John G. Michopoulos, Christiaan J.J. Paredis, David W. Rosen, Judy M. Vance

ADVANCES IN COMPUTERS AND INFORMATION IN ENGINEERING RESEARCH

ACIER vol. 01

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Contents

Foreword for the Series

The initial idea for this series was conceived as an additional activity of the ASME's Computers & Information in Engineering (CIE) Division to promote the interests of the division and increase its outreach. Members of the executive committee of the CIE Division discussed the preparation of this book series four years ago before the 30th CIE conference held in 2010 in Montreal, Quebec Canada. The decision was made to move forward before the subsequent 31st CIE conference held in Washington DC, USA in 2011.

In particular, this book series aims to capture advances in computers and information in engineering research, especially by researchers and members of the CIE Division.

The intended audience is primarily the academic, governmental and industrial mechanical engineering and computational science communities interested in recent research advances as they relate to computational and information technologies associated with engineering design, along with product and process development. The series will focus on advances in computational methods, algorithms, tools, and processes on the cutting edge of research and development as they have been reported during the last five annual CIE conferences. The series will provide a resource for enhancing engineering practice by enabling the understanding and the application of evolving and emerging technologies that impact critical engineering issues related to the topics and themes under CIE's technical committees areas of interest (but not limited to). A sampling of these areas per technical committee is as follows:

- Advanced Modeling and Simulation (AMS): Discretization Methods (Finite Element Analysis, Mesh-Free Methods, etc.); Inverse Methods; Model Identification; Symbolic Computing; High Performance Computing; Methods for Computational Metrology; Computational Multiphysics (multi-field and multi-scale).
- Computer-Aided Product and Process Development (CAPPD): Computer-Aided Design and Geometric Modeling; Computer-Aided Manufacturing; Collaborative and Concurrent Engineering; Emotional Engineering; Computer-Aided Industrial Design; Design Automation.
- Systems Engineering, Information and Knowledge Management (SEIKM): Information Modeling and Exchange; Product Lifecycle Management; Knowledge capture and reuse; Business Process Design, Integration, Deployment and Management.
- Virtual Environments and Systems (VES): Augmented and Mixed Reality Systems; Collaborative and Networked Virtual Environments; Virtual Reality in Product Conceptualization and Design; Virtual Process Planning; Virtual Assembly and Maintenance; Haptic and Multi-touch Interaction.

The books of the series are to be found both in traditional and e-book forms. It is the intention of the editorial board and the publisher to issue a new volume every 3 to 5 years in order to be able to capture the exciting advances in the work performed by researchers in the areas supported by the CIE Division of the ASME.

J. G. Michopoulos, U.S. Naval Research Laboratory, Washington DC
C. Paredis, Georgia Institute of Technology, Atlanta GA
D. Rosen, Georgia Institute of Technology, Atlanta GA
J. Vance, Iowa State University, Ames IA

Foreword for Volume 01

The first call for chapters for the inaugural volume of the series was published on the ACIER series web site in the summer of 2011 and the deadline for the chapter proposals was August 31, 2012. The editorial board received an overwhelming number of 69 chapter proposals.

As a result of the reviewing process by the editorial board, only 31 proposals were accepted and the authors were asked to submit their chapter drafts by April 15, 2013. The blind review process that followed required that three to five reviewers provide their feedback to the editorial board. The 21 chapters that were accepted to be included form the main content of the present inaugural volume.

Since a few of the chapters span across multiple technical committee topics, we decided not to separate the volume into sections. However, the distribution of chapters per CIE technical committee as they were submitted is as follows:

- Advanced Modeling and Simulation (AMS): Chapters 01–06.
- Computer-Aided Product and Process Development (CAPPD): Chapters 07-15
- Systems Engineering, Information and Knowledge Management (SEIKM): Chapters 16-18
- Virtual Environments and Systems (VES): Chapters 19-21.

The numbers in this list refer to the order of appearance of each chapter in the present volume. We feel proud to have received such high quality content, and we are confident that it will set a high standard for future volumes.

J. G. Michopoulos, U.S. Naval Research Laboratory, Washington DC
C. Paredis, Georgia Institute of Technology, Atlanta GA
D. Rosen, Georgia Institute of Technology, Atlanta GA
J. Vance, Iowa State University, Ames IA

Foreword by CIE

On behalf of the Computers in Information and Engineering Division (CIE) Executive Committee, it is my pleasure to write a foreword for the first book of the series titled "Advances in Computers and Information in Engineering Research (ACIER)". The CIE Division, within ASME, covers a broad spectrum of activities related to the use of computers, computing methods, software, and information management in engineering. The ACIER book series aims to capture these activities and recent advances, in both traditional and e-book forms. It is a culmination of an arduous three-year project. Our heartiest congratulations and gratitude goes to the ACIER Editorial Board comprising of Dr. Michopoulos, Dr. Rosen, Dr. Paredis and Dr. Vance.

To navigate through the book, one must be aware that the CIE Division is organized into four technical committees, namely, Advanced Modeling and Simulation (AMS), Computer-Aided Product and Process Development (CAPPD), Systems Engineering, Information, and Knowledge Management (SEIKM) and Virtual Environments and Systems (VES). As such the wide breadth (and depth!) of the ACIER chapters represent advances from each of these technical committees.

Specifically, the AMS Chapters focus on a variety of topics such as computational advances, mesh-free methods, inverse methods, optimization and uncertainty quantification. The CAPPD Chapters, on the other hand, cover topics including computer aided design, geometric modeling, process planning, concurrent engineering, sustainable engineering, and emotional engineering. The SEIKM Chapters cover topics including information modeling, knowledge reuse, product lifecycle management and systems engineering. Finally the VES Chapters focus on virtual reality systems, augmented reality systems, collaborative environments, and applications of virtual reality in product conceptualization and process planning.

This is a highly commendable effort, and we wish ACIER the very best,

Krishnan Suresh (on behalf of the CIE Executive Committee)
University of Wisconsin, Madison, WI

Acknowledgments

The quality of a publishing effort, such as the present volume, primarily depends on the innovations and quality of research brought forward by the authors. For this reason we want to express our deepest appreciation to all authors who contributed content for the present volume.

The second group of individuals who greatly contributed to the quality control of the contributions are our 94 international reviewers who very carefully and with tremendous focus and punctuality reviewed the drafts of the invited chapters and helped establish the final 21 accepted chapters. These individuals are: Karim Abdel-Malek, Faiz Abidi, Farhad Ameri, Gaurav Ameta, S.P. Anandaraj, Stéphane Avril, Manas Bajaj, Ahmad Barari, Jan Berssenbrugge, Conrad Bock, Monica Bordegoni, Giovanni Broggiato, Luigi Bruno, Yong Chen, Xu Chen, Edward Colgate, Giorgio Colombo, Steven Cooreman, Richard Crawford, Richard Crowder, Frédéric Demoly, Debasish Dutta, Olivier Eterradossi, Daniela Faas, Georges Fadel, Bianca Falcidieno, Francesco Ferrise, Bernd Fröhlich, Shuichi Fukuda, Susan Fussell, Franca Giannini, Hakan Gurocak, Caroline Hayes, Sebastian Herzig, Thomas Hildebrandt, John Hollerbach, Imre Horváth, Athanasios Iliopoulos, Hiroshi Ishii, Nenad Ivezic, Uma Jayaram, Kevin Jurrens, Arie Kaufman, Daniel Keefe, Dimitris Kiritsis, Dave Kirk, Valeria Krzhizhanovskaya, Ashok Kumar, Jose Lastra, Marc Erich Latoschik, Joseph LaViola, Jean-Claude Léon, Goran Lindkvist, Joshua Lubell, Greg Luecke, Mahesh Mani, Alison McKay, Chris McMahon, Gregory Mocko, Dan Negrut, Eliab Opiyo, Jitesh Panchal, Matthew Parkinson, Andrea Poggialini, William Provancher, Rahul Rai, Ravi Rangan, Caterina Rizzi, Marco Rossi, Dirk Schaefer, Michael Schuth, Ed Seidewitz, Kristina Shea, William Sherman, Tim Simpson, Mikael Sjödahl, Jan Springer, Ram Sriram, Rachuri Sudarsan, Joshua Summers, Chin-Teh Sun, Krishnan Suresh, Janis Terpenny, Cameron Turner, Frans van der Meer, Konstantinos Vergidis, Hui Wang, Charlie C.L. Wang, Yan Wang, Robert Wendrich, Peter Willemsen, Paul Witherell, Lianxiang Yang, and James Yang. This editorial board is profoundly indebted to them for their outstanding efforts to ensure the quality of the submitted chapters.

The help and support by Ms. Mary Grace Stefanchik, Ms. Tara Collins Smith and Mr. Elio Manes from the ASME-Press organization, formed the cornerstone needed for the completion of this effort and therefore we want to express our deepest gratitude to them.

The support of past and present members of the Computers and Information in Engineering (CIE) Division executive committee, has been invaluable in recognizing this series as the 2nd (after the annual conference) most important outreach activity for the CIE, and supporting us with all necessary financial and infrastructure provisions for the fruition of this effort. These outstanding individuals are all CIE executive committee members after 2007 and in particular, Fred Proctor, Shuichi Fukuda, John Michopoulos, Ram Sriram, Ashok Kumar, Joshua Summers, Krishnan Suresh, Monica Bordegoni, Ian Grosse and Marc Halpern. In addition, ASME's Ms. Erin Dolan and Ms. Mary Jakubowski, who have provided organizational assistance to the CIE Division, have also assisted on multiple occasions along the course of this process.

Dr. David Lee is especially acknowledged for expressing the forethought that the members of this editorial board would have the right chemistry and skills to work together and bring this task to its final destination which is the initiation of this book series and the production of this volume.

Finally, this board needs to emphasize that there is a particular individual without whose help this series and volume would not be possible at all. The establishment of the web site for managing the collection of chapter proposals and draft proposals, the software infrastructure for managing the

collection and the reviewing process, the creation of LaTeX web based facility for assisting authors to author their content, the development of a single authoring site for each authoring team for all of them, the final LaTeX assembly of the volume and the maintenance of these resources, are largely in existence mainly due to his uninhibited creativity, unparalleled skill and enthusiastic inspiration. This individual is Dr. Athanasios (Nasos) Iliopoulos from George Mason University resident at the Naval Research Laboratory Code 6394. The editorial board appreciates immensely the excellence he exhibited in both exercising his unique skillset as well as the results produced by his efforts.

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