Preface

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Biographical notes: Paulo Bártolo has a PhD in Polymer Physics from the University of Reading (UK), and an MSc and Licenciatura both in Mechanical Engineering from the Technical University of Lisbon (Portugal). He is a Professor of Advanced Manufacturing Processes at the Polytechnic Institute of Leiria, Portugal, Head of the Mechanical Engineering Department at the School of Technology and Management of IPL, and Coordinator of the Centre for Rapid and Sustainable Product Development at the Polytechnic Institute of Leiria. He is a Fellow of the Institute of Polymers and Composites at the University of Minho (Portugal), Advisor of both the Portuguese Agency for the Development and Innovation and the South Africa Science Foundation, a member of the Technical Committee on Biomanufacturing of the American Society of Mechanical Engineering and Vice-Chairman of the Special Interest Group on Rapid Design, Engineering and Mouldmaking of the Society of Plastic Engineering.

Nickolas Sapidis is a Professor with the Department of Product and Systems Design Engineering of the University of the Aegean in Greece. His industrial experience on CAD/CAE includes General Motors R&D Center, GM Design Center (USA) and the Marine Technology Development Co (Greece). He is the author of more than 40 papers on CAD, geometric modelling and finite-element meshing. He has edited two books and he is on the Editorial Boards of the journals *Computer-Aided Design, Computer-Aided Design and Applications, Computer Graphics and CAD/CAM, Int. J. Product Development, Int. J. Product Lifecycle Management* and *Virtual and Physical Prototyping*.

It is a pleasure to present a selection of some of the best papers presented during the Second International Conference on Advanced Research in Virtual and Rapid Prototyping, held by the Polytechnic Institute of Leiria (Portugal). More than 100 papers were presented by the authors coming from all over the world, and most subjects were related to virtual prototyping, rapid prototyping, rapid manufacturing and biomanufacturing. Presented Research papers provided an excellent overview of these vibrant and exciting research domains. This special issue, entitled 'virtual prototyping', includes selected papers resubmitted in an extended form and further reviewed prior to publication. Six top-quality papers were subsequently selected for publication, covering different topical research and application domains.

Computers were initially used to perform administrative and repetitive tasks. Nowadays, computer software systems are essential tools for the enhancement of creativity in design or product technical design details, as well for the management of the entire product design process. Geometric modelling systems have advanced greatly in the last decade, so current Computer Aided Design (CAD) systems are now capable of handling very sophisticated operations.

The first paper in this issue, by Roth-Koch, proposes an approach for the transfer of outline sketches drawn on paper into virtual models. This approach combines image-based modelling and conventional CAD modelling strategies, enabling the conceptual designer to scan paper scribbles and convert them into virtual sketch models that includes all the 'fuzziness' of the original drawing.

The human haptic system provides unique and bidirectional communication between humans and their surroundings. From a computational point of view, haptic interaction regards all aspects of the touch and body movement, as well the application of these senses to computer interaction. Haptic interfaces have the potential to increase the quality and capability of human–computer interaction by exploiting our sense of touch and ability to skilfully manipulate objects. These interfaces enable direct physical interaction with computer models providing a useful and intuitive augmentation to visual displays. In this paper, Gao and Gibson propose a new 6-DOF haptic interface able to provide both force and torque feedback to point clouds, NURBS curves and surfaces, and rigid heterogeneous material virtual representations. Two CAD

applications based on this haptic interface, including both an experimental haptic sculpting system for B-spline surfaces and a haptic-based method to draw a NURBS curve on a point-based model, are used to validate the interface. Similarly, Chen and co-authors propose a haptic system, which was developed to evaluate product physical properties such as product surface textures and stiffness, directly related to the customer comfort. A toothbrush design and evaluation is used as a case study to illustrate the use of this haptic system.

The fourth paper, by Ferreira and co-authors, proposes an integrated methodology combining virtual and rapid prototyping, as well real-time control of pressure-die casting processing parameters to efficiently optimise both the die-casting product and manufacturing process, allowing the reduction of its lead-time.

The fifth paper, by Klein and Broekel, presents a procedure for developing generic and parameterised human orbit models based on scanning data with anthropometric parameters. The mathematical algorithms used in this research work are described in detail.

The final paper discusses the use of virtual reality in the design process of a blow moulding tool. In this paper, Dimitrov and Bester investigate the cooling process of the mould. A comparison between the conventional cooling and the conformal one is carried out using computer simulation tools. The optimisation of the cooling behaviour of a mould is essential for both part quality and production cycle.

These papers are both interesting and informative. We are particularly grateful to all the authors and reviewers of these selected papers, as well to Dr. Mohammed Dorgham for his support regarding this special issue.

Finally, we would like to dedicate this special issue to the memory of Professor Carvalho Ferreira from Instituto Superior Técnico, Portugal, who devoted all his research life to the fields of virtual and rapid prototyping.