

2007 annual report

Some details of 2007 activity
coordinated by Professor Paulo M S T de Castro within IDMEC-Porto,
Faculdade de Engenharia da Universidade do Porto

Main contributors in 2007

- Miguel A V Figueiredo
- Paulo M S Tavares de Castro
- Pedro M G P Moreira
- Sérgio M O Tavares
- Stefan D Pastrama (Univ Politehnica of Bucharest)
- Valentin Richter-Trummer

RD projects

- DATON - 'Innovative fatigue and damage tolerance methods for the application of new structural concepts', European Union contract AST4-CT-2005-516053; project leader Prof P Horst, T U Braunschweig; coordinator in Portugal: P M S T de Castro, start: April 2005; current.
- PTDC/EME-TME/66362/2006 – “WELDING - Fiber Bragg grating sensors for modelling of Friction Stir Welding (FSW) and Laser Beam Welding (LBW)”;
“WELDING - Fiber Bragg grating sensors for modelling of Friction Stir Welding (FSW) and Laser Beam Welding (LBW)”;
start: July 1, 2007
- MIT-Portugal program, “New Design Concepts for Aeronautical Products Welded by Friction Stir”, with IST (Prof Pedro Vilaça) and companies OGMA and TAP Manutenção, and the interest of EMBRAER; call with application deadline July 6, 2007; approved Oct 23, 2007

Other projects

- European Rail Research Network of Excellence 'EUR2EX' (now called EURNEX), FP6 priority 1.6.2, proposal/contract FP6-PLT-506513; project coordinator: Wolfgang H Steinicke, Transport Technology Systems Network (FAV) Berlin; coordinator at IDMEC: P M S T de Castro; start: Jan 1, 2004, current.
 - proposal A 059/2005, Medida V.5 Acção V.5.2 – support to national participation in european networks and projects, “European Rail Research Network of Excellence EURNEX”; P M S T de Castro, application to FCT May 11, 2005; approved Oct 2007.

Doctoral students

- Pedro M G P Moreira, Mech Eng doctoral degree, Universidade do Porto; expected to conclude in 2008
- Sérgio M O Tavares, started MIT-Portugal doctoral program late 2007 (co-supervision: Pedro Vilaça. IST, Lisbon; Jorge F dos Santos, GKSS, Geesthacht)

- Valentin Richter-Trummer, Mech Eng doctoral degree, Universidade do Porto; to start in 2008 (co-supervision: Pedro Vilaça. IST, Lisbon; Jorge F dos Santos, GKSS, Geesthacht)

Journal papers

- P M G P Moreira, M A V de Figueiredo, P M S T de Castro, “Fatigue behaviour of FSW and MIG weldments for two aluminium alloys”, *Theoretical and Applied Fracture Mechanics*, vol.48, 2007, pp.169–177
- P M G P Moreira, A M P de Jesus, A S Ribeiro, P M S T de Castro, “Assessment of the fatigue behaviour of friction stir welded joints: aluminium alloy 6082-T6”, *Key Engineering Materials*, vols.348-349, 2007, pp.209-212
- P M G P Moreira, O Frazão, S M O Tavares, M A V de Figueiredo, M T Restivo, J L Santos, P M S T de Castro, “Temperature field acquisition during gas metal arc welding using thermocouples, thermography and fibre Bragg grating sensors”, *Measurement Science and Technology*, vol.18, 2007, pp.877-883
- P M G P Moreira, Ş D Pastramă, P M S T de Castro, “Comparative three dimensional fracture analyses of cracked plates”, *Scientific Bulletin, Universitatea Politehnica Bucuresti, Series D*, (ISSN 1454-2358), vol.69, no.1, 2007, pp.43-58
- P M S T de Castro, P F P de Matos, P M G P Moreira, L F M da Silva, “An overview on fatigue analysis of aeronautical structural details: Open hole, single rivet lap-joint, and lap-joint panel”, *Materials Science and Engineering-A*, vol.468–470, 2007, pp.144–157
- P F P de Matos, A J McEvily, P M G P Moreira and P M S T de Castro, “Analysis of the effect of cold-working of rivet holes on the fatigue life of an aluminum alloy”, *International Journal of Fatigue*, vol 29, (3), 2007, pp.575-586
- P M G P Moreira, P F P de Matos, P P Camanho, Stefan D Pastrama and P M S T de Castro, “Stress intensity factor and load transfer analysis of a cracked riveted lap joint”, *Materials and Design*, vol 28, (4), 2007, pp.1263-1270

Book chapters

- P M G P Moreira, V Richter-Trummer and P M S T de Castro, “Fatigue behaviour of FS, LB and MIG welds of AA6061-T6 and AA6082-T6”, invited chapter, in: George C Sih, ed, “Multiscale Fatigue Crack Initiation and Propagation of Engineering Materials – Structural Integrity and Microstructural Worthiness”, Springer Science + Business Media BV, to be published.

Conference communications

- S M O Tavares, P M G P Moreira, P M S T de Castro, “Friction stir welding of T-joints fabricated with three parts”, accepted for presentation at the Conference DFE2008 Design, Fabrication and Economy, Miskolc, Hungary, **April 24-26, 2008**, <http://www.alt.uni-miskolc.hu/dfc2008/>
- P M G P Moreira, S D Pastrama, P M S T de Castro, “Three dimensional stress field and stress intensity factor calibration for a central cracked plate”, published in *Modelling and Optimization in the Machines Building Field MOCM 13*, vol 4, Romanian Technical Sciences Academy, pp.145-150, ISSN 1224-7480, consisting of Proceedings of the 13th International Conference of Fracture Mechanics, University of Bacau, Romania, **November 1-3, 2007**

- V Richter-Trummer, S M O Tavares, P M G P Moreira, P M S T de Castro, “Residual stress measurement using the contour and the sectioning methods: application to MIG and FSW Joints”, poster presentation at the Residual Stress Summit 2007, Oak Ridge National Laboratory, USA, **Oct 2-4, 2007**
- P M G P Moreira, Ş D Pastramă, P M S T de Castro, “Three dimensional stress intensity factor calibration for a stiffened cracked plate”, The International Conference on Structural Analysis of Advanced Materials - ICSAM 2007, Patras, Greece, **September 2-6, 2007**
- P M G P Moreira, A M P de Jesus, A S Ribeiro, P M S T de Castro, “Assessment of the fatigue behaviour of friction stir welded joints: aluminium alloy 6082-T6”, 6th International Conference on Fracture and Damage Mechanics, Madeira, Portugal, **July 17-19, 2007**; published in: J Alfaiate, M H Aliabadi, M Guagliano, L Susmel, eds., “Advances in Fracture and Damage Mechanics VI”, Trans Tech Publications Inc, (ISBN 0-87849-448-0); *Key Engineering Materials*, vols.348-349, 2007, pp.209-212
- F J P Chaves, L F M da Silva, P M S T de Castro, “Adhesively bonded T-joints in PVC Windows”, International Conference on Advanced Computational Engineering and Experimenting ACE-X2007, Algarve, Portugal, **July 12-13, 2007** (in: A Ochsner, Z Ren, L F M da Silva, eds, abstract book, p.91)
- P M G P Moreira, R A M da Silva, M A V de Figueiredo, F M F de Oliveira, P M S T de Castro, “A comparison of the fatigue behaviour of FSW and MIG weldments of two aluminium alloys”, 9th MESO - 2007 International Conference on Mesomechanics, Giens, France, **May 13-17, 2007**; published in: George C Sih, Moussa Nait-Abdelaziz, Toan Vu-Khanh, eds., “Particle and Continuum Aspects of Mesomechanics”, ISTE, (ISBN 978-1-84704-025-1), 2007, pp.613-622
- P M G P Moreira, T Santos, S M O Tavares, V Richter-Trummer, P Vilaça, P M S T de Castro, “Friction stir welds of dissimilar aluminium alloys AA6061-T6 and AA6082-T6: mechanical characterization”, 13th Conference of Sociedade Portuguesa de Materiais, Porto, Portugal, **April 1-4, 2007** (under consideration for possible publication by Trans Tech in the proceedings, with the title: “Mechanical characterization of friction stir welds of two dissimilar aluminium alloys of the 6xxx séries”)
- P M G P Moreira, M A V de Figueiredo, F M F de Oliveira, P M S T de Castro, “Fatigue behaviour of friction stir welding and metal inert gas welding of two aluminium alloys of the 6XXX series”, 13th Conference of Sociedade Portuguesa de Materiais, Porto, Portugal, **April 1-4, 2007** (under consideration for possible publication by Trans Tech in the proceedings)

Invited communications

- “Fracture mechanics problems of aluminum alloy fuselages”, acknowledging the work of Fernando M F Oliveira, Lucas F M da Silva, Miguel A V Figueiredo, Paulo F P de Matos, Pedro M G P Moreira, Sérgio M O Tavares, and Valentin Richter-Trummer, invited seminar to the PhD Course on Engineering of Mechanical Systems, University of Naples Federico II, Italy, **November 30, 2007**
- “Fracture mechanics problems of aluminum alloy fuselages”, acknowledging the work of Fernando M F Oliveira, Lucas F M da Silva, Miguel A V Figueiredo, Paulo F P de Matos, Pedro M G P Moreira, Sérgio M O Tavares, and Valentin Richter-Trummer; invited seminar, Università degli Studi di Salerno, Italy, **November 30, 2007**

- Seminar at INESC Porto (Physics Department of Faculty of Sciences of the Universidade do Porto), presented by V Richter-Trummer, “Soldadura de componentes em liga de alumínio GMAW (MIG/MAG), LBW, FSW”; co-authors: J F R Almeida, M A V Figueiredo, P M G P Moreira, F M F de Oliveira, R A M da Silva, S M O Tavares, P M S T de Castro, V Richter-Trummer; INESC Porto, Dep. de Física da FCUP, **September 26, 2007**
- Communication to the Academy of Sciences of Lisbon, P M S T de Castro, “Problemas de fadiga e fractura em estruturas de aviões fabricadas em alumínio”, acknowledging, among others: Fernando M F Oliveira, Lucas F M da Silva, Miguel A V Figueiredo, Paulo F P de Matos, Pedro M G P Moreira, Sérgio M O Tavares, e Valentin Richter-Trummer; Lisbon, **June 14, 2007**
- “Fatigue analyses of aeronautical structural details”, invited seminar at Polytech’Lille, Lille, France, **May 10, 2007**

Other journal papers

- P M G P Moreira, S D Pastrama, P M S T de Castro, “Comparative three dimensional fracture analyses of cracked plates”, *Mecanica Ruperii, Buletinul Asociației Române de Mecânica Ruperii*, (20), Dec 2006, pp.14-26
- P M G P Moreira, S D Pastrama, P M S T de Castro, “Three dimensional stress field and stress intensity factor calibration for a central cracked plate”, published in *Modelling and Optimization in the Machines Building Field MOCM* 13, vol 4, Romanian Technical Sciences Academy, pp.145-150, ISSN 1224-7480 (<http://pubs.ub.ro/?pg=revues&rev=mocm>)

Other publications

- CD with workshop proceedings "O DEMEGI e a Pedagogia" held at FEUP on Feb 15-16, 2005, M T Restivo, P M S T de Castro, eds, ISBN 989-95208-0-2, 2007

Patent applications

- Patent application, "Soldadura por fricção linear - Soldaduras em T", número 103867, Sérgio M O Tavares *et al*, Instituto Nacional da Propriedade Industrial, Lisboa, Portugal, 2007

Theses

- Sérgio M O Tavares, “Structural integrity of stiffened structures: fatigue and fracture mechanics analysis”, Mechanical Engineering MSc Thesis, FEUP, 2007
- Valentin Richter-Trummer, “Residual stress measurement using the contour and the sectioning methods: application to MIG and FSW Joints”, Final Project, Licenciatura em Engenharia Mecânica, Faculdade de Engenharia da Universidade do Porto, June 2007

Project reports and presentations

Reports

- S M O Tavares, P M G P Moreira, V Richter-Trummer, P M S T de Castro, Fatigue crack growth in Airbus test panels with seven stiffeners and a central

crack, DaToN – WD4 – WP2 – 1.0 / IDMEC, Nov 2006 (**revised version ‘1.1’ of Feb 2007**)

- P M G P M Moreira, V Richter-Trummer, S M O Tavares, F M F de Oliveira, P M S T de Castro, “Characterization of fatigue crack growth rate of AA6056 T651 and T6. Application to DaToN panels life prediction”, DaToN–WD5-WP2-WP3–1.0/IDMEC, **December 21, 2007**

Presentations

Among others:

- DATON project, Munich meeting, **Jan 11, 2007**, IDMEC presentation (attachment 4 of minutes of meeting)
- DATON project, Porto meeting, **April 17-18, 2007**, IDMEC presentation WP2, WP3a, WP3b
- DATON project, Brno meeting, **October 15-16, 2007**, presentation WP3
- P M G P Moreira, V Richter-Trummer, P M S T de Castro, (slides presentation), visit to FEUP of ALSTOM delegation: Dr Daniel Cadet (ALSTOM, Paris) and Eng Ângelo Ramalho (Presid, ALSTOM Portugal), **Dec 10, 2007**

Participation in scientific and technological meetings

International conferences

(underlined: those where papers were presented)

Miguel A V de Figueiredo

- Portugal, 13th Conference of Sociedade Portuguesa de Materiais, Porto, Portugal, April 1-4, 2007
- Spain, IV Jornada de Procesado de Materiales con Láser de AIMEN, Porriño, Vigo, Espanha, Nov 15, 2007

Paulo M S T de Castro

- Portugal, 13th Conference of Sociedade Portuguesa de Materiais, Porto, Portugal, April 1-4, 2007
- France, 9th MESO - 2007 International Conference on Mesomechanics, Giens, France, May 13-17, 2007
- Portugal, Composites 2007 “Mechanical Response of Composites”, ECCOMAS Thematic Conference, FEUP, Sept 12-14, 2007 (<http://paginas.fe.up.pt/~comp2007/index.html>)
- USA, Residual Stress Summit 2007, Oak Ridge National Laboratory, USA, Oct 2-4, 2007

Pedro M G P Moreira

- Portugal, 13th Conference of Sociedade Portuguesa de Materiais, Porto, Portugal, April 1-4, 2007 Materiais 2007, Porto
- France, 9th MESO - 2007 International Conference on Mesomechanics, Giens, France, May 13-17, 2007
- Portugal / Madeira, 6th International Conference on Fracture and Damage Mechanics, Madeira, Portugal, July 17-19, 2007
- Greece, The International Conference on Structural Analysis of Advanced Materials - ICSAM 2007, Patras, Greece, September 2-6, 2007
- Romania, 13th International Conference of Fracture Mechanics, University of Bacau, Romania, November 1-3, 2007
- Spain, IV Jornada de Procesado de Materiales con Láser de AIMEN, Porriño, Vigo, Espanha, Nov 15, 2007

Sérgio M O Tavares

- Portugal, 13th Conference of Sociedade Portuguesa de Materiais, Porto, Portugal, April 1-4, 2007
- Germany, European Workshop on Short Distance WELding Concepts for AIRframes - WEL-AIR, GKSS Research Center, Geesthacht, Hamburg, Germany, June 13-15, 2007

- Germany, International Seminar on Friction Stir Welding of Steels, GKSS Research Center, Geesthacht, Hamburg, Germany, November 22-23, 2007

Valentin Richter-Trummer

- Portugal, 13th Conference of Sociedade Portuguesa de Materiais, Porto, Portugal, April 1-4, 2007
- USA, Residual Stress Summit 2007, Oak Ridge National Laboratory, USA, Oct 2-4, 2007
- Spain, IV Jornada de Procesado de Materiales con Láser de AIMEN, Porriño, Vigo, Espanha, Nov 15, 2007

Other relevant meetings

Miguel A V de Figueiredo

- Spain, Porriño, AIMEN, LBW welding work with Joaquin Vazquez, Eva Vaamonde and Ambroise Vandewynckele, May 22, 2007

Paulo M S T de Castro

- Germany, Munich, EADS Corporate Research Center, DATON project Munich meeting, Jan 11, 2007
- France, Lille, Polytech Lille, Jan 07, as Invited Professor
- Portugal, Porto, DATON project Porto meeting, Abril 17-18, 2007
- France, Lille, Polytech Lille, May 07, as Invited Professor
- Germany, Geesthacht, GKSS, meeting with Dr J F dos Santos, Apr 29 Abr – May 1, 2007
- Spain, Porriño, AIMEN, LBW welding work with Joaquin Vazquez, Eva Vaamonde and Ambroise Vandewynckele, May 22, 2007
- Czech Republic, Brno, DATON project Brno meeting, Out 15-16, 2007
- Italy, Salerno and Naples, invited seminars, Nov 28 – Dec 2, 2007

Pedro M G P Moreira

- Portugal, Porto, DATON project Porto meeting, Abril 17-18, 2007
- Spain, Porriño, AIMEN, LBW welding work with Joaquin Vazquez, Eva Vaamonde and Ambroise Vandewynckele, May 22, 2007
- Czech Republic, Brno, DATON project Brno meeting, Out 15-16, 2007

Sérgio M O Tavares

- Germany, Munich, EADS Corporate Research Center, DATON project Munich meeting, Jan 11, 2007
- Portugal, Porto, DATON project Porto meeting, Abril 17-18, 2007
- Germany, Geesthacht, GKSS, meeting with Dr J F dos Santos, Apr 29 Abr – May 1, 2007
- Czech Republic, Brno, DATON project Brno meeting, Out 15-16, 2007
- Germany, Geesthacht, GKSS, first stay in the context of the MIT-Portugal PhD scholarship, Nov-Dec 2007

Stefan D Pastrama

- Portugal, Porto, DATON project Porto meeting, Abril 17-18, 2007

Valentin Richter-Trummer

- Portugal, Porto, DATON project Porto meeting, Abril 17-18, 2007
- Germany, Geesthacht, GKSS, meeting with Dr J F dos Santos, Apr 29 Abr – May 1, 2007
- Czech Republic, Brno, DATON project Brno meeting, Out 15-16, 2007

Participation in international networks

- European Rail Research Network of Excellence 'EUR2EX' (now called EURNEX), FP6 priority 1.6.2, proposal/contract FP6-PLT-506513; project coordinator: Wolfgang H Steinicke, Transport Technology Systems Network (FAV) Berlin (represented in the 2007 annual meeting: EURNEX 4th Integration Conference & EURNEX Association inauguration, Nov 29-30 2007, CVUT Prague, Czech Republic, by Professor Renato Natal Jorge).
- EASN - European Aeronautics and Space Network, since 2005

Editorial boards

- *Mechanika* (ISSN 1392-1207), P T de Castro
- *Fatigue and Fracture of Engineering Materials and Structures* (ISSN 8756-758X), P T de Castro
- *Boletim da Universidade do Porto* (ISSN 0871-7249), up to the closure of this journal, July 2007, P T de Castro

Acknowledgments

Many people and organizations contributed to the work in 2007, particularly all co-authors mentioned, and, among many others, the following:

Abílio de Jesus (UTAD)
Alfredo Ribeiro (UTAD)
CEMUP
Daniela Silva (CEMUP)
Fernando M F de Oliveira (FEUP)
Fundação para a Ciência e Tecnologia
INEGI
José Duarte Ribeiro Marafona (FEUP)
José Fernando Rocha Almeida (Oficinas Mecânicas / DEMEGI / FEUP)
Luís Filipe do Valle Peixoto e Villas Boas (AUTOCONCEPTUS)
Pedro Vilaça (IST)
Peter Horst (Technische Universität Braunschweig)
Rui António Martins da Silva (LET / DEMEGI / FEUP)
União Europeia

Annexe

Outside the scope of the activity mentioned above, the following publications resulted of work of Sérgio M O Tavares in the Tribology Group of Faculdade de Engenharia da Universidade do Porto (with Professor Luís A Ferreira):

- E Ciulli, Luís A Ferreira, G Pugliese and Sérgio M O Tavares, “Rough contacts between actual engineering surfaces: Part I. Simple models for roughness description”, *Wear*, in press, corrected proof, available online 22 October 2007
- G Pugliese, Sérgio M O Tavares, E Ciulli and Luís A Ferreira, “Rough contacts between actual engineering surfaces: Part II. Contact mechanics”, *Wear*, in press, corrected proof, available online 25 October 2007