

IRF'2013

Funchal/Portugal
2013



4th International Conference on
INTEGRITY, RELIABILITY & FAILURE
(Funchal, 23-27 June 2013)

IRF2013

PROGRAM



University of Porto
University of Toronto
University of Madeira

Institutional Sponsors

FEUP
*University of Porto
Portugal*

MADL
*University of Toronto
Canada*

CCEE
*University of Madeira
Portugal*

Co-Chairs

J.F. Silva Gomes (*U. Porto*)
Shaker A. Meguid (*U. Toronto*)

Organizing Committee

Carlos C. António, Clito F. Afonso, José M. Cirne
Lino Maia, Mário A.P. Vaz, Paulo G. Piloto, Pedro M.G.P. Moreira

International Scientific Committee

Aben, H. (Estonia)	Dourado, N. (Portugal)	Masato, Y. (Japan)	Sainov, V. (Bulgaria)
Abreu, M.J. (Portugal)	Eberhardsteiner, J. (Austria)	Meda, A. (Italy)	Santos, J.M. (Portugal)
Adali, S. (S. Africa)	Esteves, J.L. (Portugal)	Meguid, S.A. (Canada)	Santos, Telmo (Portugal)
Afonso, C.F. (Portugal)	Fangueiro, R. (Portugal)	Melo, F.Q. (Portugal)	Semenski, D. (Croatia)
Alexopoulos, N. (Greece)	Fernandes, A.A. (Portugal)	Mileiko, S.T. (Russia)	Silva, A.J. (Portugal)
Alves, A. (Portugal)	Ferreira, D. (Portugal)	Miller, R.E. (Canada)	Silva, Lucas (Portugal)
António, C.C. (Portugal)	Ferreira, J.G. (Portugal)	Mines, R. (UK)	Silva Gomes, J.F. (Portugal)
Banks-Sills, L. (Israel)	Fiúza, A. (Portugal)	Miranda, R. (Portugal)	Sjödahl, M. (Sweden)
Baptista, J.S. (Portugal)	Fonseca E. (Portugal)	Moreira, F. (Portugal)	Soares, C.M. (Portugal)
Barros, R.C. (Portugal)	Gdoutos, E. (Greece)	Moreira, P. (Portugal)	Sousa, L.C. (Portugal)
Bathe, K.J. (USA)	Geraldes, M. (Portugal)	Morimoto, Y. (Japan)	Sousa, R. (Portugal)
Botsis, J. (Switzerland)	Guedes, R.M. (Portugal)	Moura, M.F. (Portugal)	Suleman, Afzal (Portugal)
Bremand, F. (France)	Hejum, Du (Singapore)	Muc, Aleksander (Poland)	Takagi, T. (Japan)
Caetano, E. (Portugal)	Igartua, A. (Spain)	Navarro, C. (Spain)	Talaia, M. (Portugal)
Camanho, P. (Portugal)	Ignaszak, Z. (Poland)	Navas, H. (Portugal)	Tamalsky, E. (Brazil)
Campos, J.R. (Portugal)	Iliescu, N. (Romania)	Pappalettere, C. (Italy)	Tamuzs, V. (Latvia)
Castro, C.F. (Portugal)	Jones, N. (UK)	Pieczyska, E. (Poland)	Tavares, J.M. (Portugal)
Castro, P.T. (Portugal)	Jorge, R.N. (Portugal)	Piloto, P. (Portugal)	Tavares, P. (Portugal)
Catarino, A. (Portugal)	Kahlen, F.-J. (S. Africa)	Pindera, M.J. (USA)	Thomsen, O.T. (Denmark)
Cavalcante, M. (Brazil)	Klein, W. (Germany)	Prime, M. (USA)	Tooren, M.J. (Netherlands)
Chen, T. (Taiwan)	Kourkoulis, S. (Greece)	Quelhas, O. (Brazil)	Truman, C.E. (UK)
Chenot, J.-L. (France)	Laermann, K. (Germany)	Ramesh, K. (India)	VanHemelrijck, D. (Belgium)
Cirne, J. (Portugal)	Langseth, M. (Norway)	Reddy, J.N. (USA)	Varum, H. (Portugal)
Correia, A. (Portugal)	Lima, G. (Brazil)	Restivo, M.T. (Portugal)	Vasques, C. (Portugal)
Croccolo, D. (Italy)	Lino, J. (Portugal)	Ribeiro, J.E. (Portugal)	Vaz, Mário P. (Portugal)
Cunha, A. (Portugal)	Lopes, H. (Portugal)	Robinson, J. (Ireland)	Vilas-Boas, J. (Portugal)
Datta, S. (USA)	Lu, Jian (Hong Kong)	Rocha, A.B. (Portugal)	Wang, Wei-Chung (Taiwan)
Degrieck, J. (Belgium)	Madureira, L. (Portugal)	Rodrigues, H. (Portugal)	Weng, G. (USA)
Dias, G. (Portugal)	Maia, Lino (Portugal)	Rodrigues, J.D. (Portugal)	Yoneyama, Satoru (Japan)
Dietrich, L. (Poland)	Mal, A. (USA)	Ruiz, G. (Spain)	Yoon, Y.C. (Singapore)
Diogo, M.T. (Portugal)	Marques, A.T. (Portugal)	Ruzicka, M. (Czech R.)	Zhang, Z. (China)

Conference Secretariat

Nuno Pinto, Lurdes Catalino, Carla Gonçalves
M.F. Silva Gomes,

with the support of

ABREU-PCO, Professional Congress Organizer (<http://pco.abreu.pt>)
Mercatura Conference System (<http://www.mercatura.pt>)

4622	STIFFENER LAYOUT OPTIMIZATION OF THE OVERALL BUCKLING OF THIN-WALLED STIFFENED PLATE. Lianchun Long, Yang Li .	517
4012	ADDRESSING GEOMETRICAL NONLINEARITY CONSIDERING PROBABLISTIC MATERIAL NONLINEARITY. Iffat Siddique.	521
4659	APPLICATION OF ANALYTICAL TARGET CASCADING TO THE DESIGN OF A RAILWAY VEHICLE SUSPENSION SYSTEM. Dário Silva, Hugo Policarpo, Miguel M. Neves, Virgínia Infante.	519

TUE, 16:00-17:30		SESSION 6G	Room G
Symp_12: VIBRATION AND STRUCTURAL ACOUSTICS ANALYSIS			
Chair: César Vasques (INEGI, Portugal)			
REF:	Title and Author(s):	Page:	
4658	A METHODOLOGY FOR THE PERFORMANCE EVALUATION OF DIFFERENT SURFACE DAMPING TREATMENTS. Márcio Furukava, Hugo Policarpo, Miguel M. Neves, Nuno M.M. Maia, Olavo M. Silva, Dário Silva, Samir N.Y. Gerges.	553	
4691	ON EFFECT OF MECHANICAL PROPERTIES OF POROUS MATERIALS ON THE TRANSFER OF ACOUSTIC VIBRATIONS. Elena Prokofieva, Mike Barker, Minsung Cho.	557	
4733	NEW VIBRODYNAMIC PHENOMENA RELATIVE TO THE SPECIFIC VOLUME FORMS OF LOOSE/GRANULAR MATTER. Yuri Makov.	559	
4746	SOUND AND VIBRATION IN AN INTERDISCIPLINARY CONTEXT; SOME EXAMPLES FROM THE LAB. Jan Tro, Ulf Kristiansen.	561	
6001	SPACE QUALIFICATION OF AN ULTRA LOW-SHOCK NON-EXPLOSIVE ACTUATOR FOR HOLD-DOWN AND RELEASE MECHANISMS: INITIAL TESTS. O.M.F. Morais, C.M.A. Vasques, L.M.S. Guimarães, P.M.G. Salvado, C. Perestrelo, V. Pimenta, G. Baldesi.	NA	

TUE, 17:30 - 18:30		POSTER SESSION III	Lounge
Symposia: 1 to 15			
REF:	Title and Author(s):	Page:	
3993	POWER HARVESTING APLICATION. Carlos A. Gallo, Roberto M.F. Neto, Amanda M. Souza, Leonardo R.O. Condor, Roberta C.S. Moreira.	427	
4687	REVIEW OF POSSIBILITY APPLICATION SHAPE MEMORY ALLOY IN KINETIC ENERGY RECOVERY SYSTEMS. Wojciech Klein, Arkadiusz Mężyk.	425	
4750	X-RAYS TOMOGRAPHIC RECONSTRUCTION IMAGES OF MATERIALS USING INVERSE PROBLEM RESOLUTION BASED ON SPARSE REGULARIZATION METHOD. Aicha Allag, Redouane Draï.	439	
4634	DISPLACEMENT AND STRAIN FIELDS ASSESSMENT OF PDMS USING DIGITAL IMAGE CORRELATION. Bebiana Mendonça, João Ribeiro, Hernani Lopes, Pedro Martins, Mário A.P. Vaz, J.F. Silva Gomes.	447	
4712	REAL-TIME DAMAGE IDENTIFICATION USING ROTATING FIELD ANALYSIS. Hernani Lopes, João Ribeiro, J.V. Araújo Santos, Mário A.P. Vaz, J.F. Silva Gomes.	451	
4654	ON THE MECHANICAL FAILURE OF ARTERIAL PROSTHESES. Catarina F. Castro, Carlos C. António, Luísa C. Sousa.	465	
4045	MOUTHGUARD FOR ORTHODONTIC PATIENT TRUMPET PLAYER. Maria João Ponces, Saúl Castro, Maria Cristina Pollmann, Paula Vaz, Jorge Dias Lopes.	487	
4014	CONE BEAM COMPUTED TOMOGRAPHY AND PROSTHODONTIC REHABILITATION OF CLEIDOCRANIAL DYSOSTOSIS. Paula Vaz, Maria Ponces, Inês Corte-Real, Afonso Ferreira, José R. Campos.	491	
4306	PRENATAL ULTRASOUND SCREENING, TOOTH GERMS HISTOLOGY AND HYPODONTIA. Mariana Seabra, António Felino, Francisco Valente, Rosete Nogueira, Paula Vaz.	495	
4682	INOVATIVE HYBRID JOINT TECHNIQUE THROUGH FRICTION STIR WELDING AND ADHESIVE BONDING. Daniel F.O. Braga, Ana Silva, Miguel A.V. Figueiredo, L.F.M. Silva, Pedro M.G.P. Moreira.	533	
4715	STUDY OF ALTERNATIVE MANUFACTURING PROCEDURES FOR AN ALUMINIUM RAILWAY CAR PASSENGER UNDERFRAME. João P.A. Dias, Daniel F.O. Braga, Sérgio M.O. Tavares, Pedro M.G.P. Moreira, Paulo M.S.T. Castro.	535	
3952	A PARAMETRIC STUDY ON THE INFLUENCE OF VARIOUS PARAMETERS ON THE UNDERWATER NOISE LEVELS GENERATED BY OFFSHORE PILE DRIVING. Gargi Kaushik, Apostolos Tsouvalas, Andrei Metrikine.	541	
4092	MECHANICAL CONTROL OF INELASTIC CHARACTERISTICS, DEFECT NANOSTRUCTURE CHANGING OF SiO ₂ + Si WAFER-PLATE, GeSi. A.P. Onanko, S.A. Vyzhva, Y.A. Onanko.	547	
4684	DYNAMIC RESPONSE OF LAYERED SATURATED SOIL SUBJECT TO SUBWAY TRAIN LOADS. Ding YuQin, Chen ChunLai, Gao ShuWei, Tao Rong.	555	

IRF2013 PROGRAM

FUNCHAL, 23-27 JUNE 2013

Time	SUNDAY (JUNE 23)	MONDAY (JUNE 24)	TUESDAY (JUNE 25)	WEDNESDAY (JUNE 26)	THURSDAY (JUNE 27)
08:00		REGISTRATION	REGISTRATION	REGISTRATION	TECHNICAL VISITS AND CRUISE TO PORTO SANTO
09:00		OPENING SESSION	POSTERS SESSION II Topics: H to N	POSTERS SESSION IV Symposia 16 to 32	
10:00		PLENARY SESSION I Prof. Shaker Meguid (U. Toronto, Canada)	PLENARY SESSION III Prof. E.A. Elsayed (Rutgers University, USA)	Session 7A (Symp-32)	
		PLENARY SESSION II Prof. Xiong Zhang (U. Tsinghua, China)	PLENARY SESSION IV Prof. Noritsugu Umehara (Nagoya Univ., Japan)	Session 7B (Symp-31)	
11:00		COFFEE-BREAK	COFFEE-BREAK	Session 7C (Symp-11)	
		Session 1A (Topic-A)	Session 4A (Topic-H)	Session 7D (Symp-13)	
		Session 1B (Topic-B)	Session 4B (Topic-B)	Session 7E (Symp-7)	
		Session 1C (Topic-C)	Session 4C (Topic-I)	Session 7F (Topic-N)	
		Session 1D (Topic-D)	Session 4D (Symp-14)	Session 7G (Symp-27)	
		Session 1E (Topic-E)	Session 4E (Topic-K)	Session 7H (Topic-L)	
		Session 1F (Symp-18)	Session 4F (Symp-28)		
		Session 1G (Topic-G)	Session 4G (Topic-M)		
12:00		Session 2A (Topic-A)	Session 5A (Topic-H)	Session 8A (Symp-32)	
		Session 2B (Topic-B)	Session 5B (Topic-J)	Session 8B (Symp-31)	
		Session 2C (Topic-F)	Session 5C (Topic-I)	Session 8C (Symp-26)	
		Session 2D (Topic-D)	Session 5D (Symp-14)	Session 8D (Symp-17)	
		Session 2E (Symp-3)	Session 5E (Symp-6)	Session 8E (Symp-30)	
		Session 2F (Symp-19)	Session 5F (Symp-10)	Session 8F (Topic-N)	
		Session 2G (Symp-21)	Session 5G (Symp-12)	Session 8G (Symp-1)	
		Session 2H (Topic-H)	Session 5H (Topic-H)	Session 8H (Symp-20)	
13:00		LUNCH	LUNCH	CLOSING SESSION	
14:00				LUNCH & END OF CONFERENCE	
15:00	EARLY-BIRD REGISTRATION	Session 3A (Topic-A)	Session 6A (Topic-H)		
		Session 3B (Topic-B)	Session 6B (Symp-5)		
		Session 3C (Topic-I)	Session 6C (Topic-I)		
		Session 3D (Topic-D)	Session 6D (Symp-15)		
16:00		Session 3E (Symp-4)	Session 6E (Symp-6)		
		Session 3F (Symp-19)	Session 6F (Symp-10)		
		Session 3G (Symp-29)	Session 6G (Symp-12)		
17:00		POSTERS SESSION I Topics: A to G	POSTERS SESSION III Symposia: 1 to 15		
18:00					
19:00		CONFERENCE RECEPTION	CONFERENCE BANQUET		
20:00					

4th International Conference on Integrity, Reliability and Failure, Funchal/Portugal, 23-27 June 2013

1- INTRODUCTION

The polydimethylsiloxane (PDMS) is an elastomer with very attractive properties for various applications in different fields, like biomedical engineering (Yabuta, 2003) and electronics (Andersson, 2003). In last years, they have been used in the development of micro and nanodevices (Mata, 2005), optical MEMs (Schneider, 2009), among others. These news applications demand a better understanding of PDMS mechanical behavior, which only could be achieved using new experimental and numerical approaches. In this work is used the Digital Image Correlation (DIC) optical technique to measure the displacement and strain fields of a specimen during a bi-axial tensile test. The numerical simulations have been done with Finite Elements Method and their results are compared with the experimental measurements.

2- EXPERIMENTAL TEST USING DIGITAL IMAGE CORRELATION

For this work was developed an experimental assembly to perform the biaxial tensile tests. The preparation of samples involved two stages: in the first stage the material was cut using a mold cutting (Fig. 1), for the second stage was created a random pattern on the surface of the material, using a spray of black ink.

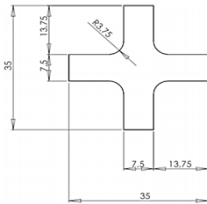


Figure 1 - Dimensions of samples tested.

Once created the random pattern, the sample was placed in biaxial tensile machine with properly grips which prevent slippage of the material (Fig. 2).

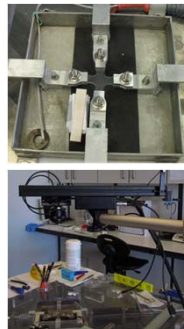


Figure 2 - Mounting optics for the tensile test, using the CDI to measure the displacement field.

In this study was used a commercial system DIC, the Gom Aramis, which consists of two CCD cameras with resolution 1624 x 1236 pixels, a computer with specific software for digital image correlation and connection cables between these two elements. The Aramis system allows control of the rate of acquisition of CCD cameras, measuring in-plane and out-of-plane displacements and strain fields using two CCD cameras.

In the presented work a single CCD camera was applied to measure in-plane displacement and strain fields. The acquisition rate was one image per second. The images were acquired during the tensile test, having been sent to the PC, which processed them according to the DIC algorithms.

3- NUMERICAL SIMULATIONS

The numerical simulation was implemented by finite element method (FEM) using the commercial engineering simulation software ANSYS[®].

To implement the numerical simulation were created models with geometry and dimensions identical to the sample used experimentally and was generated the mesh, imposing the same loading charge then the biaxial tensile test. It was considered a non-linear hyper elastic behavior and were used the numerical models of Mooney-Rivlin.

To determine the material constants was used the experimental curve of the tensile test. A mesh of isoparametric elements with 4 nodes was generated (PLANE182). The mesh used in numerical simulations is represented in Fig. 3.

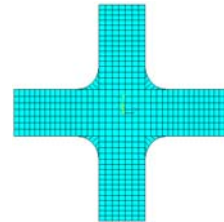


Figure 3 - Finite element mesh used.

4- RESULTS

The load curves of the bi-axial tensile test and the analysed region of the sample are shown in Fig. 4.

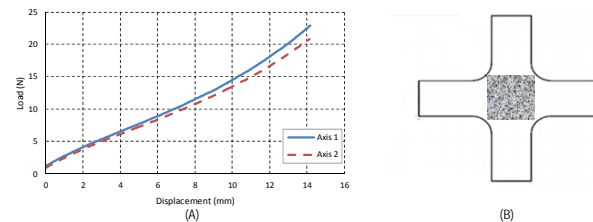


Figure 4 - Bi-axial tensile test results. (A) and the analyzed region (B)

In the Fig. 5 are shown the displacement and strain fields for a load case of 7 N applied in the vertical direction, with a crosshead speed of 5mm/min.

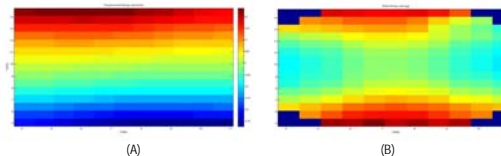


Figure 5 - The experimental results for vertical direction, obtained using DIC: (A) displacement field; (B) strain field.

The correspondent numerical simulations using Mooney-Rivlin model is presented in Fig. 6.

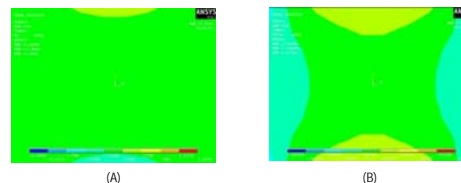


Figure 6 - The numerical results for vertical direction, obtained using FEM: (A) displacement field; (B) strain field.

In the Fig. 7 is presented a comparative analysis of the displacement profile for the vertical direction between the experimental measurements and the numerical simulation. This reveal a similar trend of the material behavior, i.e. there is an approximately linear increase of the displacements.

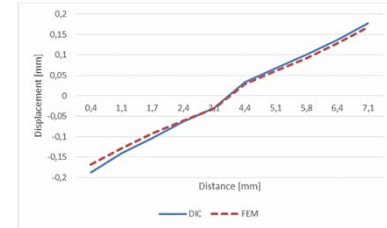


Figure 7 - Variation of displacement in the Y direction, measured experimentally with the DIC and determined numerically with FEM.

The results show a small difference in the displacement values between the experimental and numerical simulation, being the average relative error 8.3%.

5- CONCLUSIONS

The optical technique of Digital Image Correlation proved well adapted for displacement and strain fields measurement of hyper-elastic materials. The results show that this technique correlates well in the displacements when high spatial resolution is used, allowing extracting the information for large deformation amplitudes. This technique is highly dependent on the quality of the random pattern. In this work, it was necessary to test different types of patterns and, it was found that, the use of black ink spray lead to acceptable results. However, further tests are needed in order to improve the quality of the results.

REFERENCES

Andersson, L.H., Hjertberg, T. Silicone elastomers for electronic applications. *Journal of Applied Polymer Science*, 2003, 88, p. 2073–2081.
 Mata, A., Aaron, J.F., Roy, S. Characterization of Polydimethylsiloxane (PDMS) Properties for Biomedical Micro/Nanosystems. *Biomedical Microdevices*, 2005, 7, p. 281–293.
 Schneider, M.F., Draheim, J., Kamberger, R., Wallrabe, U. Process and material properties of polydimethylsiloxane (PDMS) for Optical MEMS. *Sensors and Actuators A*, 2009, 151, p. 95–99.
 Yabuta, T. Synthesis of PDMS-Based Porous Materials for Biomedical Applications. *Journal of Sol-Gel Science and Technology*, 2003, 26, p. 1219–1222.

CONTACT INFORMATION

Bebiana Mendonça - bimendonca@hotmail.com.
 João Ribeiro - jrribeiro@ipb.pt.