Advanced Design Concepts and Practice (ADCP)

ADCP 2014 Workshop

Stuttgart, Germany, 26th September 2014

http://adcp2012.com

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The 4th International Workshop on
Advanced Design Concepts and Practice - ADCP2014
Stuttgart, Germany, 26 September 2014
Conference webpage: http://www.informatik2014.de, http://adcp2012.com

Invited Speakers

Prof. Giorgio Colombo, Politecnico di Milano, Italy
Lecture topic: *KBE and simulations: from industrial applications to health-care*

Prof. Imre Horváth, Delft University of Technology, the Netherlands
Lecture topic: *On some theoretical issues of interaction with socialized and personalized cyber-physical systems*

Prof. Robert Bjärnemo, Lund University, Sweden
Lecture topic: *Application-oriented research on computed-based design analysis*

Dr. Stephen Daniels, Dublin City University, Ireland
Lecture topic: *Plasma Etching of Nanoscale Features*

Dr. Zoltán Rusák, Delft University of Technology, the Netherlands

Lecture topic: *Towards embodied human-system interaction based on affordances of cyber-physical systems*

Academic Committee
Professor Ashok K. Goel, Georgia Institute of Technology, USA
Professor Chen Li, Tsinghua University, China
Professor Chen Liping, Huazhong University of Science and Technology, China
Professor Dieter Roller, University of Stuttgart, Germany
Professor Giorgio Colombo, Politecnico di Milano, Italy
Professor Han Xu, Hunan University, China
Dr. Hou Yuemin, Tsinghua University, China
Professor Imre Horvath, Delft University of Technology, the Netherlands
Professor Ji Linhong, Tsinghua University, China
Professor John Gero, University of North Carolina, USA
Professor Michel van Tooren, University of South Carolina, USA
Professor Ming Xinguo, Shanghai Jiaotong University, China
Professor Offer Shai, Tel-Aviv University, Isreal
Professor Panos Y. Papalambros, University of Michigan, USA
Dr. Sean Hanna, University College London, UK
Dr. Stephen Daniels, Dublin City University, Ireland
Dr. Stephan Rudolph, University of Stuttgart, Germany
Professor Tetsuo Tomiyama, Cranfield University, UK
Dr. Zoltan Rusak, Delft University of Technology, the Netherlands

1. Introduction to the Workshop

The first Advanced Design Concepts and Practice (ADCP) workshop was held in Beijing on July 6-8th of 2011. The second ADCP Workshops was held in Karlsruhe, Germany, on May 8th of 2012. ADCP Summer workshop held at Tsinghua University on August 16th. In 2012, three web-based ADCP workshops also were organized, one is ADCP2012 Summer Workshop held at TU Delft on August 17th and the second is ADCP2012 Fall Workshop held in Beijing on November 8th and the third one is ADCP2014 Spring Workshop held in Beijing on 28th March 2014. ADCP2014 Summer Workshop was held on June 24th 2014. ADCP 2014 workshop will be held in Stuttgart, Germany, 26th September 2014, as one part of INFORMATIK 2014 - Big Data 44, Annual Meeting of the German Informatics Society in Cooperation with the research group of the German Informatics Society on "Graphics in design and Engineering - GI GRIB".

Goal

The goal of the workshop is to bring advanced theories, methods, technology and tools to the design and simulation of complex equipments and products, with a focus on computational design and evaluation methods and tools. The special workshop session ADCP2014 at INFORMATIK 2014 offers an opportunity to present the latest results and provides forum for discussion of these advancements and further works.

Submission

Contributions to the workshop are invited in the form of full papers and position papers (two pages), on theories, methods, tools, software, hardware, industrial examples as well as project reports of related topics. Accepted full papers will be published as an LNI volume (which will be openly available on the Web. See http://www.gi.de/fileadmin/redaktion/Autorenrichtlinien/guidelines.pdf) for author guidelines.

Acceptance of submission

The submitted contributions will be blindly reviewed by the Program Committee. Authors will be informed of acceptance and/or conditions for acceptance. Before the final acceptance, you will be asked to fill in a statement that at least one author will register and participate in the workshop.

Registration

Attendees at the workshop need to register for INFORMATIK 2014. One day registration is available. Please go to the Registration page of http://www.informatik2014.de to register.

Important dates

Full paper submission due: ~~19 May~~, 15th June, 2014
Authors informed of results of paper reviews: ~~1~~ 25th June, 2014
Accepted revised papers due: ~~23June~~, 5th July, 2014
Position paper due: ~~25th June~~, 15th July, 2014
Authors informed of results of position paper reviews: 30 June, 2014
Workshop: September 26, 2014

Registration with full paper submission, see conference webpage
http://www.informatik2014.de
Registration with only position paper submission http://www.informatik2014.de

3. Introduction to Chairs

Prof. Dr. Dieter Roller, University of Stuttgart

Prof. Dr. Dieter Roller holds the position of director of the Institute of Computer-aided Product Development at the University of Stuttgart. He is full professor and chair of computer science fundamentals. Additionally he has been awarded the distinction as an honorary professor of the University of Kaiserslautern and also serves as member of the board of trustees of the Technische Akademie Esslingen. He is chairman of several national and international working groups and former president of the ISATA forum, one of the world-wide largest technological associations, and also the leader of the experts group “Computer Graphics in Engineering - GRIB” of the German computer science society "Gesellschaft für Informatik e.V.". Furthermore he is organiser and chairman of symposia, congresses and workshops in the field of product development and automation. Professor Roller serves as reviewer for several scientific organisations as well as for the Baden-Württemberg Ministry of Science and Research for project grants. He is also reviewer for well-known scientific journals and member of several national and international program committees. As former research and development manager with world-wide responsibility for CAD-technology within an international computer company, he gathered a comprehensive industrial experience. He is the inventor of several patents and is well-known through numerous technical talks in countries all over the world, 71 published books and over 180 contributions to journals and proceedings books. With his wealth of experience, he also serves as a technology consultant to various high-tech companies.

Prof. Michel van Tooren, University of South Carolina

Prof. Michel van Tooren obtained his PhD at Delft University on Composite Fuselage Design in 1998. After positions as researcher and assistant professor at the Faculty of Aerospace Engineering, he became full professor Systems Integration Aircraft in 2002. In 2010 he accepted a job in industry and is now Manager New Concept Development at Fokker Aerostructures BV. He combines this with a part-time appointment as professor Systems Integration Aircraft at the section Flight Performance and Propulsion of the Delft University of Technology. In addition he is member of the scientific board of the NLR (Netherlands Aerospace Laboratories), member of the Technical Committee Multi-disciplinary Design and Optimization, American Institute of Aeronautics and Astronautics. The mission of his research group at Delft University is: To advance the design of and design methodologies for complex systems, in particular air transport vehicles and their flight trajectories, by exploration of: -new technologies to obtain novel or improved solutions; -the advances in flight physics to improve the prediction and simulation of the behavior of complex aeromechanical systems, especially rotorcraft and wind turbines; and –advanced mathematics and informatics to improve the quality and effectiveness of the design process. Prof. Michel van Tooren currently holds the position of professor of Department of Mechanical Engineering, College of Engineering and Computing of University of South Carolina, USA.

Professor Ji Linhong, Tsinghua University

Professor Ji Linhong obtained his Ph.D at Tokyo University and BSc and MSc at Tsinghua University. He is the associate Dean of the Department of Mechanical Engineering Department at Tsinghua University, Director of the Intelligent and Biological Machinery Division of State Key Laboratory of Tribology (SKLT) at Tsinghua University and former Director of the Institute of Design Engineering at Tsinghua University. His research focuses on Rehabilitation Engineering and design, including simulation and dynamics of IC Equipments, technology and training devices for Rehabilitation of Hemiplegia and sport training, technology of exercise evaluation on the handicapped, technology and adjuvant devices for the activities of daily living of the elder.

4. Introduction to invited speakers

Prof. Giorgio Colombo

Mechanical Engineering Department, Politecnico di Milano, Italy

Prof. Giorgio Colombo is professor at Politecnico di Milano. In 1989, he started his research activities at ITIA-CNR in Milan. From 1992 to 2000, he has been assistant professor at Faculty of Engineering of Parma. Since 2001 he has been associate professor and now full professor. His research activities focus on: shape modelling, Knowledge Based Engineering, Computer Aided Design, Simulation techniques, Computer Graphics, Virtual Reality, robotics. He has been coordinator and responsible for the research unit activities in national and European research projects.

Prof. Imre Horváth

Faculty of Industrial Design Engineering, Delft University of Technology, the Netherlands

Prof. Dr. Imre Horváth earned M.Sc. titles in mechanical engineering and engineering education at the Technical University of Budapest. I was working for the Hungarian Shipyards and Crane Factory for more than six years. With additional studies, Prof. Dr. Imre Horváth specialized in computer aided design and engineering. After the industry years, Prof. Dr. Imre Horváth has had various faculty positions at the Technical University of Budapest, and earned doctoral titles, including that from the Hungarian Academy of Sciences. Prof. Dr. Imre Horváth's research has focused on issues concerning geometric and structural modeling, knowledge-intensive software tools, advanced design support of conceptual design, and virtual reality technologies and applications. Prof. Dr. Imre Horváth has published more than 30 journal articles and more than 150 conference papers, has received 4 best paper awards (e.g., from ASME, ICED). He is serving 3 journals as permanent editor and many more in guest editor position. He initiated the International Symposia on Tools and Methods of Competitive Engineering (TMCE) and has been its general chairman for 12 years. He has served the Executive Committee of the CIE Division of the American Society of Mechanical Engineers for 7 years, also as Chair of Division. He presented several

invited and keynote talks at international conferences. As educator Prof. Dr. Imre Horváth is interested in advanced support of product design, in particular that of conceptual design, integrating research into design education, and teleconferencing-based active learning.

Prof. Robert Bjärnemo

Department of Design Sciences, Lund University, Sweden

Dr. Stephen Daniels

National Centre for Plasma Science Technology, School of Electronic Engineering
Dublin City University, Ireland

Stephen is Executive Director of the National Centre for Plasma Science and Technology (www.ncpst.ie) and a Senior Lecturer in the School of Electronic Engineering at Dublin City University. He leads a multidisciplinary research team in plasma technology and energy systems. He is Director of the Energy & Design Laboratory (energylab.eeng.dcu.ie) and the nanomaterials processing laboratory (www.eeng.dcu.ie/~npl). Stephen is a Principal Investigator in the Science Foundation Ireland Funded 'Precision' Strategic Research Cluster (www.ncpst.ie/precision), an academic member of the Biomedical Diagnostics Institute (www.bdi.ie), and a Principal Investigator at the MESTECH Marine and Environmental Sensing Hub (http://dcu.ie/ncsr/Beaufort). Stephen holds a B.Eng in Electronic Engineering from DCU and a PhD from DCU earned while studying abroad at IMEC, Belgium and Philips Research, The Netherlands. He spent 8 years with Applied Materials, where he held a number of senior positions including Metallisation Technologist for Northern Europe and Global Cluster Team Manager. Following this he spent 3 years with Scientific Systems Ltd as Head of Research and Development, developing and marketing their flagship plasma process control product. He spent 1 year at University College Dublin as Manager of the Centre for Materials Processing. In March 2004, he joined the School of Electronic Engineering, DCU as a Senior Lecturer and in July 2005 was appointed Executive Director of the National Centre for Plasma Science and Technology. His primary scientific technical competence is in the area of plasma processing for integrated circuit manufacturing, thin film deposition techniques. He also has extensive experience in team management, and product design and development. He has spent time working at Philips Research, IMEC and the Applied Materials laboratories in California, and maintains significant national and international linkages within the broader plasma and semiconductor processing industry.

Dr. Zoltán Rusák

Delft University of Technology, the Netherlands

Zoltán Rusák is an Assistant Professor at the Faculty of Industrial Design Engineering, Delft University of Technology, The Netherlands. He obtained his Master degree in Mechanical Engineering from the Budapest University of Technology and Economics in 1998. He earned his PhD in Computer Aided Design Engineering from the Delft University of Technology in 2003. His research interests include computer support of geometric modelling, use process simulation in virtual reality environments, and mobile, portable and ubiquitous computing for design applications. He is the General Secretary of the Tools and Methods of Competitive Engineering biannual symposia.

5. Introduction to invited lectures

KBE and simulations: from industrial applications to health-care

Prof. Giorgio Colombo

Mechanical Engineering Department, Politecnico di Milano, Italy

Abstract:

KBE definition

Combining definitions proposed in literature KBE is a computerized framework that supports users to reach the best option within the space of the possible solutions of an engineering problem, using the domain and strategic related knowledge. Solution obtained from a KBE application is generated in an automatic way, on the basis of the represented architecture of the product and activities of design process. In this approach KBE application can integrate some software tools for product-development (PDM, CAD, FEM, ERP, CRM...).

The role of KBE in industrial environment

KBE is currently used in the industrial field for different relevant activities; the most known are Engineering to Order, Design Automation, and Automation of analysis procedures. In general, some repetitive activities that absorb resources, both human and time, can be automated to reduce costs and increase efficiency. The formalization of product development processes by integrating domain knowledge and strategic and implicit knowledge of an organization is a powerful tool for the definition of best practices. The software implementation of the latter ones using KBE tools makes available to an organization the best way to accomplish activities.

Simulations: definition and types of simulations in engineering

Particular attention must be given in modern product development processes to the numerical simulations; in fact, they play an increasingly important role as they allow evaluating some aspects and behaviour of the product before producing them. In engineering we call "simulations" the computing of mathematical models able to represent physical and technical phenomena. In engineering practice, FE numerical methods are well known to solve structural, modal, dynamic, thermal, fluid dynamic problems; moreover multi-body techniques, boundary elements and other numerical methods can be used to aid engineers during product development process. They are powerful tools to develop more efficient products but require skilled people, important computing resources and time, mainly in defining appropriate models.

KBE and simulations

KBE techniques can be employed to automate the generation of models for numerical simulations and then all the activities of analysis, capturing procedures and rules for the computing setup and post-processing phases. Pre-processing, computing setup, post processing activities are generally not formalized, highly dependent on the knowledge and skills of the expert who implements them and finally they have a significant impact on the organization and efficiency of product development processes. In the presentation some examples of ETO, Design Automation and automated FE analyses by using KBE methods will be done.

Health-care and IT

In the last years, KBE applications for product development have undergone significant changes that affect the complexity of the problems addressed, the integration with a growing number of tools for analysis, optimization, production of documents and so on. But the greater novelty is that the numerical simulations and techniques of knowledge representation used for product and process may have application in contexts other than industrial ones. We cite as an example the economic and financial domains, entertainment, education; but the application domain that seems to be more influenced by this revolution is that of human modelling, bioengineering and medicine.

KBE and simulations in health-care

The human modelling is a discipline that may have different practical applications. Ergonomics, occupational medicine, bioengineering, rehabilitation, prostheses, whether limb or endoprosthesis, development of new biocompatible materials require different models of the human body, with different levels of detail and complexity. In human modelling it is very appropriate to talk about multi-scale approach; in fact, in human modelling we consider models of the entire body, models of particular organs or systems, models of individual cells or aggregations of cells. The different models can be used to study specific problems; for example, the kinematic models of the whole human body, can be used for ergonomic analyses or for occupational medicine problems.

In the lecture, models of human body parts used to perform simulations aimed at creating limb prosthesis and diagnosis of vascular problems will be presented. KBE methods can be used to capture, formalize and represent procedures and rules that domain experts use to create models and perform simulations. For example, geometric modelling of the socket of lower limb prosthesis can be enhanced by the opportunity to make corrections to the modelled surfaces managed by a set of empirical rules acquired by specialized orthopaedic technicians. Similarly, the diagnosis and the prognosis of Abdominal Aortic Aneurysm can be improved if data related to blood flow and stress distribution on vascular wall are available; they can be calculated by CFD analysis carried out in automatic way from images obtained by CT. Furthermore, the KBE techniques can be used to realize software frameworks that support certain activities of the experts, for example, the choice of the commercial components most appropriate to realise limb prosthesis. The lecture will explore these issues by providing a series of examples developed by the speaker.

Conclusions

The Knowledge-Based Engineering and numerical simulations can contribute in a decisive way to improve the industrial processes of product development. However, they can be widely used in other contexts, such as those of bioengineering and medicine, where it is extremely important to define best practices for diagnosis, prognosis and treatment and provide appropriate tools to automatically perform useful tasks for the therapist.

On some theoretical issues of interaction with socialized and personalized cyber-physical systems

Prof. Imre Horváth

Faculty of Industrial Design Engineering, Delft University of Technology, the Netherlands

Abstract: The paradigm of cyber-physical systems (CPSs) is changing in our days.While a decade ago they were regarded as technical systems, they are now intellectualized as socially deeply embedded and behaviorally personalized systems. This has influence on the manifestations of CPSs and on the interaction with these systems. First, the paper casts light on the drivers of the development of social-cyber-physical systems. Then, it investigates the influence of socialization and personalization of cyber-physical systems on interaction. The last part of the paper looks into theoretical issues of interaction, such as coping with the interaction profile of cyber-physical systems, combining the intellectual domains of interaction, and interaction on various intentional levels.

Towards embodied human-system interaction based on affordances of cyber-physical systems

Dr. Zoltán Rusák

Faculty of Industrial Design Engineering, Delft University of Technology, the

Netherlands

Abstract: Embodied human-computer and human-system interaction has already received tremendous attention from HCI research communities, yet there are a number of issues that has not been addressed so far. In this presentation I propose a novel human system interaction model and investigate related research challenges. In my vision, heterogeneous computing technologies together with products and artefacts of natural and artificial environment are forming a service oriented cyber-physical system. These services are offered to the user through task oriented interaction, which is achieved based on available resources of the environment that are purposefully manipulated by heterogeneous computing technologies. Through this manipulation, the environment resources are presented to users considering users' capabilities and preferences and possible workflows for completing task(s) at hand. This concept envisions a highly adaptive environment capable to (i) monitor physical, mental and emotional state of users, (ii) intelligently reason about users' intentions, (iii) purposefully adapt and reconfigure the environment to "afford" goal oriented task execution, (iv) seamlessly inform users about the environment's capacities and capabilities, and (v) synergistically assist users in task completion. Implementation of this vision, however, holds many theoretical and practical challenges. Using demonstrative case studies, the seminar intends to demonstrate the limitation and applicability of emerging cyber physical technologies for implementing embodied human-system interaction.