

PHOTOMECHANICS **2008**

7-9 July 2008
Loughborough, UK

International conference on full-field
measurement techniques and their
applications in experimental
solid mechanics



Book of Abstracts
Edited by Jonathan Huntley and Michel Grédiac

 Loughborough
University

PHOTOMECHANICS 2008

FULL PROGRAMME

SUNDAY 6TH JULY 2008

20:00 – 22:00 Registration

MONDAY 7TH JULY 2008

08:00 Registration and refreshments

08:45 Welcome address
James France Building, Loughborough University

KEYNOTE LECTURE 1

James France Lecture Theatre 1

Chair: J. M. Huntley, Loughborough University, UK

09:00 ***Dynamic photoelastic studies of crack propagation in novel materials***
A. Shukla, University of Rhode Island, USA

Session 1 – FRACTURE MECHANICS

James France Lecture Theatre 1

Chair: F. Pierron, ENSAM Châlons-en-Champagne, France

09:45 ***Visualization and analysis of interactions between a dynamically growing crack and a stiff inclusion using coherent gradient sensing***
H. Tippur and R. Kitey (USA)

10:05 ***Characterization of cracks during dynamic fatigue tests using the grid method***
S. Vanlanduit, B. Belkassam, P. Guillaume and B. Ribbens (Belgium)

10:25 ***Analysis of elastic-plastic stress field near the crack-tip by digital image correlation and nonlinear intelligent hybrid method***
K. Machida and G. Tanaka (Japan)

10:45 Refreshments – **SPONSORED BY CEDIP FLIR**



Session 2 – 3D MEASUREMENTS

James France Lecture Theatre 1

Chair: M. Sjödaahl, Lulea University of Technology, Sweden

11:10 ***3D measurement of discontinuous displacement fields by extended volume correlation using X-ray microtomography***
J. Réthoré, J. P. Tinnes, J.-Y. Buffière, S. Roux and F. Hild (France)

11:30 ***Characterisation of localised deformation in granular geomaterials using X-ray (micro)tomography and 3D-volumetric digital image correlation***
S. A. Hall, N. Lenoir, Y. Pannier, J. Desrues, M. Bornert, G. Viggiani, P. Bésuelle, M. di Michiel (France) and J. Otani (Japan)

11:50 ***Deformation in wood exposed to three point bend: analysis by use of digital volume correlation applied to synchrotron radiation μ CT data***
F. Forsberg (Sweden), R. Mooser, E. Hack and P. Wyss (Switzerland)

12:10 ***Full 3D strain measurement by digital volume correlation and X-ray micro-computed tomography: accuracy and volume image defects***
A. Germaneau, P. Doumalin and J. C. Dupré (France)

12:30 Lunch

POSTER SESSION AND EXHIBITION

Posters

1- Interference measurement of rough surface relief

O. V. Angelsky, A. P. Maksimyak and P. P. Maksimyak (Ukraine)

2- Object surface 3D dynamic measurement system based on Fourier interferometry

L. Li and M. Wang (China)

3- Who discovered the photoelastic effect?

H. Aben (Estonia)

4- A study on the development of photoelastic experimental hybrid method for small fringe orders

J.-H. Nam, J.-S. Hawong and G. Kwon (Korea)

5- A simple technique for correcting image distortion in fringe projection methods

P. J. S. Tavares and M. A. P. Vaz (Portugal)

6- Optimization of derivation regarding resolution and spatial resolution on strains

J. Molimard and R. Bergé (France)

7- Combined measurement uncertainty in phase-stepping methods

E. Hack (Switzerland)

8- Spatial phase wrapping of noisy wrapped map

M. J. Huang and Y. L. Chen (Taiwan)

9- An optimized filtering technique for wrapped phase data

G. Petrucci (Italy)

10- Strain measurement of flax fibre during tensile test by regressive spectral phase algorithm

C. Pollâne (France)

11- Sub-pixel level displacement field estimation using optical flow

A. Sousa, V. Filipe, J. Morais and M. Vaz (Portugal)

12- A space-time correlation algorithm for digital high-speed camera images

J. Réthoré, D. Grégoire, H. Maigre and A. Combescure (France)

13- Measurement of volume variation in elastomers by image correlation

J.-B. Le Cam and E. Toussaint (France)

14- Thermoelastic analysis of polymers in monotonic tensile tests

D. Tscharnuter, M. Jerabek and Z. Major (Austria)

15- Low density polyurethane foam properties characterisation by the virtual fields method and digital image correlation

B. Guo and F. Pierron (France)

16- Extension of the virtual fields method to combined isotropic and kinematic hardening laws

V. The Tran, S. Avril and F. Pierron (France)

17- An inverse method for material parameters determination of titanium samples under tensile loading

T. Pottier, F. Toussaint and P. Vacher (France)

18- Stress distribution measurement inside ball screw system using photoelasticity technique

R. Bertolaso, F. Ronde-Oustau, M. Cheikh and F. Schmidt (France)

19- Experimental study of stress repartition in aeronautical spherical plain bearing by 3d photoelasticity: validation of a numerical model

A. Germaneau, F. Peyruseigt, S. Mistou, P. Doumalin and J.C. Dupré (France)

20- The experimental analysis of stress for cylinder wall of small output 2 cycle engine using photoelastic method

S. Sasaki, T. Ezumi and K. Satoh (Japan)

21- Optical measurement of local strains development in finger-jointed wood subjected to static and sustained loads

L. Muszyński (USA), B. Clouet and R. Pommier (France)

22- Coupling advanced imaging analysis and morphology based modelling for integrated characterization of micro-mechanics of wood and wood-based composites

L. Muszyński and J.A.Nairn (USA)

23- 3D reconstruction of dental elements by optical technique

C. Casavola (Italy), M. Kujawska (Poland), L. Lamberti, G. Pappalettera and C. Pappalettera (Italy)

24- Strain fields adjacent to bone-implant interfaces: strain field analysis using digital image correlation techniques

J. Ribeiro, J. Monteiro, H. R. Lopes, M. Vaz and R. M. Guedes (Portugal)

25- Image correlation applied to wood painting

H. Maigre and F. Morestin (France)

26- Developments in the non-destructive evaluation of power plant main steam pipe: investigation and integration of DIC with ARCMAC

C. Maharaj, A. Morris, A. Puri, M. Kourmpetis, I. Palmer and J. Dear (United Kingdom)

27- TITL measurement result correction of out-of-plane deformation of a pipe under loaded by internal pressure E

K. Kim, H. Jung, S. Jung, H. Kim, S. Na and H. Chang (Korea)

28- Measuring of non-uniform residual stresses in depth with optical techniques

J. Ribeiro, J. Monteiro, M. Vaz and H. Lopes (Portugal)

29- Analysis of temperature measurement at lead/LiF interface under shock wave compression

C. Chauvin, P. L. Hereil and F. Sinatti (France)

Exhibitors

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STRAIN FIELDS ADJACENT TO BONE-IMPLANT INTERFACES: STRAIN FIELD ANALYSIS USING DIGITAL IMAGE CORRELATION TECHNIQUES

Ribeiro², J., Monteiro¹, J., Lopes¹, H., Guedes³, R., Vaz³, M.

¹INEGI – Instituto de Engenharia Mecânica e Gestão Industrial; ²ESTIG – Instituto Politécnico de Bragança; ³DEMEGI – Faculdade de Engenharia da Universidade do Porto

INTRODUCTION

The measurement of deformations within cancellous bone is frequently hampered by the material's highly porous structure and poor mechanical properties. Although detailed displacement maps derived from actual experimental data have the potential to resolve many questions concerning the mechanics of cancellous bone, the traditional method of producing maps through measurements with optical techniques has been applied infrequently in its study of this material. This is particularly important when the interface bone/implant is studied.

Digital Image Correlation (DIC) is a simple non-invasive and non-destructive technique that can be easily automated to provide full-field displacements and strains with a wide range of measurement sensitivity and resolution. Fundamentally, this technique compares pixels from different images and tries to match them.

RESULTS

The interface cancellous bone/prostheses was simulated using a fresh cow bone mounted in a polyester resin. The bone was machined to generate two plane inclined surfaces where a metallic part was placed. Load was applied to the metallic part and the displacements were assessed in both interfaces vicinities. To measure the 2D in-plane displacement field was used the ARAMIS® DIC (from UTAD) system and the experimental set-up represented in Fig.1.

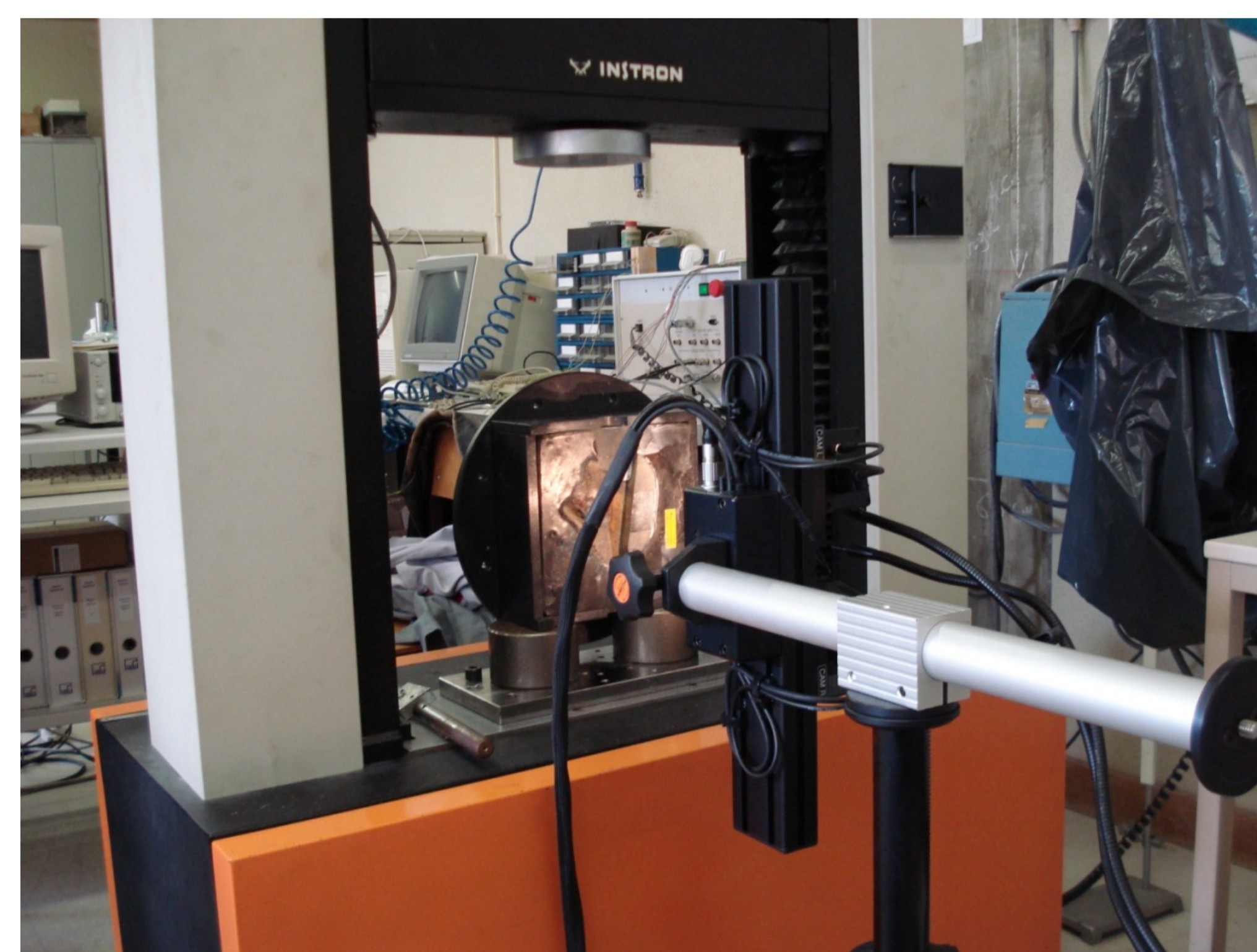
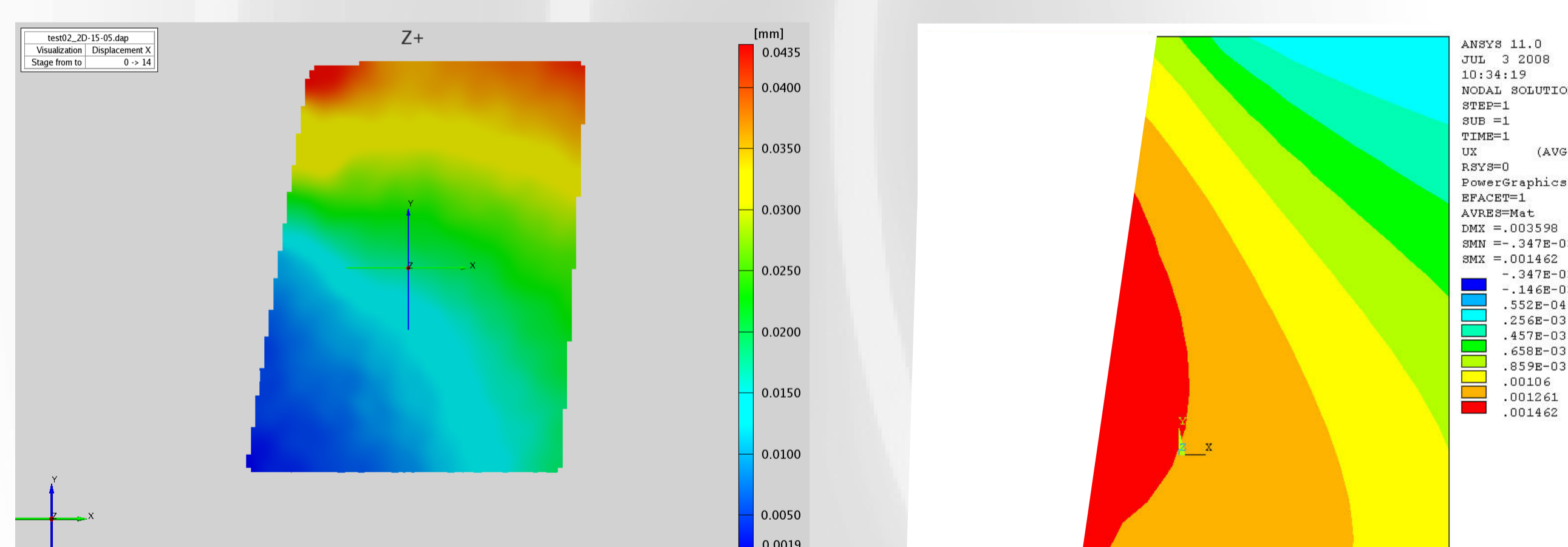


Figure 1. Experimental set-up to measure the displacements in the bone-implant interface with DIC.

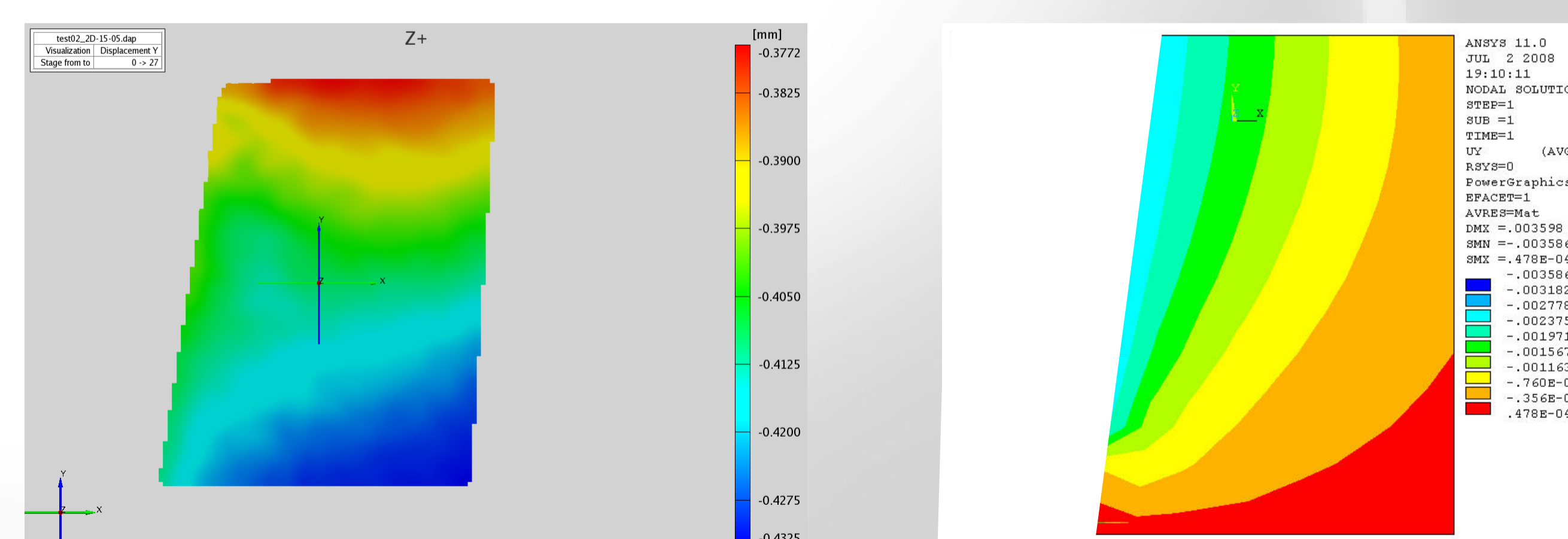
A load of 1000 N was applied to the bone implant with an Universal Testing Machine (Instron) and the measurement results with DIC for the displacement field in two orthogonal directions. A numerical model was implemented with a finite elements programme (ANSYS®) to simulate de experimental results.



(a)

(b)

Figure 2 . Displacement field in x direction;: (a) DIC and (b) numerical simulation.



(a)

(b)

Figure 3 . Displacement field in y direction;: (a) DIC and (b) numerical simulation.

CONCLUSIONS

DIC proved to be able to deal with images resulting from the bone texture. However, a gentle white paint with speckle generated by controlled spray with black ink led to better results. This technique could be very useful to study the behaviour of complex materials like the biological tissues, the same study on soft tissues is just starting.

REFERENCES

- Simões, J.A.O., Vaz, M.A., Chousal, J.A.G., Taylor, M. and Blatcher, S. (1997). Speckle interferometry to measure the strain distribution within porous materials. International Conference on Advanced Technology in Experimental Mechanics ('ATEM ' 97', Wakayama), Wakayama, 25-26 of July of 1997, Japan.
- Simões, J.A.O., Monteiro, J., Vaz, M.A., Taylor, M. and Blatcher, S. (1998). Study with speckle interferometry of bone-implant interface conditions. *11th Int. Conference on Experimental Mechanics (ICEM 98) – Advances in Design, Testing and Analysis*, 24-28 August 1998, Oxford, UK.