FRPs) for the strengthening and the rehabilitation of structures. Indeed, experimental tests mainly concerning shear lap bond tests were carried out in order to investigate the role of different factors such as the type of the strengthening system, the characteristics of the masonry material composing the substrate, the modalities of application of the strengthening system and, in case of masonry unit-mortar assemblages, the characteristics of mortar joints, on the bond mechanism of