CIE Summer 2008 Newsletter

Table of Contents

A Message from the Chairman

Chris Paredis
Division Chair
2007-2008

Welcome to another edition of the CIE Newsletter. As Chair of the division, it is my pleasure to give you an update on the state of the division and the new directions in which we are moving forward.

During the last few years, the executive committee has focused on increasing the number of active members within the division, and it is exciting to see that these efforts are starting to pay dividends. For instance, with the help of our members, we have broadened the scope of topics addressed at our yearly conference, this year from August 3-6 in Brooklyn, NY. CIE members have volunteered to organize 8 special topic areas ranging from Agent-Based Modeling to Emotional Engineering and Inverse Problems in Science and Engineering. These new topics, introduced mostly by members who were not previously active in the division leadership, have increased the overall participation to the highest levels in recent history: 172 papers, 4 panels, and 4 tutorials/workshops - this makes CIE the largest conference at this year's IDETC/CIE! We would like to build on this success and invite you to get in touch with Fred Proctor (frederick.proctor@nist.gov) to organize a special topic area at next year's conference. It doesn't take that much effort and it can really give significant additional visibility to the research area you find important and exciting. Get involved and help us make next year's conference even better!

Another way in which we have improved CIE's profile is by establishing the division's first two annual awards: the CIE Lifetime Achievement Award and the CIE Young Engineer Award. Both awards include a $2000 honorarium and will be presented yearly at the CIE-conference luncheon meeting. If you know people in the community deserving of such special recognition, then please consider nominating them. More information can be found on the division's web-site: divisions.asme.org/cie

Last but not least, to make our community more vibrant, we are currently reviewing the organization of the division's Technical Committees. The executive committee feels that there is an opportunity to improve the participation and to increase the services provided to the membership by growing the Technical Committees into larger communities with activities that reach beyond the organization of conference sessions. We are currently reviewing the Technical Committees and plan to have an open discussion about possible realignments at the

Division Annual Meeting to be held at the upcoming conference in August. I hope to see you there.

Yes, our community is active and growing, and I am confident that the future leadership of the division will maintain these positive trends. However, they will not be able to do so without your help. So, get involved and join us in making CIE a stimulating, rewarding, and exciting community.

Chris Paredis, Division Chairman 2007-2008

28th Computers and Information in Engineering Conference

The CIE Executive Committee members, along with our Technical Committees, are delighted to welcome you to the 28th Computers and Information in Engineering Conference (CIE 2008), organized in conjunction with the ASME International Design Engineering Technical Conferences (IDETC). This year we are particularly excited about the record-setting paper submissions and special topics that you will be able to experience at the conference. This clearly demonstrates that we are entering a very exciting period for the CIE community, as new topics and emerging issues challenge, stimulate, extend and substantiate the more conventional topics that have been at the core of CIE activities during the past decade.

The CIE Conference attracts researchers and practitioners from industry, government and academia. CIE's focus has traditionally been on the application of emerging technologies relative to engineering issues of representation, product design and product development, exchange, management and integration of information throughout the entire engineering product and process life-cycle. This year we are happy to offer several special topics and emerging areas such as: Agent-Based Modeling , High-Performance Computing for e-Engineering Applications , Inverse Problems in Science and Engineering , Emerging Computational Methods for Product Design , Product Lifecycle Management , Emotional Engineering , Self-Optimizing Mechatronic Systems, "Volumetric, Air-borne and Tangible Visualization", and Prognostics and Health Management - PHM. These special topics clearly establish the CIE Division as a leading proponent of multi-disciplinary problem solving in engineering. In testimony to this trend, a record total of 211 draft papers were submitted to the 28th CIE conference, of which 170 were accepted into your final program distributed over 17 topic areas. In addition, the CIE Conference will be hosting 5 panel sessions, a poster session, 5 workshops, the CIE Conference Plenary Keynote speaker, and the CIE Luncheon, which will include our awards ceremony followed by our Luncheon keynote.

We are at an exciting inflection point relative to the CIE Division, where we have the opportunity to expand and grow in several dimensions as demonstrated by this year's topics - we strongly encourage you to get involved in the CIE leadership to help build and grow our Division. Please volunteer your time and expertise to shape our growth - a quick and easy way to do this is to review the conference program, and make it a point to attend one or more CIE Technical Committee or General Committee meetings that are listed in the Program. You will discover a unique opportunity to renew acquaintances, make new friends, and share your ideas to enhance our Division.

Ravi Rangan
Conference Chair

Fred Proctor
Program Chair

Organizing a successful conference such as this takes a lot more than just the Conference and Program chair - we have been very fortunate in having many talented individuals and teams (working beyond their normal day jobs) support us in this endeavor. We wish to express our sincere thanks to the authors, review coordinators and reviewers, technical committee chairs, special topic area chairs, speakers, panelists, delegates, ASME staff and students for their contributions toward making this a highly successful and fun conference. We wish you the best of experiences at the conference and during your stay in New York City; be sure to join us next year-the 29th CIE conference will take place from August 30 through September 2, 2009 at the San Diego Convention Center!

Point-based Computational Techniques in Computer-aided Product Development

Geometric modeling and computation are essential for the computer aided product development. Currently the boundary representation (B-rep) is the most popular geometric representation in computer aided product development. The geometric operations based on the boundary representation have also been extensively studied. Commercial geometric kernels, such as ACIS and Parasolid, are widely used in CAD/CAM applications. Both of them are based on the B-rep. However, the approach based on the boundary representations lacks in robustness and simplicity. In a recent survey paper published in 2005, Prof. Les Piegl listed the top ten challenging research areas in the general field of computer-aided design. The number one and two challenges in the list are robustness and geometric uncertainties such as handling special cases. The B-rep based computational techniques have difficulties in handling both challenges especially for complex geometries.

With more widely available computational resources, the 3D geometric models used in the product development are becoming more and more complex. This spurred the growing need for other representations and related computational techniques for the computer-aided product development. Among them, the point-based computational techniques are promising. Point-based computational techniques support the use of points as a basic geometric primitive in computer-aided design, analysis and manufacturing. The geometric operations based on the point representations are generally easy to implement and robust. It can also integrate with reverse engineering, in which, the real-world objects are scanned into dense and accurate point cloud data by using 3D sensing technologies.

The point-based computational techniques have been developed and utilized in many computer graphics applications. However, they are not widely accepted in the computer-aided product development community since the computations based on the point representations are generally viewed as an approximation approach, which has limited accuracy. The limited accuracy of the point representations may not be a main issue for computer graphics applications whose main goal is to interactively display geometries. However, it is a major concern for most engineering applications, whose accuracy requirement is much higher. Therefore, one key research issue in this emerging area is how to intelligently sample and record points so that the point-based computational techniques can provide controls over the approximation errors. Other research issues include the approximation and interpolation of point primitives, analyzing topological properties of point models, developing hybrid representations and algorithms, simulating complex point-based 3D models, etc.

In the upcoming CIE conference in New York, there will be several papers presenting some point-based computational techniques for the computer-aided product development. For example, an adaptive sampling technique is proposed in "Adaptive NC path generation from massive point data with bounded error". The technique allows directly generating accurate tool paths from scanned data. Therefore, the laborious and error-prone CAD model reconstruction typically involved in the current product development processes can be bypassed. As another example, a novel point representation and related geometric operations are presented in "Layered depth-normal images for complex geometries". The accuracy of the generated layered depth-normal images and the reconstructed polygonal models can be controlled.

Research on the point-based computational techniques can potentially lead to quantum-leap progress in computer-aided product development. The growing applications of such computational techniques include product development in automotive, aerospace, biomedical, and consumer product industries, mass customization, and many other 3D applications such as digital archival and retrieving. There are many exciting research opportunities in this emerging area. And much more efforts are required for realizing its full potentials.

Yong Chen, Ph.D.
Assistant Professor
Epstein Department of Industrial and Systems Engineering
University of Southern California
Los Angeles, CA 90089

Tel: (213) 740-7829
Fax: (213) 740-1120
Email: yongchen@usc.edu

CIE Announces Two Awards

The CIE division announces two new awards: Life Time Achievement award, and Young Engineer Award. The Life Time Achievement award will recognize a person who has had a significant impact on the use of computers in engineering practice and/or education. The recipient will be given a $2000 award, along with a certificate and travel support to attend the presentation ceremony at the annual ASME DTEC/CIE conference. The Young Engineer award is designated to recognize a promising young investigator, below the age of 35 years, who is making outstanding contributions to the progress in the application of computers in engineering. The recipient will be given a $1000 award, along with a certificate and travel support to attend the presentation ceremony at the annual ASME DTEC/CIE Conference. A selection committee will be set up each year to evaluate potential nominees. To ensure that it is presented to appropriately qualified recipients and to maintain the prestigious nature of the awards these awards may not be presented every year. Further details of the awards and eligibility criteria can be found at the CIE division website.

Inverse Problems in Science and Engineering at CIE 2008

Recent advances in laboratory and industry automation methodologies and practices along with the astonishing progress of computational technologies have enabled a significant growth of data-driven inverse methods for system characterization and design. Inverse problems are rapidly becoming a multi-disciplinary field with many practical engineering applications.

When it is possible to determine governing equation(s), shape(s) and size(s) of the domain(s), boundary and initial conditions, material properties of the media contained in the field, and internal sources and external forces or inputs, then the analysis determining the unknown field is considered mathematically well-posed and solvable. If any of these elements is unknown or unavailable, then the field problem becomes incompletely defined (ill-posed) and is of an indirect (or inverse) type. The inverse problems can therefore be classified as the determination of unknown shapes, boundary/initial values, sources and forces, material properties, or governing equation(s). If sufficient amount and type of additional information is provided, the inverse problems can become sufficiently specified so that with the use of appropriate algorithms, they can be solved.

The algorithmic methods for the solution of inverse problems could be grouped into two basic approaches: pure inverse methods and optimization-based methods. That is, in most of the iterative methods for the solution of inverse problems, sophisticated regularization formulations are used in order to prevent numerical errors from growing exponentially. In many other methods, different optimization algorithms are used to solve de facto inverse problems by minimizing typically least-squares norms resulting from such algorithms.

This special topic session is designed to bring together researchers on inverse methods in science and engineering and their applications from leading international and interdisciplinary research communities.

Topics include:

- Shape design: determination of shapes, sizes and locations of (multiply connected) domains
- Material properties and constitutive responses: determination of physical properties of media.
- Boundary values/initial values: identification of the proper boundary conditions and/or initial conditions
- Forces and sources: determination of the unknown external forces or inputs acting on a domain (structural dynamic modification and reconstruction) and internal concentrated and distributed sources/sinks (sources of heat, noise, electromagnetic radiation, etc.).
- Governing equations: identification of multiple parameters appearing in complex mathematical models of

physical systems.

George S. Dulikravich, Ph.D., FASME, FAAM
Professor and Chairman
Department of Mechanical and Materials Eng.
Florida International University
10555 West Flagler St., EC 3474
Miami, FL 33174
phone: +1 (305) 348-7016
fax: +1 (305) 348-6007
e-mail: dulikrav@fiu.edu
URL: http://maidroc.fiu.edu

John G. Michopoulos, Ph.D.
Senior Scientist/Engineer
Naval Research Laboratory
Center of Computational Material Science
Special Projects Group, Code 6390.2
Computational Multiphysics Systems Lab
Washington, DC 20375
phone: +1 202.767.2189
e-mail: john.michopoulos@nrl.navy.mil
URL: http://cms.nrl.navy.mil

28th Annual CIE Conference Keynote Address: Computers and Information Driving Innovation at Ford

Nand Kochkar
Executive Technical Leader
Computer Aided Engineering
Ford Motor Company

Relentless innovation in product, process and information technologies has become a necessity to stay competitive in this tough business environment. Globalization, rising commodity prices, need for cleaner, more efficient power trains and customer segment shifts have brought unique challenges to the automotive industry. We will explore how Ford is meeting these challenges leveraging innovation. Ford is making technological strides, setting records in quality, and continuing to find new ways to go green - all while remaining a leader in safety. We will see how advanced computer simulations, new methods in information processing and collaborative technologies have enabled Ford to engineer better quality products faster. We will also discuss how research and academia can collaborate with industry in solving tomorrow's complex problems.

Prior to his current position, Nand has held several positions of increasing management responsibility Globally, including Chief Engineer, Core Vehicle Engineering, North America Engineering, Chief Engineer, Vehicle Attributes and CAE, Chief Engineer, CAE and Durability Engineering, Vehicle Engineering Manager on F-Series Super duty Truck, Chassis Design and Release Manager of award-winning Car (Mondeo) in Europe. Nand played a key role in Corporate CAD/CAM/CAE/ PIM (C3P) strategy development and implementation in Europe. Nand has held several Supervisory positions within North America Product Development.

28th Annual CIE Conference Luncheon Keynote Address: Changing market requirements for PLM and the need for improving collaboration with universities

While Product Lifecycle Mgt (PLM) evolved over the last several years, requirements from the industry also kept on changing. The big improvements of the PLM systems are partly driven by the advances in the technology

Dr. Korhan Sevenler
Director of PLM
Xerox Corporation

and partly by the changing needs of the market. Several current market requirements will be defined with examples, and the shortcomings of the current systems will be illustrated. How can the PLM industry respond to these changing needs and what is the role of the universities in this growing field? How successful are the Quality Function Deployment (QFD) tools in capturing voice of the customer for the PLM industry? While QFD is used by the PLM companies, can it be used for the universities? Can universities help to formalize and optimize PLM processes such as Change Mgt, Config Mgt and Problem Mgt. and design SW systems to support them? The presentation will conclude with examples of how industry - university collaboration can be improved for the overall benefit of the PLM discipline.

Korhan Sevenler is the Director of PLM in Xerox Corporation where he has worked for 17 years. He is responsible for the development, integration and deployment of commercial/internally developed PLM solutions corporate wide. Before joining Xerox he worked 11 years at Battelle Memorial Institute as a Principal Research Scientist. He is a mechanical engineer and holds a MS and Ph.D. in Ind. and Systems Eng from Ohio State University.

5th International Conference on Product Lifecycle Management, 2008 (PLM'08)

Seoul, Korea
July 9-11, 2008
www.plm-conference.org

Product Lifecycle Management (PLM) is an integrated business approach to manage the creation and dissemination of product information throughout an enterprise. It is an emerging and evolving field of research in academia with potentially strong impact on industry practice. From a product perspective, PLM encompasses a holistic approach to product development and its management beginning from the conception of the product and ending with its retirement/decommissioning. From the point of view of tools required to support this and issues involved therein, PLM can be thought of as tools and methodology to manage the creation, sharing and archiving of product related information across the lifecycle. PLM is emerging as a major concern for most organizations (be it discrete goods manufacture or process industries) and a major opportunity for those involved in integrating diverse tools used in each task domain or stage of product development and beyond.

The PLM'XX conference series was started as a symposium in Bangalore 2003, jointly by University of Michigan, Ann Arbor and Indian Institute of Science(IISc), Bangalore. The success of this event and the large and growing interest in the PLM field led us to run the event annually as an International conference from 2005. The conference has alternated between Europe and Asia moving from Lyon, France (organised by the Université Lumière of Lyon) in 2005 to Bangalore, India (Indian Institute of Science) in 2006 and Milan, Italy (Politechnico di Milano) in 2007. The objective of this conference series has been to bring together researchers and practitioners involved in product innovation, product development and product delivery together in one forum to share their viewpoints on new product development, lifecycle management and supply chain.

The conference series was started when PLM as an area of research was seeking an identity and more importantly a community in academia. Defining the research agenda for PLM therefore was and continues to be an important goal of the conference. Over the years we are seeing a community emerge from among researchers in academia and industry labs. This is also borne out in the increasing number of papers in the conference that describe research output (as opposed to development or implementation). The conference series has emerged as the only international academic conference in the world in the area of product lifecycle management. However, while majority of the delegates are from academia, one of the successes of this conference series has been the healthy participation by industry. In each edition, more than a third of the participants have been from industry. This is unique because PLM is a field where industry must participate in shaping the research agenda.

The core team of organisers has continued to expand with each new venue the conference has been to. This has allowed the creation of an International Working Group in PLM, the PLM-IWG(www.plm-iwg.org). The International Working Group on PLM (PLM-IWG) groups researchers and users of PLM, with the common goal of disseminating and consolidating the PLM concept. The broad aims of the group are:

- consolidating the international community of PLM, already existing and acting inside the International Conference on Product Lifecycle Management and in the board of the International Journal of Product Lifecycle Management (IJPLM) (http://www.inderscience.com/IJPLM) since 2003
- creating knowledge and synergies for the worldwide PLM community, exploring the latest R and D results and applications and defining next PLM visions and boundaries
- promoting and disseminating the concept of PLM to the scientific and industrial society
- providing a forum for researchers and practitioners to meet for debating their points of interest on PLM

This year the PLM conference is being held in Seoul, Korea and is being organised by KAIST, www.kaist.edu. The conference will have 48 paper presentations and 10 poster presentations selected from 124 submissions. The topics discussed in the accepted papers cover a broad spectrum of topics from information models for PLM, collaboration across task domains, knowledge management, framework and architecture, lifecycle assessment and portfolio management. There are two presentation only sessions (without an accompanying paper) to provide a forum for presenting emerging ideas, industry trends, interesting applications and case-studies. Discussion panels are also planned to provide an opportunity for the delegates to interact with experts on issues of relevance to PLM research, education and practice. Delegates to the conference this year will also have a chance to participate in the Korean domestic conference on PLM Best Practices (www.plm.or.kr). With over 800 delegates (mostly from industry) this will be a unique opportunity to observe both local and global issues and approaches. As in the previous editions of the conference, potentially archival papers will be selected for possible publication in the International Journal of Product Lifecycle Management (IJPLM, www.inderscience.com/IJPLM).

Interest in this conference series is growing as witnessed by the steady increase in the number of both paper submissions and delegates. The conference had collaborated in one of the earlier events with the CIE division of ASME. We would like to solidify this collaboration with the CIE division of ASME and possibly bring this conference to the US at some point in the future. The venue for the next conference in this series (July 2009, in Europe) will be announced at Seoul during this year's conference.

Industrial Applications of Swarm Intelligence

Dr. Bipin Chadha
VP Solutions Development
NuTech Solutions
Bipin.chadha@nutechsolutions.com

Swarm Intelligence is a term used to describe complex emergent behaviors arising from a collection of relatively simple, decentralized entities. The term swarm is attributed based on the analogy to the swarming of insects. In fact, swarm intelligence and swarm theory are inspired by a variety of biological systems that exhibit such behaviors [1, 2, 3].

In nature, biological systems tend to scale very well and also tend to be very robust in dynamic, noisy and uncertain environments. Researchers have explored behaviors such as bird flocking, ants foraging, and termites nest building to understand how the biological systems achieve these properties. In contrast to typical engineering design methodology, the "design" or architecture of biological systems tends to exploit decentralization, non-linearity, noise, and uncertainty. One of the computational mechanisms to explore these concepts is Agent Based Modeling (ABM). Agent Based Models allow modeling of individual entities called agents and their interactions with each other and the environment [4, 5]. The agents can self-organize and exhibit highly complex system level behaviors even though the each individual agent has very modest capabilities and is operating with simple local

rules. Such organized complex behavior is achieved without the need for a centralized controller or leader. These techniques, therefore, offer a unique opportunity to design highly capable and scalable hardware and software systems.

NuTech Solutions has an Intelligent Business Engine® Platform for predictive analytics, simulation and optimization that uses the principles of swarm intelligence and agent based modeling along with other advanced computational science that is applied to engineering and industrial applications to solve complex problems that are otherwise very hard or nearly impossible to solve. These techniques have also been applied in a wide range of disciplines such as economics, social science, political science, wargaming, logistics, engineering, computer science, and systems biology. Here are some applications that demonstrate the effectiveness and tangible results of these approaches [4]:

Air Liquide - NuTech Solutions implemented an ant based algorithm to develop production and distribution schedules that adapt to energy prices, weather changes, client demand and desired inventory on a continuous basis resulting in savings of $1.5 million a quarter.

NASDAQ - NuTech Solutions implemented an agent based model to enable NASDAQ to evaluate the impact of changes in trading policies on the stock markets (which represents a highly complex and dynamic system) and thus avoided potential problems in the stock market.

Southwest Airlines - NuTech Solutions implemented an agent based model of the cargo routing system to enable Southwest Airlines to determine optimum policies for handling cargo in an environment that is highly dynamic and complex resulting in increased revenues of over $10 million without incurring additional costs.

Navy Expeditionary Logistics - NuTech Solutions worked with Lockheed Martin to implement an agent based model of the expeditionary logistics concepts to allow logistics managers to understand the impacts of sea-basing strategies, assets, and communications on war-fighting effectiveness of marine forces [5].

The ASME CIE 2008 conference is organizing a special topic track on Agent Based Modeling. This includes several technical sessions as well as an industry panel to discuss Agent Based Modeling and its applications.

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3. Miller, P., Swarm Theory, National Geographic, July, 2007.
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7th International Symposium on Tools and Methods in Competitive Engineering

April 21- 25
Izmir, Turkey

TMCE 2008, the 7th International Symposium on Tools and Methods in Competitive Engineering, was held in Izmir, Turkey. The main theme was "Collaboration and Competition between East and West". This conference is held every two years. Immediate past Division Chair Prof. Imre Horvath, Technical University of Delft hosted the conference. There were 15 tutorials, 8 keynote speeches, 1 panel and a poster session in addition to about 130 paper presentations.

The CIE Division co-sponsored this conference. Three executive committee members participated. Dr. Ram

Sriram, NIST, was a keynote speaker and talked on Information Modeling Framework and Ontology Development for Product Lifecycle Management. Dr. Plamen Bliznakov, Parametric Technologies, served as a panelist in the panel on Cooperation or Competition between East and West. Prof. Shuichi Fukuda, Stanford University, was a tutorial speaker and talked on Market Design, Development and Realization: A New Role for Engineers.

For details of the conference, visit www.tmce.org.

Join Virtual Environments and Systems at the 28th CIE Conference in NYC

Virtual Reality and Augmented Reality are gaining popularity as an engineering design tool and are increasingly used in the product design process. We are proud to announce a record braking high of 5 sessions with a total of 19 papers submitted to the Virtual Environments and Systems (VES) technical area. Due to this year's numerous contributions, one topical emphasis will be on "Virtual Reality in Product and Process Design" for which we dedicated two sessions. The other sessions underline the increasing importance of simulation based design and teleoperations, as well as virtual prototyping.

We further would like to draw your attention to the workshop "Augmented Reality-Based Visual Analysis of Mechatronic Test Benches" which relates to VES as well as to a new CIE topical area on "Self-Optimizing Mechatronic Systems" debuting at this year's conference.

Finally, we would like to invite every one who is interested to our annual Technical Committee Meeting.

So, join us in New York City in August. Looking forward to seeing you at the conference.

Jan Berssenbruegge
Abshishek Seth
TC Chairs, Virtual Environments and Systems