



HAL
open science

Experimental and numerical study on masonry triplet test. Preliminary results

S Lentile, Pierre Argoul, Ioannis Stefanou, Franziska Schmidt

► To cite this version:

S Lentile, Pierre Argoul, Ioannis Stefanou, Franziska Schmidt. Experimental and numerical study on masonry triplet test. Preliminary results. Journées nationales de la Maçonnerie - JNM, Mar 2016, CHAMPS-SUR-MARNE, France. Journées nationales de la Maçonnerie - JNM, 1 p., 2016. hal-01512969v2

HAL Id: hal-01512969

<https://hal.science/hal-01512969v2>

Submitted on 22 Jun 2017 (v2), last revised 4 Oct 2021 (v3)

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Experimental and numerical study on masonry triplet test. Preliminary results.

Ientile, S.¹, Argoul, P.², Stefanou, I.³, Schmidt ², F.,

¹IUAV University of Venice, ²SDOA Laboratory, IFSTAR, ³UR Navier, Ecole des Ponts ParisTech (ENPC)

INTRODUCTION & OBJECTIVES

The knowledge of the geometrical and construction characteristics and those related to the strength of materials, is useful to determine the dynamic behaviour of existing buildings, characterized by a wide range of uncertainties related to geometrical irregularities, imperfections, past damages and also by the state of material conservation. The purpose of this study is a primary estimation of the most influential parameters on a brickwork prism subjected to the uniaxial compression test through a method of experimental design carried out on a numerical model.

EXPERIMENTAL DESIGN-FACTORIAL EXPERIMENTS

A designed experiment is a test or series of tests in which purposeful changes are made to the input variables of a process so that we may observe and identify corresponding changes in the output response. In a factorial experiment several factors are controlled at two or more levels, and their effects upon some response are investigated. A factorial experiment with k factors (each factor at two levels) is known as 2^k factorial experiment or design.

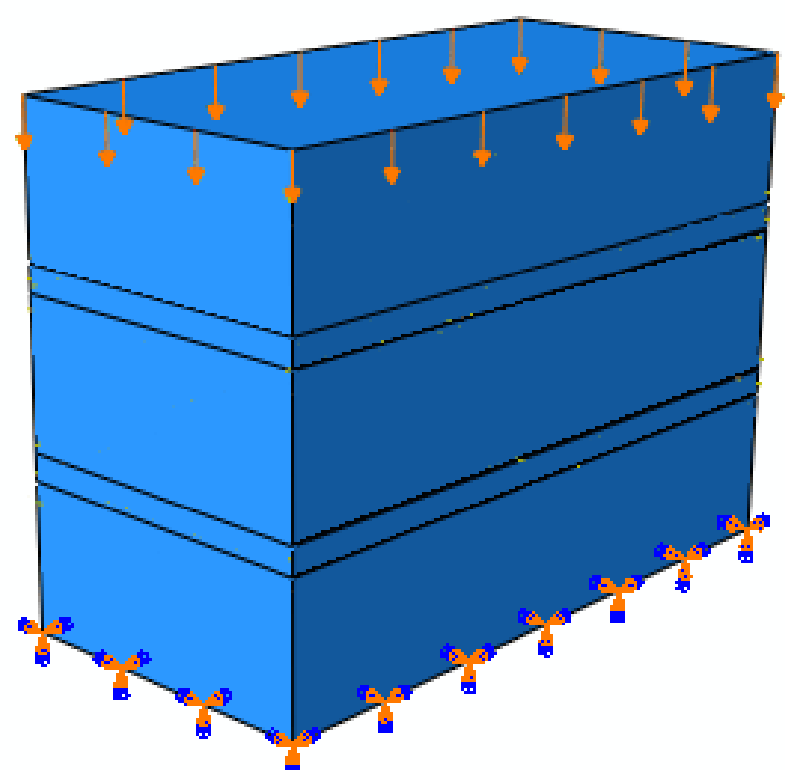
2^k Factorial Design

K factors change simultaneously in an organized pattern of trials

- Estimation of the individual effect
- Estimation of the interactions of K factors in an experimental program

UNIAXIAL COMPRESSION TEST ON MASONRY TRIPLET

The uniaxial compression test can be used to obtain an initial value for the masonry strength. A FE model was built to simulate the test according to ASTM C1314-14 on a masonry triplet. The linear elastic model is defined by elastic properties input with literature values.



Brick Material	Mortar Material
$E_b = 1100 \text{ MPa}$	$E_m = 2200 \text{ MPa}$
$\nu_b = 0.2$	$\nu_m = 0.25$

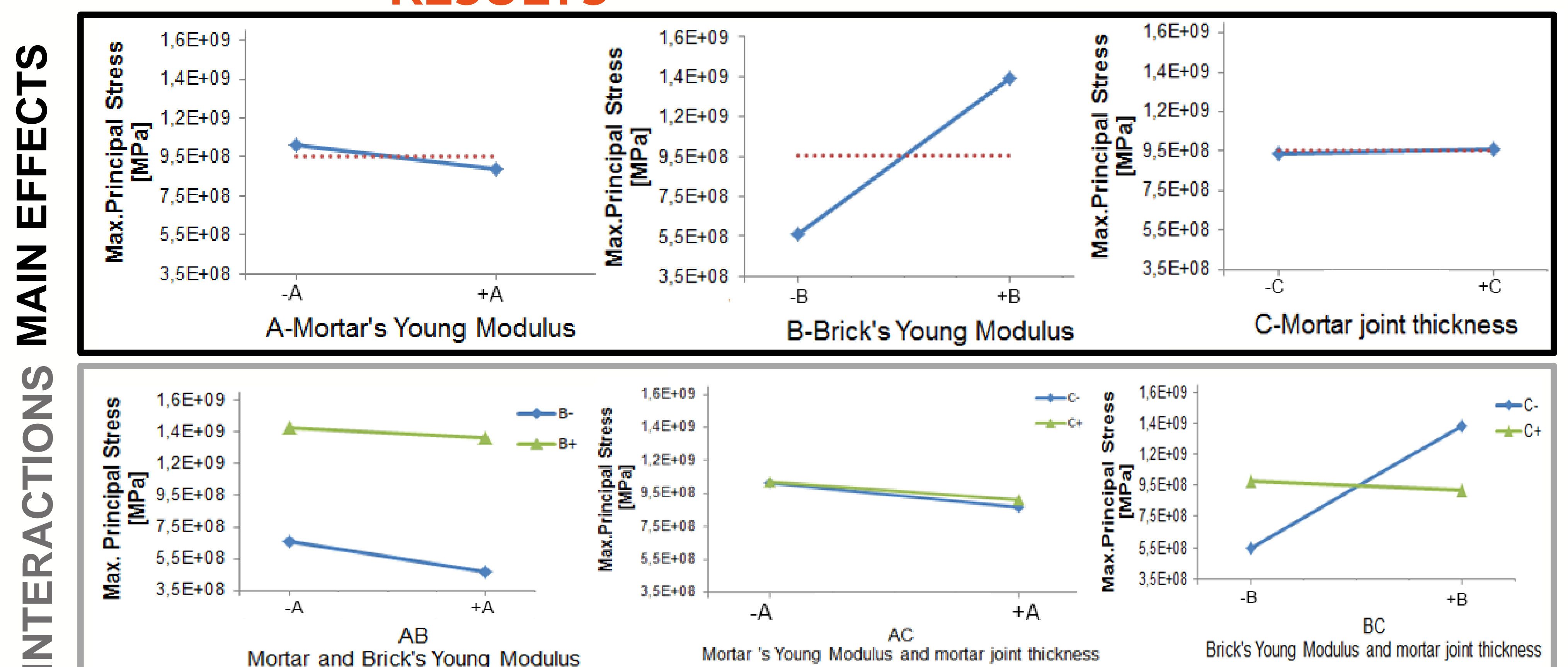
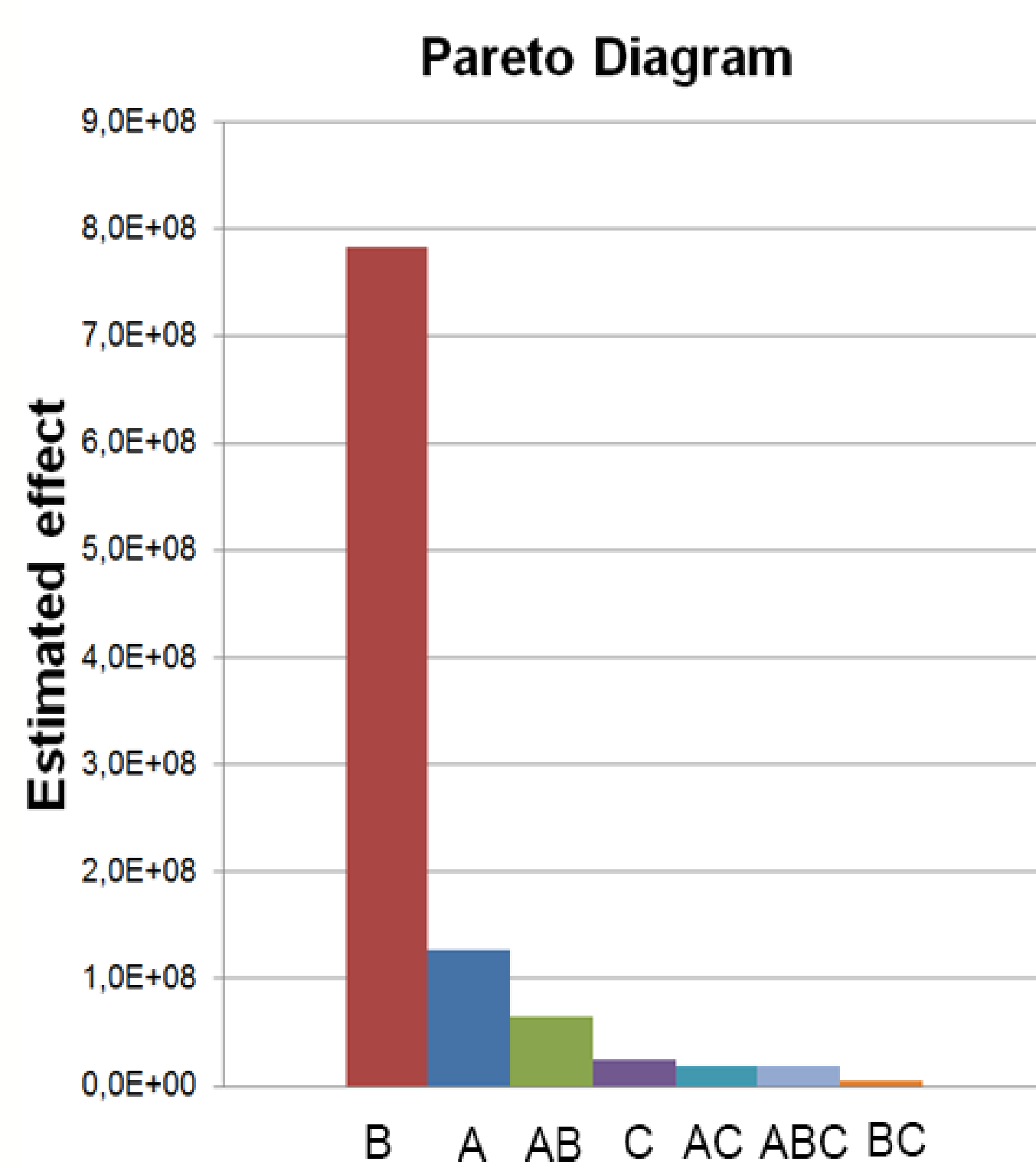
2^k FACTORIAL DESIGN ON MASONRY TRIPLET TEST

The estimation of effect is carried out through Yates' Algorithm. The criteria is the maximum principal stress in the triplet.

N° of trials	A	B	C
1	-	-	-
2	+	-	-
3	-	+	-
4	+	+	-
5	-	-	+
6	+	-	+
7	-	+	+
8	+	+	+

A	E_m	1100 MPa
		2200 MPa
B	E_b	5500 MPa
		11000 MPa
C	t_{joint}	0.005 m
		0.01 m

RESULTS



CONCLUSIONS

- Maximum principal stress highly influenced by Brick's Young Modulus parameter
- Weak influence of mortar joint thickness as main effect, more influent as interaction
- Elastic behaviour of masonry triplet under compression load mainly influenced by brick's properties and its interaction with joint thickness.

REFERENCES

Juran J.M., Godfrey A.B., Juran's Quality Handbook, McGraw-Hill 1999
Montgomery D.C., Statistical Quality Control, Jhon Wiley & Sons, 2012

ACKNOWLEDGEMENTS

This Work was carried out during the research period abroad at the IFSTAR as part of PhD Thesis project regarding the sensitivity of masonry dynamic parameters.