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► 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 2016), Mar 2016, Marne-la-Vallée, France. . hal-01512969v1

HAL Id: hal-01512969

<https://hal.science/hal-01512969v1>

Submitted on 24 Apr 2017 (v1), last revised 4 Oct 2021 (v3)

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

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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.

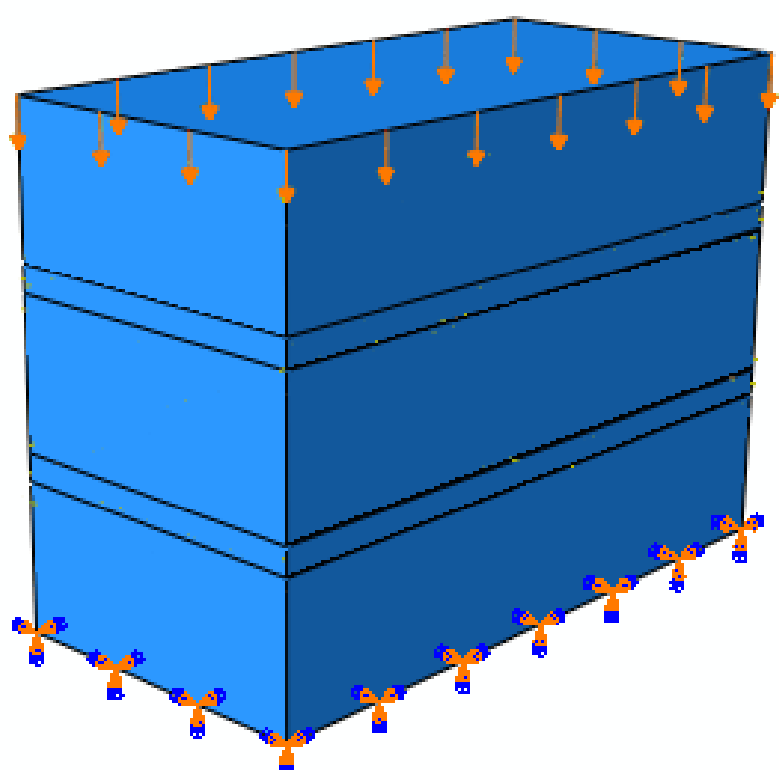
2^k Factorial Design

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

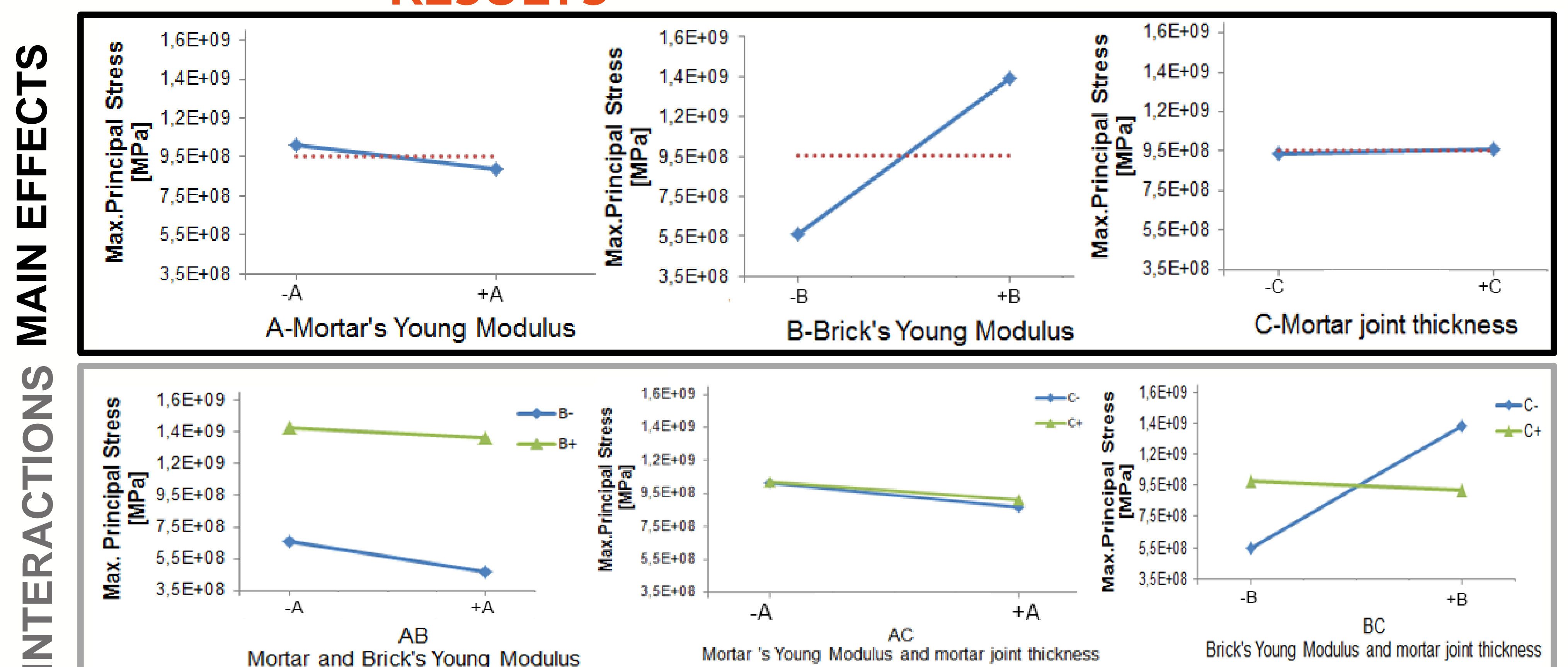
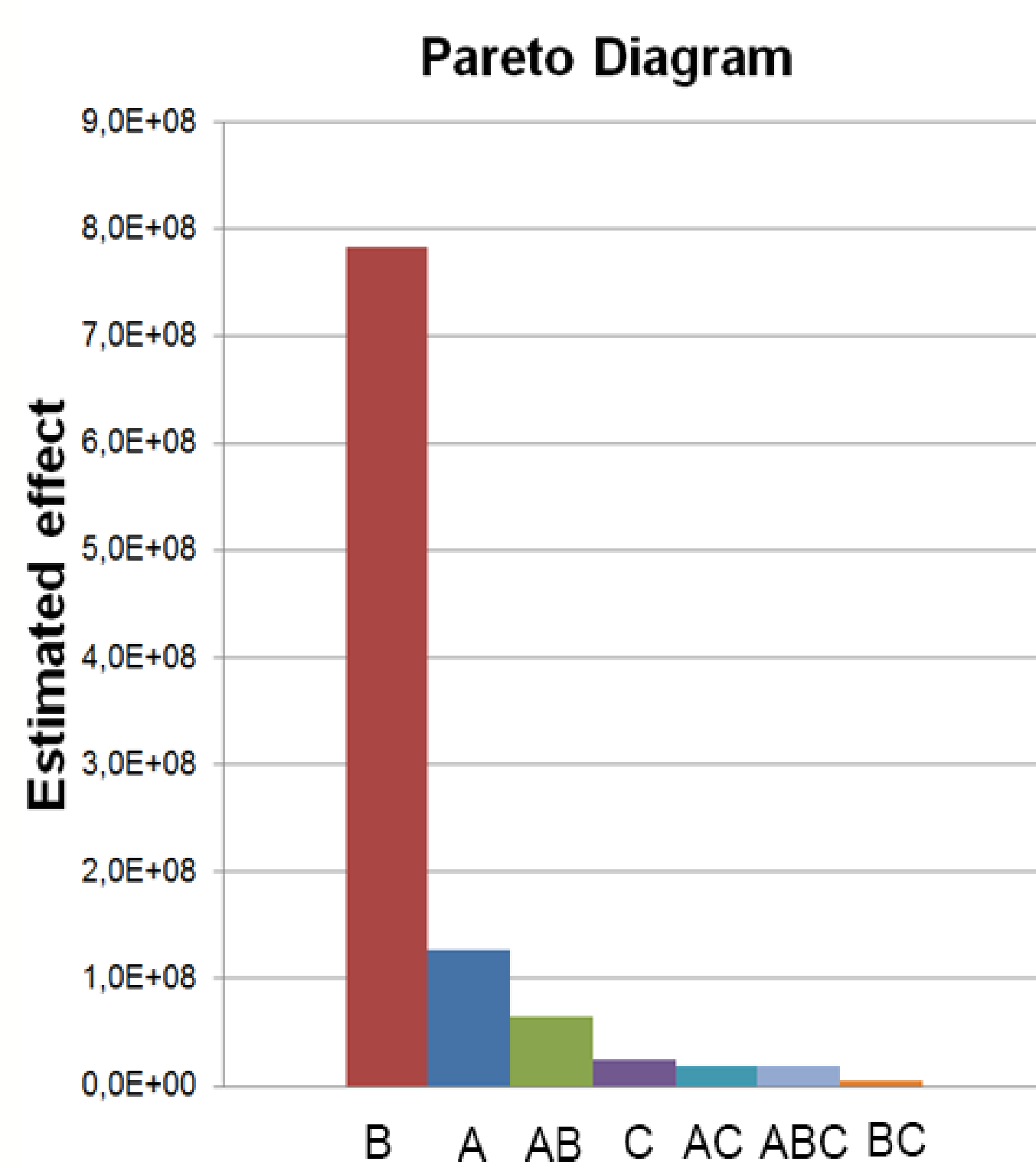
2^k FACTORIAL DESIGN ON MASONRY TRIPLET TEST

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.

