

FCT Relatório Científico 2010 Print: 04-04-2011 15:31:01 [Centro de Tecnologias Mecânicas e de Materiais]

General Information

Name of Research Unit:	(EME-Norte-4077) Centre for Mechanics and Materials Technologies
Coordinator:	José Carlos Fernandes Teixeira
Main Scientific Domain:	Engenharia Mecânica
Other Subdomains:	n/a

Host Institutions

Leading Host Institution: Universidade do Minho

Other Institutions Involved:

Objectives & Achievements

Unit Description

The Unit is currently composed of 54 'Integrated Members' and 18 'Collaborating Members'. The former group includes 31 PhD holders (of which, 4 pos doc), 20 PhD students and 2 other researchers, all the non PhDs having a research grant or contract or in the process of obtaining. The group of collaborating members is composed of 4 PhD students (enrolled at other institutions) and 14 MSc students working on their MSc dissertations.

The members of the Unit are grouped in three research groups. Each group has a Principal Investigator (group coordinator) elected by all integrated members of the group, having as main functions to foster the research group and to coordinate its activities. All decisions concerning the research activity of the Unit (definition of a research policy, applications to research funding programs, development of protocols of collaboration with other research institutions and with industry, approval of research reports, approval of the activity budget, acceptance of new members), are under the competence of the Scientific Committee (SC), constituted by all integrated members of the Unit holding a PhD degree. The coordination of the Unit's activities as defined by the SC is assured by the Executive Committee (EC), which is constituted by the Director of the Unit and the Principal Investigators of the research groups. The Director is elected directly by all integrated members of the Unit holding a PhD degree. He represents the Unit and chairs the Scientific and the Executive Committees. The elected director may designate deputy Director within the integrated members holding a PhD degree, to help him in the coordination of the Unit. In 2010 the unit approved its statutes, in accordance with the general guidelines of the University, which clearly define the role and duties of each one of its bodies.

The External Advisory Committee (EAC), created in 2009 and composed of three scientists of internationally recognized merit in the areas of interest of the Unit, has met for the first time in July 12 through 13, 2010. In this meeting the panel reviewed the activities, objectives and structure of the research unit. Various suggestions were discussed. The members of the EAC are: Professor Jean-Pierre Celis, Universidade Católica de Leuven (Belgium), Professor Andrés Kecskméthy, University of Duisburg-Essen (Germany) and Professor Jouni Hamalainen, VTT Technical Research Centre (Finland).

General Objectives

The mission of the unit is to contribute to the advance of scientific knowledge in mechanical engineering, in particular in the areas of mechanical systems, energy and environmental technologies, functionalized materials. Also, to make this knowledge available to the scientific community through its publication in international journals and conferences, and to industry, by means of the establishment of joint research projects and protocols for technology transfer. The training of post-graduate students is also within the mission of the unit, as well as the contribution to the general public awareness of science and innovation.

The general objectives of the Centre mainly remain as specified in the initial proposal for this period of activity, presented in 2007. Most of them have been corroborated by the assessment panel after the visit made to the Unit in April 2008. Good progress has been made regarding some of those objectives. The Unit will continue making efforts to accomplish all the proposed objectives to a good degree. The feedback from the EAC is of the utmost relevance to the guidance of the center.

i) The focusing of the research is a matter of uppermost importance. Although the research groups are not all in the same situation concerning focussing, some progress is occurring but it is an issue that requires attention at all time. Niche areas of research have been identified, being the main stream of the research effort directed to those areas in each group. These niche areas are 'tribocorrosion', 'functionally graded materials', 'waste-to-energy' and 'energy management'. Regarding the first and the second areas, the Unit is unique in Portugal and already achieved international recognition. It is a strategic objective of the Unit to achieve international recognition in all niche areas identified as such.

ii) Regarding scientific production, the improvement of both quantity and quality of journal publications and of the number of PhD students as a whole, are objectives of the Unit. In 2010 the productivity ratio of the Unit viewed as the number of papers in international journals per PhD researcher, was of 1.66 which is just above the objective of 1.5 by the end of the current activity period. Also, the ratio of PhD students to the total number of PhD integrated members has increased up to 0.77 in 2010, up from 0.52 in 2009. The objective of the Unit is to push this ratio towards 1.

iii) The enlargement of internationalization of the research groups constitutes a very important objective of the Unit. The number and the relevance of the groups' liaisons with other international groups are growing slowly but steadily. This growing interaction is bringing fruits in terms of collaborative research and joint supervision of graduate students. The collaboration in research projects the joint publication of papers, the co-organization of scientific meetings and conferences, the mobility of researchers, are all important targets whose intensification is to be pursued. New fruitful collaborations have been developed over 2010.

iv) The Unit benefits of the regular funding attributed within the Plurianual Funding Programme of FCT. Additional direct funding comes mainly from research projects sponsored by national agencies and industry. This source of financing Despite the present crisis that causes the reduction of available funding making the approval of new projects more competitive, increasing the amount of external funding based on national, European Union and industrial projects still remain an objective of the Unit. The lack of FCT programmatic funding for the current period of activity is causing a significant limitation on the development of some niche areas.

Main Achievements during the year of 2010

Objectives & Achievements

In 2010 the unit carried out 37 research projects and 5 industrial contracts, involving a global funding for this year (unit component alone) of over 890.7 k€. These projects were mainly financed by public agencies (some with private co-funding: 397.5 k€; 45%) but also by private companies (around 6% of total funding). The direct funding by FCT to the center represents 13% of the 2010 budget.

Regarding the scientific output, 48 papers in international journals, 13 in books and 102 communications in international conferences were published, and 4 patents and 3 prototypes were disclosed. One book (Portuguese edition) has been produced. 2 PhD and 54 MSc thesis have been concluded in 2010. By the end of the year 24 PhD and over 30 MSc students were carrying out research in the Unit, including 4 PhD students that are enrolled at other international institutions. Sustained international collaboration occurs with various European countries, the USA, Japan and Brazil.

It should be referred that the number of projects, publications and training that result from collaborative work within the Centre is growing and occurs with all the groups: in 2010, 9 publications and 4 thesis resulted from this trend.

Concerning internationalization:

- The FunMat&SP group organized the 11th Int Symposium on Multiscale, Multifunctional and FGM's (Guimarães, 26-29 September, 2010)
- Members of the DMS group (P Claro, JL Alves, P Flores) integrate a large team involving 10 institutions of 7 countries that put together an European project in the study, development and implementation of a new type of spinal disk prosthetics implants. This project was approved in 2010 and will start in 2011.
- J L Alves continued his prestigious collaboration with the Riken Institute (Tokyo, Japan) as invited scientist, under the VCAD Systems Research Program. He performed research work in materials design and in the development of finite element codes for biomechanics for a period of 15 weeks in 2010.
- F Castro integrated the evaluation panel of the European Eco-Innovation Programme.
- J Martins has acted as international expert for the FP7, having evaluated projects for the program 'Information and Communication Technologies for the Fully Electric Vehicle'.
- J C Teixeira integrates the Steering Committee of the European Technology Platform on Renewable Heat & Cooling.
- Eduardo Ferreira integrates the European pellet Council
- JCF Teixeira and E Ferreira participate in the Portuguese technical committee for the review of standards in heat and cooling in buildings.
- Researchers of the unit acted as reviewers for 36 international journals and conferences.
- Members of the unit belong to the editorial board of 6 international journals.

In 2010, the quality of research was recognized by the award of scientific prizes: a) Sónia Costa was awarded the 2010 SPM (Portuguese Materials Society) prize for her MSc thesis; b) Fernando Oliveira, the 2010 Engineering School prize for the best MSc thesis; c) André Castro – special honor "Nunes Correia Verdades de Faria", in section B, "PROGRESSO DA MEDICINA NA SUA APLICAÇÃO ÀS PESSOAS IDOSAS", with his thesis in Biomedical Engineering "Development of a new femoral component of patellofemoral prosthesis".

Paulo Flores was awarded the special honor for a young researcher by the Portuguese Applied and Computational Mechanics Society.

F.S. Silva - Research Award for outstanding, creative or innovative insight in research for the jewelry industry, Santa Fe Symposium, Albuquerque – New Mexico, 2010

Activities

Integrative/multidisciplinary activities during the year of 2010

The multidisciplinary activity of the unit is present in the research projects in which it is involved. These projects are carried out with the collaboration of research groups within the unit, with groups of other national and international institutions, and with the industry. Some key aspects:

- Collaboration projects involving researchers from more than one research group of the unit are progressively gaining more importance. As an example, two externally funded projects in the area of biomass combustion systems include researchers of the DMS and the E&ETech groups, as well as researchers from IST-Technical University of Lisbon. In general, joint publications and training now occurs across all the groups.
- Also, work on fluids in biomechanics involves the collaboration of the DMS and the E&ETech groups. It is focused on both the dynamics of blood flow and respiratory systems, being based on MSc and PhD projects. These projects have also the collaboration of public health institutions, namely the hospitals of Braga and Gaia.
- The FMG and EET groups elaborated a preliminary report for the Bosch group evaluating the research opportunities for the development of novel systems for water heating. Currently, discussions are being carried out for the development of this initiative into an extensive R&D partnership.
- A large project on "Assessment and development of integrated systems for electric vehicles" involving researchers from centres in three major Portuguese universities was launched. The project is financed by the MIT-Portugal/EDAM Programme, being coordinated by a member of the unit. It includes scientific skills on automotive design, power electronics and control, environmental engineering, materials engineering and development of efficient IC engines.
- The ongoing work on biomaterials for dental restorations and dental implants involves multidisciplinary teams from the areas of materials science, medicine, biology, mechanical engineering, physics and chemistry. A network of Dental Schools from Portugal, Belgium, Brazil, USA and Japan is being created to support this activity.
- Members of the unit in conjunction with the Center for Residues Valorization (CVR) and the industrial company W2V, S.A., putting together existing knowledge on extraction metallurgy, waste management and chemical technologies. This spin off was initiated in 2009 and, currently, a few projects are partnered through this route.
- Members of the unit continued their participation in three other projects coordinated by private companies (UNICER, Deroovo and Decorgel) also financed by QREN. These projects are concerned with the design and development of product goods and equipment for the food industry, involving researchers from other research centers of Minho University.
- Unit members from two groups participate in a project funded by two industrial companies (W2V, S.A. and Indutex, S.A.) aimed at developing a process to recover chlorine from PVC mixed plastic wastes, and recover energy by pyrolysis gasification route.
- An interdisciplinary laboratory has been created to respond to industrial solicitations. It is dedicated to the development of scientific and technological solutions in the fields of functionalized materials and surface coatings. It includes researchers of the FMat&SP group of CT2M and of the coatings group of the Physics Research Centre of Minho University.

Activities

Outreach activities during the year of 2010

Unit members have participated in actions and events directed to the general public, calling their attention to the benefits of science and innovation and to the contributions of this Unit in specific areas of knowledge. Other actions were intended to foster the motivation of young secondary school students to the academic courses in which members of the Unit are involved.

The main activities carried out in 2010 are as follows.

i) Visits of high school students to the laboratories of the Unit. These visits, involving around 200 students from various schools in the region, were organized by the University with the support of members of the Unit. The visits started with the exhibition of a short video film (of about 20 minutes), showing mechanical engineering applications in day-to-day life. Students were then guided on a tour through the laboratories, where specific demonstrations were staged to highlight the relevance of physics and engineering.

ii) In 2010, the Head and the Vice-Head of the Master Course on Mechanical Engineering took part in the "Fair of Professions", Secondary School of Caldas de Vizela (March), and EB 2/3 School of Celeirós, Braga (May). (In the Secondary School of Caldas de Vizela, an oral presentation has been given, regarding the master course on Mechanical Engineering).

iii) In the context of our involvement in the development of electric vehicles' studies, it has been possible to motivate the local municipality towards the promotion of urban mobility. This shall be materialized during the European Capital of Culture Event (Guimarães, 2012). This partnership also includes a sponsorship for the participation of the University of Minho in two international events with a low consumption vehicle. This prototype involves the participation of undergraduate students.

iiii) The interdisciplinary laboratory previously referred has protocols with an University Design School (ESAD-Escola Superior de Artes e Design – Matosinhos, Portugal) and with a group of companies (8 companies). In the framework of these protocols company employees and design students join in the lab in order to do a collaborative work. The aim is to link research, design, and production.

v) Members of the unit (indicated by the institution and subsequently designated by the court) acted as experts in around a dozen criminal court cases, mainly involving the analysis and simulation of road traffic accidents and structural analysis of equipment (P Claro, J Martins, J Meireles, AM Pinho, L Martins)

vi) Unit members (JC Teixeira, E Ferreira) participated on the technical workshop "Salão das Energias Renováveis e do Meio Ambiente", organized by the Association of Commerce of Braga (November). Talks were delivered on renewable technologies and refrigeration systems.

viii) Various workshops and invited speeches have been organized throughout 2010.

Funding

	2008	2009	2010
LA FCT	0,00	0,00	0,00
Units FCT	0,00	107.250,00	113.093,00
Projects FCT	231.000,00	294.141,00	315.273,00
Other (National)	246.000,00	392.103,00	397.482,00
Other (International)	0,00	13.187,00	7.000,00
National Industry	19.700,00	50.933,00	49.500,00
International Industry	0,00	0,00	8.330,00
	496.700,00	857.614,00	890.678,00

General Indicators

	2006	2007	2008	2009	2010	Total
No. of Researchers Proposed	0,00	0,00	0,00	0,00	0,00	0,00
No. of Researchers Hired (LA)	0,00	0,00	0,00	0,00	0,00	0,00
Balance	0,00	0,00	0,00	0,00	0,00	0,00
No. of Researchers Hired (Ciência Programme)	0,00	0,00	0,00	0,00	0,00	0,00
No. of Researchers integrated with PhD	26,00	25,00	27,00	29,00	31,00	
Training Masters (Master thesis completed)	2,00	16,00	44,00	42,00	0,00	104,00
Training PhDs (PhD thesis completed)	3,00	0,00	3,00	7,00	2,00	15,00

Researchers Hired

Name	Start Date	End Date	Other Institution
No researchers found...			

Technical Personnel Hired

Name	Start Date	End Date	Other Institution
No technical personnel found...			

Additional Comments

Research Groups

Reference	Title / Principal Investigator
RG-Norte-4077-327	<u>Functionalized Materials and Surfaces Performance</u> (Luis Augusto Sousa Marques da Rocha)
RG-Norte-4077-329	<u>Energy and Environmental Technologies</u> (José Carlos Fernandes Teixeira)
RG-Norte-4077-1400	<u>Mechanical Systems Dynamics</u> (José Carlos Pimenta Claro)

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Group Description

Title of Research Group:	(RG-Norte-4077-327) Functionalized Materials and Surfaces Performance
Principal Investigator:	Luis Augusto Sousa Marques da Rocha
Main Scientific Domain:	Ciências e Engenharia de Materiais
Group Host Institution:	Universidade do Minho

Funding, source, dates

Funding, source, dates

The absence of definition on the FCT programmatic funding (not yet decided by FCT, since 2008) and the lack of the financial support contracted by FCT for the year 2008, but not yet available, are strongly affecting the activity of the group. In fact, the 2 post-doc researchers considered for the programmatic funding are still considered as vital, essentially because the Centre could not participate (because of the delay of the evaluation process of the Centre) in the "Compromisso com a Ciência" Programme that ran in 2008 and 2009 with the aim of contracting 1000 post-doctoral researchers for the National Science and Technology System. Also, the 70,000 € requested for equipment (most of it intended for integrative research activities within the Centre, being unique in Portugal) is fundamental for further development of the group.

During 2010 the total amount financial support for the activities of the group was of 292.4 k€. Sources were: FCT pluriannual funding (16%); FCT projects (67%); Industrial contracts (17%).

Details on running projects: www.ct2m.uminho.pt.

Objectives & Achievements

Objectives

In 2008, the FCT Evaluation Panel recognized the great scientific potential of the group. As referred in the evaluation report, the activities of the group are focused, resulting in an appreciable scientific production. On the other hand, the need of raising the scientific activity and visibility at an international level were pointed out by the evaluation panel. Thus, the focal point of the strategic evolution of the group is focused in the increase of its international visibility.

Keeping in mind its specific competences, the main scientific objectives of the group are:

1. Development of innovative technologies for the production of functionalized materials/surfaces based on casting, powder, and/or thin film/surface modification technologies. Emphasis is put on the exploitation of the capabilities of the techniques to produce micro-nano spatial gradations;
2. Development of transition/graded joints of dissimilar materials, aimed at producing "smart interfaces" capable of fulfilling specific functions;
3. To give a step forward on the knowledge of the mechanisms involved in the tribocorrosion and fatigue-corrosion of functionalized materials;
4. To develop computational materials science tools to predict materials properties in functionalized materials.

The challenges for the coming years are:

- To improve the synergies within the group and with other groups of the Centre. The group has a multi-disciplinary composition (Mechanical, Materials and Biomedical Engineering, Physics, Chemistry, etc.), which constitutes an added value for its activities. Links with the DMS group appear more and more as natural. Furthermore, a good balance between fundamental and applied research exists and should be kept.
- At the national level the group is already a leading group in the areas of FGM's Processing Technologies and on the Tribocorrosion Behavior of Materials. The international visibility in those areas is being further improved through the effort in participation in European Networks (research projects, networks of excellence, etc.), and through the organization of relevant International Conferences, Workshops or Advanced Courses.
- To increase both the quality and the quantity of the scientific production. A publication policy was adopted in 2007, in which a number of journals of high impact factor and the participation in international conferences considered as the most important in the field of actuation of the group were selected. This policy continues to be pursued. The target of 2.5 papers in SCI journals/PhD is nearly achieved, although it is our expectation to improve on this.
- To get additional funding (public and industrial) through the application to National, and particularly, European projects;
- To strength cooperation with Industry, improving technological transfer actions;
- To promote high-level education of human resources, at the MSc and PhD levels;
- To attract permanent researchers, namely doctoral and post-doctoral researchers.

As referred above a strong strangle for an efficient achievement of some of the referred objectives is the indecision on the attribution of programmatic funding by FCT.

Main Achievements

In terms of scientific achievements the following should be highlighted:

Activities concerning the development of specific (some unique) technologies for the production of bulk functionally graded materials (FGM's) have continued. Particular reference should be made to the techniques related with incremental melting and solidification, induction assisted centrifugal casting, ultrasonic energy and powder metallurgy. Other technologies, for surface treatment/functionalization of materials were also developed with success. These activities resulted in several publications and on the implementation of consortium of 8 jewelry companies for research and technology transfer (back in 2009). This work was recognized by a prestigious international prize awarded in (Research Award for outstanding, creative or innovative insight in research for the jewelry industry, Santa Fe Symposium, Albuquerque – New Mexico, 2010). F Silva, presented his work at the fair "Feira Ourindústria", in Gondomar, Portugal on May 7th, 2010. Additionally, joining of γ -TiAl based alloys, either to themselves or to other metallic materials, by brazing techniques was also investigated.

Objectives & Achievements

New activities have started on the production and characterization of Al-based functionally graded materials reinforced with nano-particles (carbon nanotubes and SiC nano-particles). Scientific fundamental research on the corrosion and tribocorrosion behavior of Al-based composites and FGM's was also carried out, with the first results starting to be published in 2010.

Work in the field of biomaterials is gaining a further boost. A significant part of the research activities have been directed for applications related with dental restorations and medical implants. Activities are focused on the application of the FGM concept for the development of new restorative materials and on the functionalisation of the surface of Ti and Ti alloys for dental implants, as well as on the tribological characterisation of new cartilage replacing materials. International and national collaborations on this field have significantly increased in 2010, involving multi-disciplinary teams from areas such as Materials Science, Medicine, Biology, Mechanical Engineering, Physics and Chemistry. Relevant publications in the field appeared in 2010. Furthermore, the group organized in September 2010 the 11th International Symposium on Multiscale, Multifunctional and Functionally Graded Materials (M&MFGM 2010), one of the most important world events in the area of the FGM's. Because a sizable share of I&D activities fitted within the main topics of the Conference, there was strong involvement of the group.

Two young researchers were distinguished by scientific prizes: a) Sónia Costa – Portuguese Society Materials (SPM 2010) for the best thesis in Materials Engineering and b) Fernando Oliveira – best masters thesis by the school of engineering (University of Minho).

Work on the investigation of the tribological behavior of materials has continued. From 2003 a strong emphasis was put on the investigation of the tribocorrosion mechanisms of FGM's and dental materials. Significant advances were achieved in this area, either through publications, participation in international advanced courses on Biotribocorrosion, and participation in European projects proposals.

A huge effort has been continued in preparing proposals to international programs (either FP7, or bilateral cooperation with other countries). In 2010 there were no proposals submitted to FCT. In this context one should refer the growing importance of industry based funding (3 projects) with a combined budget of 99,000 €. Currently, there are an additional 8 projects with a combined funding of 590,000 €.

The group has been gaining visibility outside as confirmed by the growing number of foreign students (4 in 2010) that carry out part of their work in our facilities.

The number of publications in SCI journals was of 23, giving a ratio of 2.3 papers in SCI journals/PhD (1.6 in 2009). The effort of publication in journals of higher impact factor continued in 2010. The number of publications in international conferences amounted to 29. Members of the group were invited to give lectures in 6 major international conferences.

Regarding training, a reasonable number of post-graduate, 14 MSc and 1 PhD students completed their thesis within the group.

The group has been involved in the scientific committees of various conferences and is actively organizing the Materials 2011-6th International Materials Symposium that will be held in Guimarães.

Details on the scientific outputs can be found at <http://www.ct2m.uminho.pt>.

Group Productivity

Publications in peer review Journals

* G. Chirita, I. Stefanescu, D. Soares and F. Silva, On the ability of producing FGMs with an AlSi12 aluminium alloy by using centrifugal casting, *Int. J. Materials and Product Technology*, Vol. 39, Nos. 1/2, 30-43, 2010.

* L. Mazare, G. Miranda, D. Soares and F. Silva, Influence of solidification rates on a Directional Solidification process for the Production of Functionally Graded Materials, *Int. J. Materials and Product Technology*, Vol. 39, Nos. 1/2, 44-58, 2010.

* Gueorgui P Vassilev, V Gandova; Delfim Soares, Kristina Lilova, Jean-Claude Tedenac, Phase equilibria in the system Sn-Zn-Ni, Submitted to *Journal of Alloys and Compounds* (2010).

* F. Gomes, H. Puga, J. Barbosa, S. Ribeiro - Effect of melting pressure and superheating on chemical composition and contamination of ceramic crucible induction melted titanium alloys. *Journal of Materials Science*. In press.

* H. Puga, Joaquim Barbosa, J. Gomes, E. Seabra, S. Ribeiro – Evaluation of ultrasonic aluminium degassing by piezoelectric sensor. *Journal of Materials Processing Technology*. In press.

* F. Mendes, J. Barbosa, G. Santos - Certification an Integration of Management Systems – the experience of Portuguese SMEs. *Journal of Cleaner Production*. Submitted.

* H. Puga, J. Barbosa, S. Ribeiro – Influence of ultrasonic melt treatment on microstructure and mechanical properties of A380 aluminium alloy. *Journal of Materials Processing Technology*. Submitted.

* A.C. Vieira, A.M.Pinto, L.A. Rocha, S. Mischler, "Influence of Cu phases size distribution of age-hardening Al-Si-Cu-Mg alloys on corrosion behaviour under mass transport conditions", accepted for *Eletochimica Acta*.

* J.C.M Souza, M.C.R. Henriques, D.R. Oliveira, W. Teughels, L.A. Rocha, J.P. Celis. Biofilms inducing ultra-low friction on titanium. *Journal of Dental Research*, 89 (2010), 1470-1475.

* S. Kanagaraj, M.T. Mathew, A. Fonseca, L.A. Rocha, M.S.A. Oliveira, J.A.O. Simões, Tribological characterization of carbon nanotubes/ultrahigh molecular weight polyethylene composites: The effect of sliding distance, *International Journal of Surface Science and Engineering*, 4 (2010) 305-321.

* M.T. Mathew, E. Ariza, L. A. Rocha, F. Vaz, A.C. Fernandes, M. M. Stack, Influence of electrode potentials and load on the tribocorrosion behaviour of TiCxOy multi-functional thin film in simulated bio-fluid: mechanisms, maps and synergism, *Electrochimica Acta*, 56 (2010) 929-937.

* M.T. Mathew, J. Novo, J. Covas, L.A. Rocha, J.R.Gomes, Tribological, rheological and mechanical characterization of polymer blends for ropes and nets, *Tribology International*, 43 (2010) 1400-1409.

* J.C.M Souza, M.C.R. Henriques, D.R. Oliveira, W. Teughels, L.A. Rocha, J.P. Celis. Do oral biofilms influence the biotribocorrosion behavior of titanium? *Biofouling*, 26 (2010) 471-478

* T. Cadavez, S.C. Ferreira, P. Medeiros, P.J. Quaresma, L.A. Rocha, A. Velhinho, G. Vignoles – A graphical tool for the tomographic characterisation of microstructural features on metal matrix composites, *Int. J. of Tomography & Statistics*, 14 (2010) 3-15. * S.C. Ferreira, A. Velhinho, R.J.C. Silva, L.A. Rocha - Corrosion behaviour of aluminium syntactic functionally graded composites, *Int. J. Materials and Product Technology*, 39 (2010) 122-135

* Costa, N., Silva, F.S. (2010). On a new temperature factor to predict the fatigue limit at different temperatures. *International Journal of Fatigue*, in Press.

* F.S. Silva, George Chirita, Nuno Costa, Ioan Stefanescu, Delfim Soares (2010). Guidelines for Establishment of Correlations Between Mechanical Properties and Microstructure in Al-Si alloys. *Materials Science and Technology*, in Press.

Group Productivity

- * G. Chirita, I. Stefanescu, D. Cruz, D. Soares, F.S. Silva, Sensitivity of different Al-Si alloys to centrifugal casting effect, *Materials & Design*, Elsevier, 2010
- * N. Costa, N. Machado, F.S. Silva, A new method for prediction of nodular cast iron fatigue limit, *International Journal of Fatigue*, Elsevier, 2010
- * Raimond Grimberg, Adriana Savin, Filipe Silva, Paul Doru Barsanescu, Petrica Daniel Salavastru, Rozina Steigmann, Degradation of CFRP with woven fabric reinforcement and PPS as matrix due water action, *Buletinul Institutului Politehnic Din IASI, Tomul LVI (LX), Fasc. 4*, 2010
- * M. Buciumeanu, L. Palaghian, A.S. Miranda, F.S. Silva, Fatigue life predictions including the Bauschinger effect, *Int Journal of Fatigue*, 33(2011), 145-152. Accepted.
- * M. Amaral, C.S. Abreu, A.J.S. Fernandes, F.J. Oliveira, J.R. Gomes and R.F. Silva, Nanodiamond-based tribosystems, *Surface and Coatings Technology*, Volume 204, Issues 12-13, 15 March 2010, Pages 1962-1969
- * M. Amaral, C.S. Abreu, A.J.S. Fernandes, F.J. Oliveira, J.R. Gomes, R.F. Silva "Nanodiamond-Based Tribosystems", *Surface & Coatings Technology* 204 (2010) 1962-1969.

Other international publications

- * D. Soares, et al, On the ability of the incremental melting and solidification process to produce gradient castings (oral presentation), 11th International Symposium on Multiscale, Multifunctional and functionally Graded Materials, 26-29 September, Guimarães, 2010.
- * G. Chirita, et al, On the assessment of processing variables (centrifugal pressure, vibration and fluid dynamics) on gradients of obtained castings (oral presentation), 11th International Symposium on Multiscale, Multifunctional and functionally Graded Materials, 26-29 September, Guimarães, 2010.
- * C. Carneiro, et al, Development and characterisation of transparent thin films for applications in jewellery (poster presentation), 11th International Symposium on Multiscale, Multifunctional and functionally Graded Materials, 26-29 September, Guimarães, 2010.
- * O. Carvalho, et al, Processing and shear stress evaluation of functionally graded composites with different gradient profiles (oral presentation), 11th International Symposium on Multiscale, Multifunctional and functionally Graded Materials, 26-29 September, Guimarães, 2010.
- * B. Henriques, et al, Mechanical performance of graded metal ceramic interfaces obtained by powder metallurgy (oral presentation), 11th International Symposium on Multiscale, Multifunctional and functionally Graded Materials, 26-29 September, Guimarães, 2010.
- * D. Soares and F. Silva, Incremental Melting and Solidification Process, "Short Course on FGM: An integrated Approach", 25 September 2010, Guimarães, Portugal, 11th International Symposium on Multiscale, Multifunctional and Functionally Graded Materials.
- * E. Seabra, et al - Study, design and development of a vacuum furnace to perform pressure diffusion welding of lightweight alloys. *Actas do XIV International Congress on Project Engineering*, Madrid, Junho 2010.
- * F. Gomes, J. Barbosa - Application of the FGM concept to the production of multilayer melting crucibles for reactive alloys. 11th International Symposium on Multiscale, Multifunctional and Functionally Graded Materials, Guimarães, Setembro 2010.
- * A. Guedes, et al, Brazing Ti-47Al-2Cr-2Nb to Inconel 718 with Different Filler Alloys: Microstructural Characterization of the Interfaces, 63rd Annual Assembly & International Conference of the International Institute of Welding, 11-17 July 2010, Istanbul, pp. 353-359.
- * Seabra E, et al., "Design and Development of a Tribometer for Dental Applications", *Selected Proceedings from the 13th International Congress on Project Engineering*, Edited by AEIPRO (Spanish Association of Project Engineering, ISBN-13: 978-84-614-0185-7, pp. 391-400, 2010.
- * Seabra E, et al, "Design and Development of a Centrifugal Casting Machine for Pistons Production", *Selected Proceedings from the 13th International Congress on Project Engineering*, Edited by AEIPRO (Spanish Association of Project Engineering, ISBN-13: 978-84-614-0185-7, pp. 401-408, 2010.
- * Seabra, E, et al, Design and Development of a Vacuum Furnace to Perform Pressuring Diffusion Welding of Lightweight Alloys, *Proceedings of XIV International Congress on Project Engineering*, Madrid, Spain, June 30 July 1-2, 2010, 10p.
- * J.L. Lopes, et al "Tribological Properties of Bacterial Cellulose in Reciprocating Sliding Against Bovine Articular Cartilage", *Proceedings of the 14th Nordic Symposium on Tribology - NORDTRIB 2010*, CD-ROM: ISBN 978-91-7439-124-4, 8 páginas, Storforsen, 2010.
- * C.S. Abreu, et al "Chromium sculptured thin films: tribological evaluation under macro- and micro-testing conditions", *Proceedings of the 14th Nordic Symposium on Tribology - NORDTRIB 2010*, CD-ROM: ISBN 978-91-7439-124-4, 8 páginas, Storforsen, 2010.
- * J.R. Gomes, et al "Tribological Performance of Bacterial Cellulose-Articular Cartilage Systems: Influence of Loading Conditions in Simulated Synovial Fluid", 1st International Brazilian Conference on Tribology – TriboBR 2010, Rio de Janeiro, RJ, Brasil, Novembro de 2010, p.4.
- * J.R. Gomes, et al "Mechanical and Tribological Evaluation of Osteochondral Devices: a in vivo Study", 1st International Brazilian Conference on Tribology – TriboBR 2010, Rio de Janeiro, 2010.
- * C.S. Abreu, et al, "Tribological behaviour of glancing angle deposited chromium thin films under micro-testing conditions", *First International Brazilian Conference on Tribology*, 24-26 November, 2010, Rio de Janeiro, Brasil
- * A. Guedes, et al, Brazing Ti-47Al-2Cr-2Nb to Inconel 718 with Different Filler Alloys: Microstructural Characterization of the Interfaces, 63rd Annual Assembly & International Conference of the International Institute of Welding, 11-17 July 2010, Istanbul, pp. 353-359.
- * A.C. Alves, et al - Multifunctional Ti oxide-based films for biomedical applications, *CIMTEC 2010*, Montecatini Terme, 2010
- * A.C. Vieira, et al - Corrosion and tribocorrosion behaviour of age-hardened functionally graded Al-SiCp composites, *MM&FGM 2010*, Guimarães, 2010
- * P. Capela, et al - Investigation of the effect of surface films on the tribocorrosion behavior of a Ni-30%Cr alloy, *MM&FGM 2010*, Guimarães, 2010
- * S.C. Ferreira, et al - Electrochemical characterization of anodic films formed on different Al/SiCnp substrates – A basis for fgm constitution, *MM&FGM 2010*, Guimarães, 2010
- * M.T. Mathew, et al, Mapping Tribocorrosion Behaviour of ZrOxNy Nano-Structured Thin for Decorative Applications, *ICMCTF 2010*, San Diego
- * L.A. Rocha, et al - Functionalization of Ti surfaces for biomedical applications, 2nd International Symposium on Advanced Plasma Science and its Applications for Nitrides and Nanomaterials, March 7-10, 2010, Meijo University, Nagoya (invited communication)
- * S.C. Ferreira, et al - Characterization of anodic oxide film on Al/SiCnp metal matrix composites, *MPA 2010*
- * A.C. Vieira, et al - Tribocorrosion behaviour of age-hardened Al alloys and functionally graded Al-SiCp composites, *TriboBR 2010*
- * A.C. Alves, et al - Tribocorrosion of functionalized titanium surfaces for biomedical applications, *TriboBR 2010*
- * H. Cruz, et al - Tribological behaviour of oral mixed biofilms, *Biofilms 4 International Conference*

Group Productivity

- * Silva, F.S On the Use of an Induced Solidification Process Based on Mould Thermal Gradients to Reduce Casting Defects', Santa Fe Symposium, Albuquerque. USA, 2010
- * Silva, F.S An Induced Solidification Process to Reduce Casting Defects Jewelry Technology Forum Vicenza, 2010

Other national publications

Technical report

- * Silva, FS; Teixeira, JCT; Barbosa, JJ; Soares, D (2010) "Reduzir em 10% o custo em cobre de câmara de combustão", Bosch technical report - proposal for a joint research partnership

National Conferences

- * Chirita, G., Soares, D., Silva, F.S., Correlation between mechanical properties and microstructure in an Al-7%Si Alloy, 8º Congresso Nacional de Mecânica Experimental, Guimarães, Portugal, Abril 2010
- * Costa, N.; Silva, F.S. Evaluation of Murakami and De Kazinczy models on prediction of high strength nodular cast iron fatigue limit, 8º Congresso Nacional de Mecânica Experimental, Guimarães, Portugal, Abril 2010
- * Henriques, B. 1; Soares, D.1; Silva, F.S. RESISTANCE EVALUATION OF A METAL-CERAMIC DENTAL FUNCTIONALLY GRADED RESTORATION, 8º Congresso Nacional de Mecânica Experimental, Guimarães, Portugal, Abril 2010
- * O. Carvalho, D. Soares, F.S. Silva, Optimization of sintering temperature and compaction pressure of stainless steel/SiC composites, 8º Congresso Nacional de Mecânica Experimental, Guimarães, Portugal, Abril 2010
- * Silva, F.S. A Inovação na Joalheria: Tendências e Oportunidades, Ourindústria, Gondomar, 07 Maio 2010

National Journals

- * H. Puga, Joaquim Barbosa, S. Ribeiro, S. Costa – Afinação de grão da liga de alumínio A356 por ultra-sons. Fundição 256 (2010) 13-18.
- * H. Puga, Joaquim Barbosa, S. Ribeiro - Afinação de grão e modificação do silício eutético da liga A356 por ultra-sons. Fundição 258 (2010). 9 – 13.

Ph.D. thesis completed

Phd:

- * Júlio César Matias de Souza, Programa Doutoral em Engenharia Biomédica, Universidade do Minho. Título: Comportamento bio-tribo-corrosivo de sistemas metal-cerâmicos dentários em diferentes meios de simulação oral. Supervision: Luís A. Rocha and Jean-Pierre Celis (KULeuven, Belgium), Mariana Henriques (DEB). 2010

Patents/prototypes

Patent:

n/a

Prototype:

n/a

Organization of conferences

11th International Symposium on Multiscale, Multifunctional and functionally Graded Materials, Guimarães, 26-29 September 2010

- * Luís A. Rocha and Ana Maria Pinto: Chairs to the Organizing Committee VI International Materials Symposium MATERIAIS 2011 and XV Meeting of SPM - Sociedade Portuguesa de Materiais, Universidade do Minho, Abril 2011.
- * Luís A. Rocha: Organizing Committee EUROCORR 2013
- * Filipe Samuel Silva: Organizing Committee 11th International Symposium on Multiscale, Multifunctional and functionally Graded Materials, Guimarães, 26-29 September 2010
- * Luís A. Rocha: Organizing Committee 6as Jornadas da Revista de Corrosão e Protecção de Materiais, Novembro 2011.
- * Filipe Samuel: Organizing Committee 8º CNME - Congresso Nacional de Mecânica Experimental, Universidade do Minho, Guimarães, 09-10 Oct. 2010
- * Filipe Samuel; Delfim Soares: "Short course on FGM Processing Techniques: An integrated Approach", 25 September 2010, Guimarães, Portugal (no âmbito da 11th International Symposium on Multiscale, Multifunctional and functionally Graded Materials).

Industry contract research

- * Project - Development of SiO₂ based refractories for the foundry industry using national raw-materials; coordinator: Geoinertes, Lda; Project IAPMEI (vale I&DT); starting date: Aug 2009; closing date: Aug 2010; Budget: 33,000 €.
- * Project - Componentes de Ouriversaria/Joalheria pela tecnologia de sinterização de pós, Filipe Silva, Delfim Soares, Filipe Vaz, Paulo Pinto, CT2M and Fernando Rocha Joalheiro, Lda, Vale I&DT n.º 2009/6471, Sept. 2009 through Feb. 2010. Budget: 33,000 €.
- * Project - Novos efeitos estéticos em peças de joalheria obtidos pelo método de fusão e solidificação incremental, Filipe Silva, Delfim Soares, Filipe Vaz, Paulo Pinto, CT2M e Ouronor, Lda, Vale I&DT n.º 2009/6499, Sept. 2009 through Feb. 2010. Budget: 33,000 €.

Internationalization

- * U. Galati (Romania) – PhD supervision
- * U. IASI (Roménia) – PhD supervision

Group Productivity

- * Aalto University Foundation (Finland) – PhD supervision
- * École Centrale de Paris, France – exchange.
- * Katholieke Universiteit Leuven, Belgium – exchange.
- * École Polytechnique Fédérale de Lausanne, Switzerland – exchange.
- * CENIM - Centro Nacional de Investigaciones Metalúrgicas, Spain – exchange.
- * TEKNIKER, Spain – Project
- * Universidad Politecnica Valencia, Spain – Project
- * University of Strathclyde, Glasgow, Scotland – joint research.
- * Universidade Tecnológica Federal do Paraná, Curitiba, Brazil – joint publication
- * Faculdade de Odontologia de Araraquara, UNESP, Brasil – Exchange and joint research
- * Faculdade de Odontologia de Ribeirão Preto, USP, Brasil – Exchange
- * RUSH University Hospital, Chicago, USA – exchange and joint publication
- * Indian Institute of Technology Guwahati, Department of Mechanical Engineering, North Guwahati, Índia: project application in program Portugal-Índia 2010-12.
- * Universidade Estadual de Campinas, UNICAMP, Campinas, Estado de São Paulo, Brasil. Joint project (application).
- * Universidade de Vigo. Joint research.
- * EU COST 602: "Advanced Solder Materials for High Temperature Application", (2007 – present day).
- * Group Project: "Design, process and control in a multiscale domain of Cu-Ni-X-Y (X, Y=Sn, Bi, Zn) based alloys" (EU COST 602: "Advanced Solder Materials for High Temperature Application"); 2007 – present day.
- * Université de Neuchâtel, Neuchâtel, Switzerland – joint research and publication
- * University of Idaho, USA - joint research
- * Brno University of Technology, Czech Republic – joint research
- * Azterlan – Centro de Investigacion Metalurgica, Bilbao, Spain – joint research
- * Sodecia – Centro Tecnológico, Portugal – joint research
- * Alcan – Grenoble, França – joint research
- * Insertec Hornos e Refractarios – Bilbao, Spain – joint research
- * Alucast - Czech Republic - joint research

Government/Organization contract research

- * Project - Desenvolvimento de uma nova técnica de fundição de ligas de alumínio de alta resistência para aplicações no âmbito da biomecânica e nas indústrias automóvel e aeronáutica – PTDC/EME-TME/64663/2006; partners: UM (coordinator), FEUP; starting date: June 2007; closing date: May 2010; Budget: 45,000 €.
- * Project - PTDC/CTM/60645/2006, "Nano-Brazing of Advanced Materials", (FEUP, UM, IST, FCTUC), FEUP (Coordinator), UM, IST; starting date: Oct 2007; closing date: Dec 2010; Budget (2010): 7,200 €.
- * Project - PTDC/CTM/68160/2006 - Surface modification vs. tribocorrosion mechanisms and cytotoxicity in Ti and Ti alloys for dental applications; UM (coordinator), IST; budget: 120,000 €; starting date: Jan 2008; closing date: Dec 2010; Budget: 120,000 €.
- * Project - PTDC/CTM/67500/2006 - Metal/porcelain interfaces for restorative dentistry: A new approach including improvement of tribo-corrosion properties, modelling and simulation of physicochemical and mechanical behaviour and biocompatibility studies; R&D team: UM/CT2M; coordinator: Edith Ariza and Luís A. Rocha; FCT; starting date: 1/03/2008; closure date: 28/02/2011; budget: 132,000 €
- * Project - PTDC/CTM/69362/2006 - POLIFILM - Multifunctional films for flexible and plastic material applications; R&D team: M/CFUM; coordinator: Filipe Vaz (CFUM); Luís A. Rocha (CT2M); FCT; starting date: 1/03/2008; closure date: 28/02/2011; budget: 108,000 €
- * Project - PTDC/CTM/66380/2006 - Smart Composites; R&D team: UNL/UM; Coordinator: Francisco Braz Fernandes (UNL), Luís A. Rocha (CT2M); FCT, starting date: 1/03/2008; closure date: 28/02/2011; Budget: 108,000 € (11,160 €, CT2M).
- * Project - 'Propriedades mecânicas, de desgaste e de fadiga, de compósitos sintrizados, com nano-tubos de carbono e com gradiente de propriedades', Filipe Silva, Buciumeanu Mihaela, CHIRITA GEORGEL MARICEL, Delfim Fernandes Soares, Jorge José Gomes Martins, Jorge Manuel Afonso Antunes, José Luis de Carvalho Martins Alves, José Manuel Ramos Gomes, José Valdemar Bidarra Fernandes, Luis Filipe Martins Menezes, Nuno Miguel Coelho da Costa, Minodora Ripa, PTDC/EME/68664/2006, U. Minho, Filipe Silva, 15 Agosto 2007 – 14 Fev. 2011; Budget: 70,000 €.

FCT Relatório Científico 2010 Print: 04-04-2011 15:33:17 [Centro de Tecnologias Mecânicas e de Materiais]

Group Description

Title of Research Group:	(RG-Norte-4077-329) Energy and Environmental Technologies
Principal Investigator:	José Carlos Fernandes Teixeira
Main Scientific Domain:	Engenharia Mecânica
Group Host Institution:	Universidade do Minho

Funding, source, dates

Funding, source, dates

FCT annual base funding in 2010 – 28.2 k€.

During 2009 there were 17 ongoing granted projects, 12 of them coordinated by the group. The overall budget for them in 2010 was 366 k€.

A summary of the funding is presented below, including the 2010 budget for the group:

Source (projects) Group (2010)

 QREN (10) 236.4 k€
 CCDRN (1) 22.9 k€
 FCT (4) 63.2 k€
 UE (1) 7 k€
 Industry (1) 8.3 k€

TOTAL 337.9 k€

Obs.: for contract/funding details see: 'Industry contract research' and 'Government/Organization contract research', in 'Group Productivity'.

Objectives & Achievements

Objectives

The International Evaluation Panel in 2007, summarized the position of the research group in two levels: reducing dispersion and focusing on W2E. Quoting their recommendation: "Most of the topics covered by this group are very interesting and in-line with societal needs. However, too much scatter weakens their effort. The group should focus their activity on a subset of projects where they are strongest (W2E)".

Following this observation, the group decided to focus its main activities in two key areas: a) waste to energy and b) energy management. Most of the projects fit within this policy and effort has been put in order to coordinate the actions accordingly: post graduate and R&D projects. A close collaboration with the Hospital de Gaia, Hospital S Marcos should be highlighted (joint PhD supervision). A recent partnership has been formulated with the technology center for the shoe industry (Centro Tecnológico de Calçado de Portugal). As far as the resource evaluation and characterization is concerned a partnership with the Universidade Nova de Lisboa and the Escola Superior Agrícola de Coimbra has been established. Also an important cross border collaboration with the north of Spain is being developed for waste characterization. Energy conversion of biomass has been focused in the combustion process for small scale applications and on co-gasification with polymers.

Regarding the international collaboration, it is understood that it is an activity paramount to the group. This has been carried out through two actions: a) the MIT-Portugal program which started in 2008 and b) the collaboration within the AEBIOM (European Biomass Association). From this, the foundations for the participation in the FP7 technology platform since 2009 "Renewable Heat and Cooling" were established. A member of the group has been elected to the steering committee of this platform. The MIT-Portugal program is a cornerstone for the development of energy management systems for the transportation and mobility. This partnership also involves the collaboration of other two leading universities in Portugal (FEUP and IST). At an international level, the development of materials and technical solutions for application in thermal walls is of high relevance. Two projects are worth citing. In late 2009 a project was commenced which aims the development of highly conductive fibers using carbon nanotubes, funded by the EU. Another also aims to develop non fabric textiles for thermal applications is funded by a private company. Currently, other initiatives are being prepared with Europe and Latin America.

Due to continuous involvement in the biomass sector through AEBIOM, a member of the group was invited to be president of the recently founded Portuguese Association of Pellet Producers (ANPEB). In addition, among the European countries the European Pellet Council was created and this member joined the steering committee. This position is important due to its strong connection to the market of solid biomass and we expect to develop several projects in this area in cooperation with private companies.

The development of combustion systems for solid biomass has enabled the initiation of joint research collaboration with a private company.

As far as the publications are concerned it should be registered that the number of publications in journals is still low and unevenly distributed. None the less, the figure is improved and the effort is resulting in various publications submitted to international journals. However, participation in selected events is also an important vehicle for dissemination of the results. For this purpose the participation in international conferences is being focused in selected high profile events.

Collaborative work has been strengthened at various levels. Within the group, as a vehicle to reduce the dispersion of activities. Also inside the center, the collaborative research is being expanded, mostly with the Mechanical Systems Dynamics group. Collaboration has also been improved with other research centers in the University in the field of energy in buildings, energy management and optimization. Collaboration with the IST in the combustion now includes a joint PhD project. A joint proposal for a research partnership with Bosch group has been formulated. Collaboration with the CITEPE research center is also established through various projects. The link has primarily been focused on heat and flow simulation: environmental

Objectives & Achievements

technologies (flow simulation in venturi scrubbers); biomechanics (human comfort, respiratory aiding devices, blood flow) and energy systems (co-generation of small scale systems).

Main Achievements

Human Resources:

- 1 PhD completed
- 21 MSc completed. Various were in collaboration with other groups and institutions.

Research Projects:

There were 17 R&D projects running in 2009, with an overall budget of over 3,000 k€ from various sources. The '09 budget for the group was over 250 k€, an increase over the previous year. Of these, 12 were led by researchers within the group. One was directly financed by an industrial partner. The details regarding these are described in the 'group productivity' item. In 2009 the group was involved in three international projects. Further work in being done in order to prepare and submit work proposals in the near future (2010).

As far as publications are concerned:

In addition to the 1 PhD thesis and 21 MSc thesis that came as the output of the research activities in 2010, the overall scientific production can be summarized as follows: a) editorial coordination of a scientific bulletin, published twice a year: "Valorização de Resíduos", ISSN 1647-2780, Ed: MCLG Vilarinho; b) publication of a book of proceedings; c) 8 papers in international journals and books; d) 13 in International conferences with peer review; e) 1 in National conferences; f) 5 in national journals; g) the edition of a proceedings book.

The group has organized three one-day technical workshops. In addition the 1st edition of the Iberian Congress on Solid Biofuels was held in Pontevedra, Spain. This is a joint event with the University of Vigo and in 2011 the event will take place in Guimarães. Various talks regarding the use of biomass and renewable energies have been given at various fora. It should be referred the participation in the scientific committees of two conferences and as reviewers to scientific journals: ASME; Chemical Engineering Processing; Biomass and Bioenergy. One member is member of the editorial board of /International Journal of Materials Engineering Innovation/, published by Interscience Enterprises, Ltd.

F Castro is member of the evaluation panel of European Programme Eco-Innovation, 2010. J Martins acted as an expert in the evaluation panel of the FP7 "Energy and Transport".

In addition:

- a) Consultancy to various companies (Riocer - Cerâmica do Rio, Lda. Tempo Magnético Unipessoal Lda, Geoinerte Lda, Viganor - Carvalho & C Lda e Savinor - Sociedade Avícola do Norte SA, Globotrilha, a Ambisousa, a Resinorte e a Solinor; Ferespe).
- b) Participation in the Shell Eco Marathon – JIG Martins.
- c) Participation at the technical workshop of the "Salão das Energias Renováveis e do Meio Ambiente", organized by the Associação Comercial de Braga (November 2010).
- d) 3 invited speeches on renewable energy and its use in buildings.

Group Productivity

Publications in peer review Journals

* Araújo, MAVC; Teixeira, JCF; Teixeira, SFCF, (2010) The effect of surface oscillations on the flow patterns near a simulated bed, Coastal Engineering, Volume 57, Issue 7, Pages 684-693.

* Carvalho JM, Araújo J and Castro FA (2010), Alternative low-cost adsorbent for water and wastewater decontamination derived from eggshell waste – an overview, Waste and Biomass Valorization (accepted for publication)

* Lourenço, Paulo B., Fernandes, Francisco M., Castro, Handmade Clay Bricks: Chemical, Physical and Mechanical Properties, International Journal of Architectural Heritage, 4, pp. 38-58, 2010

* Nunes, M.L., Ferreira, A.C, Teixeira, S.F.C.F., Leão, C.P., Silva, A.M, Teixeira J.C.F., Martins, L.A.S.B., Numerical optimization and economic issues in the design of small-scale cogeneration systems, Energy Conversion & Management (submitted).

Other international publications

in Books:

* Oliveira, RF; Teixeira, S; Silva, LF; Teixeira, JC and Antunes, H (2010) Study of a pressurized metered-dose inhaler spray parameters in Fluent. Proceedings of the WCE2010 World Congress on Engineering 2010, 30 de Junho a 2 Julho 2010, London, UK, in Lecture Notes in Engineering and Computer Science, Volume 2184, S I Ao, Len Gelman, David WL Hukins, Andrew Hunter, A M Korsunsky (Eds.), Volume II, p. 1083-1087, International Association of Engineers, ISBN 978-988-18210-7-2.

* Rebelo, R; Oliveira, R; Silva, LF; Teixeira, SFCF; Teixeira, JCF and Antunes, H (2010) Further Developments on the CFD Flow Analysis Inside the Volumatic Spacer Selected Proceedings of the 13th International Congress in Project Engineering, pp 443-451. (ISBN 978-84-614-0185-7)

* Ferreira, ME and Teixeira, FCT – Co-editor of "1º Congresso Ibérico de Biocombustíveis Sólidos". PonteVedra, June 21 through 23, 2010.

* Ribeiro, B, Brito, F and Martins, J, "A Survey on Electric/Hybrid Vehicles", in 'Transmission and Driveline 2010', SAE International Publ., Warrendale, USA, ISBN 978-0-7680-3425-7, pg 133-146, 2010

International Conferences:

* Teixeira, J.C., Lomba, R.S., Lobarinhas, P.M. Seabra, E., Silva, L.S., The Influence of Boundary Conditions on the Natural Ventilation in Buildings, Proceedings of ICEE2010 – International Conference on Engineering Education, Gliwice, Poland, July 18-20, 2010, 8p. (full text)

* Teixeira, JCF; Ferreira, R and Ferreira, MEC (2010) Optimization of a small scale pellet boiler, Proceedings of the ASME International Mechanical Engineering Congress & Exposition. 12 – 18 de Novembro 2010, Vancouver, British Columbia, paper IMECE2010-39263. (ISBN 978-0-7918-3891-4)

Group Productivity

- * Oliveira, RF, Teixeira, JC, Teixeira, SF, Silva, LF, Antunes, H (2010) CFD study of the Volumatic® spacer: A realist approach, Proceedings of the ECCOMAS CFD Fifth European Conference on Computational Fluid Dynamics, 14 – 17 Jun 2010, Lisbon, Portugal.
- * Teixeira, SFCF, Leão, CPL, Neves, M, Arezes, P, Cunha, A, Teixeira JCF (2010) Thermal Comfort Evaluation using a CFD Study and a Transient Thermal Model of the Human Body, Proceedings of the ECCOMAS CFD Fifth European Conference on Computational Fluid Dynamics, 14 – 17 Jun 2010, Lisbon, Portugal.
- * Oliveira, RF, Teixeira, JC, Teixeira, SF, Silva, LF (2010) Study of a pressurized metered-dose inhaler spray parameters in Fluent, Proceedings of the WCE International Conference of Mechanical Engineering, 30 de Junho a 2 Julho 2010, London, UK.
- * Oliveira, RF, Teixeira, JC, Teixeira, SF, Silva, LF, Antunes, H (2010) Design and development of a new valve geometry for spacer devices, Proceedings of the ASME International Mechanical Engineering Congress & Exposition. 12 – 18 de Novembro 2010, Vancouver, British Columbia, paper IMECE2010-39211. (ISBN 978-0-7918-3891-4)
- * Ferreira, A.C., Martins, L.A.S.B., Teixeira, S.F.C.F., Leão, C.P., Teixeira, J.C.F., Nunes, M.L (2010) Development and Evaluation of a Micro-Cogeneration Prototype for Residential Applications, Proceedings of the ASME International Mechanical Engineering Congress & Exposition. 12 – 18 de Novembro 2010, Vancouver, British Columbia, paper IMECE2010-39192. (ISBN 978-0-7918-3891-4)
- * Teixeira, JCF; Lomba, RS and Lobarinhas, PAM (2010) The Influence of Boundary Conditions on the Natural Ventilation in Buildings, Proceedings of the ICEE-2010, 18-22 Julho 2010, Gliwice, Poland.
- * Costa, C.H., Lobarinhas, P., Silva, L.F., "Projecto de um sistema experimental para determinação do desempenho do conjunto motor-hélice de veículos remotamente pilotados", Proceedings of the XIV Congreso Internacional de Ingeniería de Projectos, Madrid, 30 June through 2 July 2010.
- * Martins, J, Goncalves, L.M., Antunes, J, Rocha, R and Brito, F. P., 2010, "Heat-Pipe Assisted Thermoelectric Generators for Exhaust Gas Applications", Proceedings of IMECE10: 2010 ASME International Mechanical Engineering Congress and Exposition, November 12-18, 2010, Vancouver, British Columbia, Canada.
- * Martins, J, Vandenberghe, W, Teixeira, S and Falcao, R, (2010) "Use of Fluent for the Development of a DI-SI Engine", 2010 ASME International Mechanical Engineering Congress and Exposition, November 12-18, 2010, Vancouver, British Columbia, Canada.
- * Ferreira, A. C., Leão, C. P., Nunes, M., Teixeira, S. and Martins, L. B., Nonlinear optimization in a thermo-economic analysis of a small cogeneration system. 24th European Conference on Operational Research - EURO XXIV, 11-14 July 2010, Lisbon, Portugal.

Other national publications

National Journals

- * Teixeira, JCF; Ferreira, MEC; "Biomassa, como desperdiçar um recurso e hipotecar o futuro", in Renováveis Magazine, nº 4, 2010.
- * Castro, F. – O interesse da análise química de cerâmicas para a investigação arqueológica, Arqueologia Moderna e Contemporânea, nº 1, 2010, pp. 35-41
- * Vilarinho, C.; Castro, F; Mendonça, B.; Coelho, C. – Incorporação de resíduos industriais no fabrico de agregados leves de argila expandida para construção civil, Águas & Resíduos, Série III, nº 11, 2010, pp. 20-29
- * Pereira, P; Peixinho, N; Dimas, D; Soares, D; Vilarinho, C, Experimental study on impact energy absorbing elements using configurable thermal triggers, texto completo em proceedings do 8º Congresso Nacional de Mecânica Experimental, Guimarães, 2010
- * Roque, A.; Castro, F; Correia, A.Silva, S.; Cavalheiro, A. – Study of the leaching of the aggregate coming from electrical arc furnace steel slag in laboratory and in field", Seminário Geotecnia, Lisboa, 2010

National Conferences

- * Carvalho, JM, Castro, AM and Castro, FA; Os Resíduos Como Matérias-Primas Energéticas - RENEXPO, Centro de Congressos de Lisboa, 2010: VALORIZAÇÃO DE RESÍDUOS: DESAFIOS E OPORTUNIDADES

Technical report

- * Carvalho JM, Araújo J, Araújo J and Castro FA. (2010) RED-Genera. Valorização de Resíduos 14 (ISSN 1647-2780).
- * Carvalho JM and Silva B. (2010) Bioshoes – Sapatos biodegradáveis com características antifúngicas e antibacterianas e incorporação de resíduos. Valorização de Resíduos 15 (ISSN 1647-2780).
- * Silva, FS; Teixeira, JCT; Barbosa, JJ; Soares, D (2010) "Reduzir em 10% o custo em cobre de câmara de combustão", Bosch technical report - proposal for a joint research partnership
- * Vilarinho, C (2010) "Manual do Sistema de Gestão da Investigação, Desenvolvimento e Inovação (IDI) da W2V " (NP 4457: 2007).
- * "Reciclagem de metais de valor a partir de sucatas especiais", Vale I&DT do QREN, com empresa Tempo Magnético.
- * "Desenvolvimento de um processo de aproveitamento de sais a partir de concentrados de evaporação", Vale Inovação do QREN, com a empresa Alumínios Ibérica, SA;
- * "Bio-Shoes", Vale I&DT do QREN, com a empresa Globotrilha;

Ph.D. thesis completed

- * Ana Filipa Gonçalves da Costa Carneiro, "Influência do ciclo cardíaco no escoamento sanguíneo na vizinhança da bifurcação íliaca", PhD thesis, Mechanical Engng, Universidade do Minho, 2010.

Patents/prototypes

Patent:

n/a

Prototype:

Group Productivity

- * "Air induced low water consumption tap", Teixeira, JCF; Ferreira, MEC. 2010
- * "Banki type water turbine for water mill"; Martins, LASB. Development of a low power Banki turbine for direct application in water mills. 2010
- * "Development of a test facility for acid based leaching metal recovery"; Vilarinho, C; Teixeira, JC. 2010

Organization of conferences

- * Teixeira, JCF – Session Organizer 2-4-1 Vibration and Accoustics in Respiratory and Cardiovascular Applications I, ASME International Mechanical Engineering Congress and Exhibition, Vancouver, November 2010.
- * Ferreira, MEC; Teixeira, JCT - 1º Congresso Ibérico de Biocombustíveis Sólidos. PonteVedra, June 21 through 23, 2010.
- * Castro, F. Membro da Comissão Organizadora do Workshop, "Os Resíduos Como Matérias-Primas Energéticas", Lisboa, Maio de 2010
- * Castro, F. Membro da Comissão Organizadora do Workshop "Resíduos de Construção e Demolição: uma estratégia para a Região Norte", que decorreu em Guimarães, a 17 de Novembro de 2010
- * Valorização de Resíduos na Euro-Região: Perspectivas e Recursos; 5 Fevereiro 2010 – Viana da Castelo

Industry contract research

- * "Development of technical needle-punched nonwovens for a multifunctional thermal panel", directly financed by the company Groz Beckert. In collaboration with the Textile Department at the University of Minho. 25,000 €; 8,300 € (2010).
- * Various other projects co-financed but managed by government bodies.

Internationalization

- * partnership with the European Biomass Association (AEBIOM)
- * participation in the steering committee of the FP7 technology platform
- * participation in the MIT-Portugal project
- * partnership with the AVEBIOM (Valladolid, Spain)
- * partnership with the Universidade de Vigo – Departamento de Engenharia Florestal
- * École des Mines de Albi, organization of WasteEng, 2012
- * ABC University, São Paulo, Brazil
- * Interreg Project with AVEBIOM - Asociación Española de Valorización Energética de la Biomasa
- * Interreg Project with UCFE - Union de la Coopération Forestière Française
- * Interreg Project with CIEMAT - Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
- * Interreg Project with INRIA - Institut National de Recherche en Informatique et Automatique
- * Interreg Project with UCE - Unión de Consumidores de España

Government/Organization contract research

- * Inteltex (6PQ), starting in 2009, for 12 months. Budget: 10,000 €. EU
- * Pellets para aquecimento produzidas com mato, project: PTDC/AGR-AAM/104288/2008, starting in 2009, for 24 months. Budget of 18,480 € (9,240 €, 2010). FCT
- * Sense4me, starting in 2007. Budget of 32,330 € (5,400 €, 2010). FCT
- * MIT-Pt/EDAM-SMS/0030/2008 "Análise e Desenvolvimento de Sistemas Integrados para Veículos Eléctricos", starting in 2009, for 36 months. Budget of 164,697 €, 54,000 € (2010). FCT
- * RED - Genera, starting in 2009, for 20 months. Budget of 45,766.67 € (22,800 €, 2010). CCDRN
- * Influência das Características do Combustível no Desempenho Energético e Ambiental de Caldeiras Domésticas, starting in 2009, for 12 months. Budget of 24,750.00 € (12,375 €, 2010). QREN
- * Optimização de Modelo de Logística para a Recolha e Processamento de Biomassa Florestal e Agrícola, starting in 2009, for 12 months. Budget of 24,000 € (12,000 €, 2010). QREN
- * VALMETAIS, starting in 2009, for 24 months. Budget of 159,523.02 €, 79,700 € (2010). QREN
- * Implementação de um plano de prevenção e gestão de resíduos - desenvolvimento de metodologias de valorização, starting in 2009, 12 months. Budget of 4,150 € (2010). QREN
- * Val-Plast, starting in 2009, 12 months. Budget of 6,300.00 € (2010). QREN
- * Desenvolvimento de palmilhas antifúngicas e antibacterianas a partir de subprodutos da indústria de calçado, starting in 2009, 12 months. Budget of 8,300.00 € (4,150 €, 2010). QREN
- * Desenvolvimento de um processo inovador de tratamento de emissões gasosas utilizando um adsorvente de baixo custo, starting in 2009, for 12 months. Budget of 11,000.00 € (5,500 €, 2010). QREN
- * Implementação de um processo inovador de produção de biodiesel a partir de gorduras animais - o caso particular da gordura bovina, starting in 2009, for 12 months. Budget of 12,300.00 € (6,150 €, 2010). QREN
- * Reciclagem de Metais de valor a partir de sucatas especiais, starting in 2009, for 12 months. Budget of 15,000.00 € (7,500 €, 2010). QREN
- * Optimização de queimador industrial a Biomassa, financiado pelo QREN, starting in 2010, for 12 months. Budget of 21.645,00 € (12,480 €, 2010). Funded by QREN

Group Productivity

* PVC4Gas. Projecto financiado pelo QREN, nº NORTE-01-0202-FEDER-011447, W2V, SA, Endutex (2010-2012). Budget (2010): 51,606 €

* Projecto - Desenvolvimento de aços vazados de alta resistência mecânica com controlo de inclusões, QREN, Ferespe. (2010-2011). Budget (2010): 24,607 €

FCT Relatório Científico 2010 Print: 04-04-2011 15:34:11 [Centro de Tecnologias Mecânicas e de Materiais]

Group Description

Title of Research Group:	(RG-Norte-4077-1400) Mechanical Systems Dynamics
Principal Investigator:	José Carlos Pimenta Claro
Main Scientific Domain:	Engenharia Mecânica
Group Host Institution:	Universidade do Minho

Funding, source, dates

Funding, source, dates

FCT annual base funding – 44.7 k€

Research Projects:

- 12 granted projects:
- 1 new, starting in 2009

Coordination (IR):

- 9 of DSM Group;

- Projects Financial Sources (2010):

- Overall Budget for the group: 232.7 k€ (including the FCT's annual funding). A project worth 474 k€ was initiated late in 2010; its budget was not included in the previous figure.

As far as the source of the 2010 Budget,

Regarding the projects budget,

FCT: 55.3 k€ (24% of the total).

Others: 60% of the total budget results from projects joint financed by the industry and QREN (managed by QREN).

And the remaining 17% is from FCT's annual funding.

Objectives & Achievements

Objectives

The main objective of the Group was to pursue high level computer simulation development, and its main application in both biomechanical and human safety fields, in continuity of the strategic team work coming from the previous year.

Focus was on the following vectors:

- improving skills and tools, within the Group's members, in biomechanics;
- fostering cooperative work inside CT2M, in computer analysis;
- strengthening connections with other Portuguese institutions, working in the area;
- promoting and developing international links in R&D.

As a strategic field of development, strictly connected to the main objectives above, it was identified the area of R&D - study, analysis and simulation - of surface contact and bulk characteristics of (bio and non bio) materials with non-linear mechanical behavior.

Highlight was also put on:

- selectivity of editions and conferences, where Group publications and communications should be addressed to;
- improvement of Groups' productivity, with a special effort on indexed publications;
- reinforcement of project submissions (and grants) per effective member and funding program available;
- increasing conditions for young researchers (MSc & PhD) graduation/research project grants.

Alongside with these vectors, as a complement to increase both the quality and the quantity of the scientific production, as well as to improve the group's objectives and skills, the group will also establish action activities:

- To further strengthen cooperation with Industry, improving technological transfer actions (some good experiences have already been attained and interesting achievements have been accomplished so far), and
- To promote high-level education of human resources, at the MSc and PhD levels.

Main Achievements

1. Human Resources:

- 23 MSc. concluded (both in mechanical, materials and biomechanical engineering).
- Currently 9 PhD are enrolled under supervision of researchers from the group.
- The group has been increasing its international visibility, including the exchange of students with other institutions.
- Various visits of scientists from 12 research institutions (Brazil, Turkey, France, Romania, Czech Republic)

Objectives & Achievements

2. Research Projects (national):

A project jointly financed by the industry was approved in 2010: High Performance Torsion Beam with an overall budget of 1,784,658.49 €
The total budget of the projects currently being carried out approaches nearly 1 M€.

3. Research Projects Submission (European):

DSM Group (local IR, plus 3 effective members and 1 from another Group, 1 year pos-doc, 9 years PhD and 3 years MSc students grants) formed a CT2M team involved in the submission of an European research project, with 10 institutions of 7 different countries - in the biomedical development of nanomaterials for spinal disk prosthetics implants - contributing with a novel multi-disciplinary computer simulation approach to the study and prediction of biomechanical behavior under working conditions.

This project was approved (3,750 k€ budget / 400 k€ CT2M share) in late 2010 and is scheduled to start in early 2011.

4. Scientific Production:

The Group was responsible for a total of 99 international works presented, been:

- 21 papers (1.75/PhD)
 - 11 in books, including the edition of 2;
 - 66 communications (5.5/PhD)
- which represents an increase from the previous years.

In addition, 5 technical reports were issued.

Furthermore, 3 patents were registered.

In this context, two prize awards were obtained by researchers of this group: a) Paulo Flores was awarded the special honor for a young researcher by the Portuguese Applied and Computational Mechanics Society. b) André Castro – special honor "Nunes Correia Verdades de Faria", na section B, "PROGRESSO DA MEDICINA NA SUA APLICAÇÃO ÀS PESSOAS IDOSAS", with his thesis in Biomedical Engineering "Development of a new femoral component of patellofemoral prothesis".

5. Other Scientific Activities

5.1 Organization of Conferences:

Workshop on Biomechanics and Medical Devices, Universidade do Minho, Azurém, 17 de Dezembro, 2010.

Scientific Committees of 6 conferences

5.2 Reviewers:

Of publications in 19 journals and conferences, such as:

Multibody System Dynamics

ASME J. Computational and Nonlinear Dynamics

Mechanism and Machine Theory

J. Sound and Vibration; Nonlinear Dynamics

ASME J. Applied Mechanics

Tribology International

5.3 Boards:

a) Institutions

General Meeting of INTEROP-VLab 2009

The Georgia National Science Foundation - evaluation of research projects

b) Publications

Editorial board of 7 journals

5.4 Invited Communications

- Multiaxial weaving and fabrics, special seminar at TITS Bhiwani
- "MoniRtor - Monitorização em tempo real da fermentação de cerveja na região do UV-VIS e IVPOC com recurso a sondas de fibra óptica", Portugal Tecnológico'2010, FIL – Parque das Nações, Lisboa

5.5 Other

- participation in pos graduate panels: 3 PhD and 20 MSc
- Technical reports: 6 studies, analysis and simulation of traffic accidents
- Various news concerning "DACHOR – Multibody Dynamics and Control of Hybrid Active Orthoses", including one in a national TV network (SIC Noticias).

Group Productivity

Publications in peer review Journals

* Flores, P., Leine, R., Glocker, C., 'Modeling and analysis of rigid multibody systems with translational clearance joints based on the nonsmooth dynamics approach', Multibody System Dynamics, Vol. 23(2), pp. 165-190, 2010.

Group Productivity

- * Meireles, S., Completo, A., Simões, J.A., Flores, P., 'Strain shielding in distal femur after patellofemoral arthroplasty under different activity conditions', *Journal of Biomechanics*, Vol. 43(3), pp. 477-484, 2010.
- * Flores, P., Lankarani, H.M., 'Spatial rigid-multi-body systems with lubricated spherical clearance joints: modeling and simulation', *Nonlinear Dynamics*, Vol. 60(1-2), pp. 99-114, 2010.
- * Machado, M., Flores, P., Claro, J.C.P., Ambrósio, J., Silva, M., Completo, A., Lankarani, H.M., 'Development of a planar multi-body model of the human knee joint', *Nonlinear Dynamics*, Vol. 60(3), pp. 459-478, 2010.
- * Flores, P., Ambrósio, J., 'On the contact detection for contact-impact analysis in multibody systems', *Multibody System Dynamics*, Vol. 24(1), pp. 103-122, 2010.
- * Flores, P., 'A parametric study on the dynamic response of planar multibody systems with multiple clearance joints', *Nonlinear Dynamics*, Vol. 61(4), pp. 633-653, 2010.
- * Lopes, D.S., Silva, M.T., Ambrósio, J.A., Flores, P., 'A mathematical framework for contact detection between quadric and superquadric surfaces', *Multibody System Dynamics*, Vol. 24(3), pp. 255-280, 2010.
- * Flores, P., Machado, M., Seabra, E., Silva, M.T., 'A parametric study on the Baumgarte stabilization method for forward dynamics of constrained multibody systems', *ASME Journal of Computational and Nonlinear Dynamics*, Vol. 6(1), 011019-9, 2011.
- * Tian, Q., Liu, C., Machado, M., Flores, P., 'A new model for dry and lubricated cylindrical joints with clearance in spatial flexible multibody systems', *Nonlinear Dynamics* (published online in 2010).
- * Flores, P., Machado, M., Silva, M.T., Martins, J.M., 'On the continuous contact force models for soft materials in multibody dynamics', *Multibody System Dynamics* (published online in 2010).
- * Flores, P., Koshy, C.S., Lankarani, H.M., Ambrósio, J., Claro, J.C.P., 'Numerical and experimental investigation on multibody systems with revolute clearance joints', *Nonlinear Dynamics* (published online in 2010).
- * Leão C.P., Soares F.O., Machado J.M., Seabra E., Rodrigues, H., 'Platform WALC: design and development of a PLC network', *iJET Journal* (accepted for publication in 2010).
- * Machado, J., Seabra, E., 'A Systematized Approach to Obtain Dependable Controllers Specifications', *COBEM'2009 – ABCM Symposium Series in Mechatronics - Vol. 4* (accepted for publication in 2010).
- * Borges, P.; Machado, J.; Seabra, E.; Lima, M. 2010. "A Formal Approach for Safe Controllers Analysis", *The Romanian Review Precision Mechanics, Optics & Mechatronics* 20, 37: 7 - 12.
- * Ferreira, J.; Rodrigues, P.; Soares, FO; Machado, J. 2010. "An Approach for Spasticity Quantification Based on the Stretch Reflex Threshold", *The Romanian Review Precision Mechanics, Optics & Mechatronics* 20, 37: 51 - 56.
- * Carvalho, N; Costa, S; Leão, CP; Soares, FO; Machado, J; Rodrigues, H. 2010. "A Network Configuration for Industrial Systems Control", *The Romanian Review Precision Mechanics, Optics & Mechatronics* 20, 37: 69 – 76
- * F.I. Pereira, M.C. Oliveira, A. Ramalho, J.L. Alves, L.F. Menezes, R. Padmanabhan, Finite Element Analysis on the Influence of Material Mechanical Properties in Local Contact Conditions, *Int J Mater Form* (2010) Vol. 3 Suppl 1:139 – 142.
- * H. Laurent, R. Grèze, M.C. Oliveira, L.F. Menezes, P.Y. Manach, J.L. Alves, Numerical study of springback using the split-ring test for an AA5754 aluminum alloy, *Finite Elements in Analysis and Design* 46 (2010) 751–759.
- * T.M. Rocha, J.F. Meireles, J. Ambrosio, A.C. Pinho, 'Updating of Coarse Finite Elements Structural Models for Dynamic Analysis Identified by Complex Model Results', *Int. Journal Mechatronics and Manufacturing Systems*, in print.
- * JL Vilaça, JC Fonseca and AM Pinho, Non-contact 3D acquisition system based on stereo vision and laser triangulation. *Journal Machine Vision and Applications*, ISSN 0932-8092 (Print) 1432-1769 (Online), Volume 21, Number 3 / April, 2010, doi: 10.1007/s00138-008-0166-7, pages 341-350.
- *JL Vilaça, JC Fonseca, ACM Pinho and E Freitas, 3D Surface Profile Equipment for the Characterization of the Pavement Texture - *TexScan. Mechatronics* (Elsevier) Volume 20, Issue 6, September 2010, Pages 674-685.

Other international publications

in Books:

- * Rebelo, R, et al (2010) Further Developments on the CFD Flow Analysis Inside the Volumatic Spacer Selected Proceedings of the 13th International Congress in Project Engineering, pp 443-451. (ISBN 978-84-614-0185-7)
- * Flores, P., Seabra, E., *Dynamics of Planar Multibody Systems – Concept, Formulation, Resolution*. VDM Verlag Dr. Müller, 100p., 2010.
- * Flores, P., *Cam Size Optimization of Disc Cam-Follower Mechanisms with Translating Roller Followers*. *New Trends in Mechanisms Science: Analysis and Design*, (Pisla, D. et. al. editor), Springer. 225-233, 2010.
- * Seabra, E., Flores, P., *Kinematic analysis of the roller follower motion in translating cam-follower mechanisms*. *New Trends in Mechanisms Science: Analysis and Design*, (Pisla, D. et. al. editor), Springer. 253-259, 2010.
- * Machado, M, et al, *Spatial multibody systems with lubricated spherical joints: modeling and simulation*. *New Trends in Mechanisms Science: Analysis and Design*, (Pisla, D. et. al. editor), Springer. 397-404, 2010.
- * Flores, P, et al *Modeling and Analysis of Rigid Multibody Systems with Translational Clearance Joints Based on the Nonsmooth Dynamics Approach*. *Multibody Dynamics: Computational Methods and Applications*, In *Computational Methods in Applied Sciences Series*, Springer, 2010. (in press)
- * Seabra, E., et al *Design of Medical Rehabilitation Devices: a Case Study*, In *Technology and Medical Sciences*, Tavares J. and Natal R. (eds.), Springer, 2010. (in press).
- * N Peixinho, "Laser Welding Application in Crashworthiness Parts", in book *Laser Welding*, editado por X. Na, 2010, ISBN 978-953-307-129-9.
- * Lima, M, Zabka, P, *Analysis, design and manufacturing of special conjugate cam mechanisms for a textile machine application*, Selected Proceedings of the XIV International Congress on Project Engineering, Madrid, Spain, 30 Jun – 2 Jul, 2010. (in press).
- * Silva, M.T., Flores, P., (Eds.), *International Journal for Computational Vision and Biomechanics*, Special Issue on Multibody System Dynamics in Portugal, 2009.

Group Productivity

* Flores, P., Cuadrado, J., (Eds.), *Multibody System Dynamics*, Special Issue that includes paper presented at the mini-symposium on Multibody Dynamics of the ESMC2009 - EUROMECH Solid Mechanics Conference, 2010.

CONFERENCES

* E. Seabra, et al - Study, design and development of a vacuum furnace to perform pressure diffusion welding of lightweight alloys. *Actas do XIV International Congress on Project Engineering*, Madrid, Espanha, Junho 2010 (full text).

* Castro, A, et al, The importance of geometry and thickness for the conception of a new patellofemoral prosthesis, *Proceedings of 9th International Symposium – Computer Methods in Biomedical Engineering 2010*, The Westin Hotel, Valencia, Spain, February 24-27, 2010, 6p. (full text).

* Meireles, S, et al, Strain Shielding in distal femur after patellofemoral replacement under different activity conditions - a computational study, *Proceedings of 9th International Symposium – Computer Methods in Biomedical Engineering 2010*, The Westin Hotel, Valencia, Spain, February 24-27, 2010, 1p. (abstract)

* Flores, P., How do mechanical engineering students see their training and learning at university? Findings from a case study. *Proceedings of WICE 2010 – World International Conference in Education: Higher Education in the 21st Century: Challenges and Futurism*, Amman, 2010

* Moreira, P, et al, A Biomechanical Multibody Foot Model for Forward Dynamic Analysis, *Proceedings of the 1st Joint International Conference on Multibody System Dynamics*, May 25-27, 2010, Lappeenranta, Finland, 2010, 10p. (full text).

* Machado, M, et al, Influence of the contact model on the dynamic response of human knee joint, *Proceedings of the 1st Joint International Conference on Multibody System Dynamics*, May 25-27, 2010, Lappeenranta, Finland, 2010.

* Flores, P., 'Application of the nonsmooth dynamics approach to model and analyze contact-impact events in rigid multibody systems', *Proceedings of EUROMECH Colloquium 515, Advanced Applications and Perspectives of Multibody System Dynamics*, Blagoevgrad, 2010, 2p.

* Flores, P., Lankarani, H.M., 'Modeling and analysis of lubricated joints in spatial multibody systems', *Proceedings of EUROMECH Colloquium 515, Advanced Applications and Perspectives of Multibody System Dynamics*, Blagoevgrad, July 13-16, 2010, 2p.

* Seabra, E, et al, Competency-Based Education in the Design of Medical Rehabilitation Devices: a Case Study, *Proceedings of ICEE2010 – International Conference on Engineering Education*, Gliwice, Poland, 2010.

* Flores, P., 'Modeling and analysis of contact phenomena in multibody systems using a linear complementarity formulation', *The Fifth Asian Conference on Multibody Dynamics 2010*, Kyoto, Japan, 2010.

* Pereira, C, et al 'The Influence of Contact Model, Friction and Lubrication on the Dynamics of Cylindrical Clearance Joints', *The Tenth International Conference on Computational Structures Technology and ECT2010: The Seventh International Conference on Engineering Computational Technology*, Valencia, 2010.

* Machado, M, et al 'Spatial multibody systems with lubricated spherical joints: modeling and simulation', *Proceedings of EUROMES2010, The Thrid European Conference on Mechanism Science*, Cluj-Napoca, Romania, 2010.

* Seabra, E., Flores, P., 'Kinematic analysis of the roller follower motion in translating cam-follower mechanisms', *Proceedings of EUROMES2010, The Thrid European Conference on Mechanism Science*, Cluj-Napoca, Romania, 2010.

* Flores, P., 'Cam Size Optimization of Disc Cam-Follower Mechanisms with Translating Roller Followers', *Proceedings of EUROMES2010, The Thrid European Conference on Mechanism Science*, Cluj-Napoca, Romania, 2010.

* Machado, M, et al 'On the contact force models for soft materials', *Proceedings 11th International Symposium on Multiscale, Multifunctional and Functionally Graded Materials*, Guimarães, 2010

* Silva, L.F, et al, Successful Partnership for the Development of a Laboratory Friction Testing Apparatus: A Project Review, *Proceedings of ICEE2010 – International Conference on Engineering Education*, Gliwice, Poland, 2010

* P. Lourenço, et al, Testing and analysis of masonry arches subjected to impact loads, texto completo em proceedings da conferência, ARCH'10 – 6th International Conference on Arch Bridges, Guimarães, 2010

* N. Peixinho; S. Costa, IMPACT ENERGY ABSORPTION OF STAINLESS STEEL AND MULTIPHASE HIGH STRENGTH STEELS, "2nd International conference Super-High Strength Steel", Verona, Italy, 2010

48 other Publication not included by lack of space

Other national publications

Technical report

* Araújo, P., Seabra, E., Silva, L. F., "MONI@TOR – Concepção de um Sistema de Amarração para uma Sonda de Fibra Óptica", *Relatório técnico do projecto QREN-1572 – MONI@TOR*, Escola de Engenharia, Universidade do Minho, Setembro, 2009, 16p. (Confidencial).

* Silva, J., Vicente, A., Martins, R., Araújo, P., Seabra, E., Silva, L. F., "MONI@TOR – Monitorização em tempo real da fermentação da cerveja na região do UV-VIS e SWNIR com recurso a sondas de fibra óptica", *Relatório técnico-científico do projecto QREN-1572 – MONI@TOR*, Escola de Engenharia, Universidade do Minho, Outubro, 2009, 23p. (Confidencial).

* Araújo, P., Seabra, E., Silva, L. F., "MONI@TOR – Monitorização em tempo real da fermentação da cerveja na região do UV-VIS e SWNIR com recurso a sondas de fibra óptica", *Relatório técnico do projecto QREN-1572 – MONI@TOR*, Escola de Engenharia, Universidade do Minho, Abril, 2010, 21p. (Confidencial).

* Araújo, P., Seabra, E., Silva, L. F., "MONI@TOR – Monitorização em tempo real da fermentação da cerveja na região do UV-VIS e SWNIR com recurso a sondas de fibra óptica", *Relatório técnico final do projecto QREN-1572 – MONI@TOR*, Escola de Engenharia, Universidade do Minho, Agosto, 2010, 19p. (Confidencial).

* Miranda, F., Vicente, A., Bourbon, A. I., Vieira, G. A., Seabra, E., Silva, L. F., "HealthyCream – Desenvolvimento de soluções dietéticas inovadoras para a indústria de pastelaria", *Relatório técnico do projecto QREN-5345 – HealthyCream*, Escola de Engenharia, Universidade do Minho, Janeiro, 2011, 44p. (Confidencial).

National Conferences

N. Peixinho, Determinação de propriedades mecânicas de ligas de magnésio e alumínio para aplicações de crashworthiness, texto completo em proceedings da conferência: 8º Congresso Nacional de Mecânica Experimental, Guimarães, 2010

Group Productivity

P. Pereira; N. Peixinho; D. Dimas; D. Soares; C. Vilarinho, Experimental study on impact energy absorbing elements using configurable thermal triggers, texto completo em proceedings do 8º Congresso Nacional de Mecânica Experimental, Guimarães, 2010

Lima, M., Silva, L. F., Seabra, E., Vasconcelos, R., "Projectos Vocacionados para Têxteis Técnicos e para Vestuário", Apresentação oral convidada, Semana do Gestor de Projectos'2010, Centro Cultural de Belém Lisboa, 28 a 30 de Setembro, 2010.

Ph.D. thesis completed

n/a

Patents/prototypes

Patent:

* "Sistema de modelagem/dobragem automática e personalizada de prótese cirúrgica para correcção de Pectus Excavatum com base na informação imagiológica pré-cirúrgica", concedida a 14-09-2010, publicação no Boletim de Propriedade Industrial nº 181/2010 de 17-09-2010. Inventores: J. Vilaça; A. Pinho; J. Fonseca; J. Pinto, N. Peixinho.

* V-Biomech: advanced finite element software, which has been developed within the VCAD System Research Program, and is devoted to the numerical simulation of the biomechanical behavior of the soft tissues and of the musculo-skeletal system, being especially designed for health and medical applications. Patent application in Japan. (Luis Alves et al.)

* V-MultiMat: advanced finite element software, which has been developed within the VCAD System Research Program, and is devoted to the structural analysis of multi-materials and heterogeneous media. A special module of V MultiMat can also be used for the 3D reconstruction of two-dimensional images of real microstructures that are obtained either by serial sectioning or CT-scanning methods. Patent application in Japan. (Luis Alves et al)

Organization of conferences

* Paulo Flores, Luís F. Silva, André Castro and Pedro Moreira, Workshop on Biomechanics and Medical Devices, Universidade do Minho, Azurém, 17 de Dezembro, 2010.

Industry contract research

Project - Estudo da dinâmica dos enrolamentos e da estrutura de suporte da parte activa em transformadores quando sujeitos ao curto circuito, A. C. Marques Pinho (U. Minho), António Jácomo Ramos (EFACEC) e Hélder Mendes (EFACEC), Project financed by EFACEC, starting date: Jan 2009; concluding date: 2014.

Internationalization

Department of Mechanical Engineering, Wichita State University, Kansas, USA

Aerospace and Mechanical Engineering Department, University of Arizona, USA

Laboratory of Robotics and Mechatronics, University of Cassino, Italy

Institute for Mechanical Systems, Swiss Federal Institute of Technology, ETH-Zurich, Switzerland

Department of Mechanical and Medical Engineering, University of Bradford, Leeds, UK

Computational Biomechanics Lab, University of Florida, USA

Institute of Mechanical Engineering, Aalborg University, Aalborg, Denmark

School of Mechanical Science & Engineering, Huazhong University of Science & Technology, Wuhan, Hubei, China

Mechanical and Aerospace Engineering, University of Florida, USA

Mechanical Engineering Laboratory, University of La Coruña

Project elaboration: AO Foundation, (Sw), VU University (NI), STEGA (NI), University Hospital Zurich (Sw), Sheffield Hallam University (UK)

Departamento de Engenharia Mecânica, Universidade Federal de Minas Gerais, Brasil.

Universidade Federal do Rio Grande do Sul, Brasil, Orientação de Doutorado em co-tutela;

Universidade de São Paulo, Brasil, Orientação de Mestrado Integrado em co-tutela;

Laboratoire Universitaire de Recherche en Production Automatisé da École Normale Supérieure de Cachan,

Instituto Tecnológico de Aeronáutica, Brasil, Projecto REVVIS – Rede de Especialistas em Verificação e Validação;

Instituto de Aeronáutica e Espaço, Brasil, Projecto REVVIS – Rede de Especialistas em Verificação e Validação;

RIKEN - Institute of Physical and Chemical Research, Wakishi, Japão –Invited Scientist VCAD System Research Program (Luis Alves)

Government/Organization contract research

- Sistema pectus 3D: modelagem/dobragem automática e personalizada de prótese cirúrgica com fixadores acoplados sem radiação, e simulação virtual do resultado cosmético pós-cirúrgico, FCT TDC/SAU-BEB/103368/2008; A. C. Marques Pinho; April 2010 through April 2013.

- Protótipo multifuncional de Oxycorte e plasma com furação por broca integrada; A. C. Marques Pinho, company: HIM, Lda.; Vales I&DT, Proj. nº 11463; Nov 2009 through June 2011.

- Melhoria de absorção de energia de impacto em componentes de alumínio utilizando iniciadores configuráveis provocados por aquecimento localizado. FCT-PTDC/EME-PME/65009/2006; Nuno Peixinho; budget: 40,000 €, 7,000 € (2010). Partners: U Coimbra.

- REVVIS – Reunião de Especialistas em Verificação e Validação de Software; CYTED, 2006-2010; José Machado; partner: José Creissac Campos; budget: 6,000 €.

Group Productivity

- WALC – Assisted Laboratory for Control Engineering on-line Education; project: PTDC/ESC/68069/2006; José Machado; Budget (2010): 2,000 €.
- PROPAFE – Projecto e Desenvolvimento de uma Prótese Patelo-Femoral; Project FCT; Paulo Flores; partner: IST; Budget: 42,000 €.
- BIOJOINTS – Desenvolvimento de modelos avançados de juntas biológicas para estudo biomecânico de locomoção humana; Project FCT; Paulo Flores; Nov 2010 through June 2012; Budget (2010): 16,000 €
- DACHOR - Dinâmica Multicorpo e Controlo de Ortóteses Híbridas Activas; Project FCT; IST, P Flores; Nov 2009 through June 2011; Budget (2010): 10,000 €.
- BarMetalRod – Barreiras metálicas rodoviárias: uma abordagem mista à capacidade de retenção; P Claro; IST, UA, UM; FCT: PTDC/EME-PME/108625/2008; 2009 through date: 2011
- 'Monitorização em tempo real da fermentação de cerveja na região do UV-Vis e IVPOC (SWNIR) com recurso a sondas de fibra óptica – MONI@TOR'; POCI 2010; budget: 132,600.0 €; E Seabra; UNICER; 2008 through 2010
- 'Eggready - Protótipo para Produção industrial, em contínuo, de ovos estrelados para consumo no canal HORECA'; ADI nº 5443; budget: 302,974.18 €; E Seabra, Derovo e Valinox; 2009 through 2011
- 'HealthyCream - Desenvolvimento de soluções dietéticas inovadoras para a indústria de pastelaria'; ADI nº5345; budget: 366,145.52 €; E Seabra, Decorgel e Valinox; 2009 through 2011
- HPTB (High Performance Torsion Beam); SODÉCIA Centro Tecnológico, SA; Universidade do Minho; FCOMP-01-0202-FEDER-008037; Dec 2010 through Jul 2013. Budget: 1,784,658,49 € (overall); CT2M – 474,344.65 €)