

RESEARCH ARTICLE | JULY 10 2018

Preface of the “3rd Symposium on Integrated Computational Tools for Advanced Manufacturing”

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AIP Conf. Proc. 1978, 160001 (2018)

<https://doi.org/10.1063/1.5043811>



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Preface of the “3rd Symposium on Integrated Computational Tools for Advanced Manufacturing”

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The 3rd Symposium on Integrated Computational Tools for Advanced Manufacturing (ICT4AM) held within the 15th International Conference of Numerical Analysis and Applied Mathematics (ICNAAM), in Thessaloniki, Greece, from September 25 to 30, 2017. This symposium is a relevant forum for the scientific exchange of multidisciplinary issues related to integrated computational tools for advanced manufacturing. It contains eight reviewed papers, covering important research topics, such as, computer modelling, image processing, biomechanics modelling for functional analysis, and digital design and manufacturing. The obtained results suggest a significant improvement regarding the state of the art.

On the first one, an important research work was developed on micro-cooling constructal design for injection moulds. It presents a flow configuration developed for micro-cooling in mould inserts designated as *Umbrella*, and a synthesis of the theoretical grounds of the geometrical relations which minimize the currents that flow through the channels increasing thermal performance. The authors suggest the constructal design as a design tool to produce guidelines for cooling channels in mould injection.

Martins-Ferreira et al., presented a computational method to extract optimal regions of interest (ROI) in arbitrary images. The results show that such method is capable of finding the most relevant rectangular ROI, extracting optimal sub-images according to the relevance measure given by a generic saliency map. Since the method is not tied to any particular type of images, it finds application in quite different fields, such as, salient object extraction and processing in industry and surveillance, image compression using attention modelling or in biomedical imaging.

Two papers used computer fluid dynamics (CFD) as a numerical tool applied to biomedical field (endodontic irrigation) and aerodynamics. On the first one, data were obtained from mandibular molar root scanned by computed tomography providing a three dimensional computer model of the root pulp channel system. CFD analysis allowed to estimate the velocity and wall stress distributions, as well as, apical pressure in the channel system. The other one, aimed to analyse the aerodynamics in a racing position of a wheelchair-racing sprinter, at the world record speed. It was used the Fluent computational tool to predict the pressure, viscosity and the total drag force, as well as, the respective coefficients of the drag. This work helped on getting a deeper insight about the aerodynamic profile of a wheelchair-racing athlete, at a 100m world record speed.

Malça et al., presented a numerical modelling of mechanical and thermal behaviours of cellular structures produced using selective laser melting (SLM). Two types of metal cellular internal topologies - hexagonal and cub-octahedral and manufactured using SLM were designed. Numerical simulations were performed to predict mechanical and thermal behaviour through compression and thermal analysis. The results demonstrate that the hexagonal cellular internal topology provides a higher mechanical strength when compared to the cub-octahedral cellular structure while the thermal analysis shows that cub-octahedral topology is more efficient for heat dissipation.

A finite element analysis on human temporomandibular joint (TMJ) disc was presented by Gomes et al.. The aim of the study was to introduce a three dimensional mechanical model to study the stresses distributions at TMJ disc and to provide an efficient tool as an alternative to experimental preclinical studies. Preliminary results estimated von Mises stresses for two boundary and load conditions modelled.

The seventh paper is focused on biomechanics modelling for functional analysis of sheep. This study presents a comprehensive overview of biomechanical model parameters helpful to develop the ovine model in tissue engineering and regenerative medicine.

The last one presents a study of digital design and manufacturing for design training. The work is developed through the relationship between advanced thinking and advanced making. This methodology shaped the project from the initial idea to its materialization and moved through the processes of bottom-up and top-down modalities, both analogically and digitally. This was applied in the design and manufacture of a family of full-scale sustainable and intelligent pavilions.

Nuno Alves



Nuno Alves is the Director of the Centre for Rapid and Sustainable Product Development (CDRSP), which is dedicated to the transformation of the manufacturing industry through the development and implementation of novel Additive Manufacturing (AM)/three/four-dimensional (3D/4D) printing technology. He is an Associate Professor on Computer Modelling and Simulation at the Polytechnic Institute of Leiria (PIL).

Nuno Alves received a first degree, a MSc and a PhD degree in Mechanical Engineering, all from IST at Technical University of Lisbon.

Nuno Alves was Course Coordinator of the Mechanical Engineering Programme at the School of Technology and Management of the PIL and Coordinator of the Socrates/Erasmus Programme for Mechanical Engineering at the same Institute. He is/was supervisor/cosupervisor of 25 MSc and PhD theses (+ 4 PhD ongoing) and he designed and led a Bachelor (Licenciatura) programme on Mechanical Engineering (2006-2009) according to the European Union rules (Bolonha process), and he designed two Master programmes, one in Product Design Engineering together with Prof. Paulo Barártolo (2007/08), and other in Engineering for Direct Digital Manufacturing, together with Prof. Geoffrey Mitchell. He has acted as an MSc and PhD Examiner on 24 occasions (6 PhD and 18 MSc) in Portugal, Spain and Italy.

Nuno Alves has co-edited 8 books, authored and co-authored more than 100 papers published in books, international journals, international conferences and 9 patents.

He received 5 awards: 2 best papers, 1 best teaching award in Mechanical engineering at PIL (from Academic Association), and a grant for PhD studies.

Nuno Alves is experienced at multidisciplinary research and external collaborations, comprising European Union and bilateral projects, international conferences (chairman, organising/scientific committees, and invited lectures), peer-reviewed journal papers. He has been act as a reviewer for National Agency for Innovation, South Africa National Research Foundation, Banco Espírito Santo Innovation programme. He is Co-chair of the International Conference on Advanced Research in Sustainable and Intelligent Manufacturing (RESIM), International Conference on Direct Digital Manufacturing and Polymers (ICDDMAP) and Symposium on Integrated Computational Tools for Advanced Manufacturing (ICT4AM). He is a reviewer for Materials & Design (ISSN 0264-1275), Journal of Materials Science (ISSN: 0022-2461), Bioinspiration and Biomimetics Journal (ISSN 1748-3182), JMIR Research Protocols (ISSN 1929- 0748), International Journal of Vehicle Design (ISSN 0143-3369), Assembly Automation journal (ISSN 0144-5154), and several International Conferences.

Nuno Alves is involved in several research projects on the fields of the AM/3D-4D Printing, Bio-Manufacturing, Reverse Engineering and Plastic Injection Moulding. He is the Principal Investigator (PI) of the Scientific Infrastructure – Portuguese Additive Manufacturing Initiative (PAMI), funded by FCT and EU/PT2020 through Centro2020. He is also engaged as PI in 4 more research projects funded by FCT/PT2020 and 8 as Research Member.

His research interests are based on the development and exploitation of novel direct digital manufacturing systems, contributing for the new paradigm of the industry 4.0 (as recently named new industrial and societal revolution), mainly based on additive manufacturing/printing techniques, including computer-aided modelling and fabrication of complex multi-material 3D and 4D structures (with spatio-temporal varying properties) for both industrial and biomedical applications; Computer vision and photogrammetry; Biomimetics and bioinspiration (learn from nature); Tissue engineering; Mould design and polymer injection moulding; Rapid product development; and Circular economy.

Paula Pascoal-Faria



Paula Faria is a Lecturer of the Mathematics Department at the School for Technology and Management of the Polytechnic Institute of Leiria and a Research Member of the Centre for Rapid and Sustainable Product Development (CDRSP) of the Polytechnic Institute of Leiria. Master of Science in Pure Mathematics (Numerical Analysis and Computational Mathematics) and with a PhD in Biophysics and Biomedical Engineering by the University of Lisbon. She is the Head of the R&D Computational and Mathematical Methods Research Team at the CDRSP. Her research activity focuses mostly on numerical modulation techniques for medical application as well as for direct digital manufacturing applied to metals, polymers and ceramics, and virtual and augmented reality. She has Co-edited 2 books, authored and co-authored more than 30 papers published international journals and international conferences. She is the Member of the Editorial Board in several international peer-review journals and was received already two science awards from the international society of biomechanics and the national society of neurology. She is the chairman and co-chairman, and member of several editions of the scientific and organizing committee of different international events, workshops and congresses, such as, the International Workshop on Direct Digital Manufacturing, the Health and Social Care Information – HCIST, the International conference ICBEB – The International Conference on Biomedical Engineering and Biotechnology, the International Conference on Tissue Engineering (ICTE), the International Conference VRAP Conference – International Conference on advanced research in virtual and physical prototyping, the International Conference on Sustainable Intelligent Manufacturing, the International Conference on Direct Digital Manufacturing and Polymers (ICDDMAP), the International Conference on Advanced Research in Sustainable and Intelligent Manufacturing (RESIM) and the International Symposium on Integrated Computational Tools for Advanced Manufacturing (ICT4AM), being held within International Conference of Numerical Analysis and Applied Mathematics. She also coordinates granted national and international research projects and participates in the scientific committee of the CDRSP Advanced Courses on Regenerative Medicine and Workshops on Direct Digital Manufacturing. Additionally, she is the supervisor of several master thesis on Biomedical and Mechanical Engineering, as well as in the master of Healthcare Information Systems Management. She is also part of the direction board of OPEN – Business Specific Opportunities which is a non-profit private institution, created in November 2002 for the promotion of innovation and employment through several different actions held in Marinha Grande, Portugal. She is also the mentor of an entrepreneurship Programme called MATERIALIZA that is now on its 2nd edition that intends to transform business technological ideas into successful startups companies. Her research interests are mainly Numerical Analysis applied to Biomedical Engineering and Manufacturing/Bio- Manufacturing Engineering. Additionally she focus her studies on Applied and Computational Mathematics, Finite Element Method, Computer-Aided Design, Bioinspired Engineering and Biomimetic Design, and the Application of Electrical and Electromagnetic Stimulation on different Tissue Engineering applications.

Sandra Amado



Sandra Amado is a researcher at the Center for Rapid and Sustainable Product Development of the Polytechnic Institute of Leiria (2016), and Neuromechanics Research Group at the Interdisciplinary Center for the Study of Human Performance, Faculty of Human Kinetics – University of Lisbon (2012). Amado has a background in Physiotherapy (1997) and she is a Professor at the Health School Science, Polytechnic Institute of Leiria, Portugal (2010). She obtained her PhD in 2012 on Human Kinetics – specialty of Physiotherapy, from the Faculty of Human Kinetics – University of Lisbon. She has developed and lectured several courses and MSc tracks and guided 50+ BSc students. Amado has published numerous scientific articles and has received several awards. Further, Amado serves on several editorial boards of journals indexed in the Web of Science; She is Co-chair of the International Conference on Advanced Research in Sustainable and Intelligent Manufacturing (RESIM), International Conference on Direct Digital Manufacturing and Polymers (ICDDMAP) and Symposium on Integrated Computational Tools for Advanced Manufacturing (ICT4AM). Her work has been related with the study of functional analysis after peripheral nerve injury using the rat model. Amado and coworkers were able to identify differences from 3D analysis of hindlimb movement during gait after different clinical intervention with different biomaterials for nerve regeneration. She has been working with multidisciplinary research teams like veterinarians, exercise physiologists, biologists, biomechanics, engineers, and medical doctors.