Journal of Computing and Information Science in Engineering

Editorial

10th Anniversary Special Issue: From Fringe to Mainstream—We Have Come a Long Way

At the start of my Ph.D. in 1980, I caught a glimpse, purely by chance, of the emerging field of computer-aided design (CAD). It intrigued and fascinated me to such an extent that I ended up scrapping my original plans, switching schools and changing my research area. Even though my new school, Ohio State, was one of only a handful of schools with computing facilities dedicated to CAD, I ran into stiff resistance when I expressed my desire to get a Ph.D. in CAD. I was told that CAD was hardly an intellectually challenging field worthy of a Ph.D. dissertation. I was directed to consider mainstream mechanical engineering areas, such as solid mechanics, vibrations, kinematics, and dynamics. The closest I could get to CAD was to do my dissertation in FEA, which allowed me to do at least part of my work in computing and visualization.

When I began my academic career at Arizona State, I thought I was finally free to pursue my true love. But I soon realized that we were still a fringe group; faculty in traditional fields, such as thermofluids and solid mechanics, took a dim view of computational research. The proposed thesis plan for my first graduate student (Expert System for Conceptual Synthesis of Frame Structures) was rejected by the Graduate Chair, who remarked "This is not mechanical engineering." He viewed it as purely a computer program without any regard for the fact that we needed to explicate, structure, and represent experiential knowledge for structural synthesis not found in any textbook on the subject.

Of course, I was not alone in facing this predicament. Fortunately, for misfits like us there was an ASME Division that welcomed us. Originally named the Computer Engineering Division (CED), and later known as Computer & Information Engineering (CIE) Division, it was approved in 1979 and began operating in 1980. Unlike academia, industry was well aware of the potential of computing and information technologies to revolutionize product design and manufacturing. Visionaries from computer industry (CDC, IBM, DEC, Applicon), an infant software industry (SDRC, CV, Swanson), and a variety of OEMs (GM, GE, McDonnell-Douglas) led a grassroots effort to convince ASME of the importance of mechanical engineers active participation in these evolving areas through the creation of a new Division. The first CED newsletter in 1981 boldly heralds "…the dawn of an era that is certain to be dominated by computer technology. All projections indicate that mechanical engineers, more than any other professional group, will be more involved in the utilization of this (computer) technology." They saw MEs playing as important a role in the IT revolution as their far predecessors had in the industrial revolution—a prediction that was to come true.

Prof. Ali Seirig was appointed the first Chair of CED. I am in awe of the progress this new Division made in just the first two years. Twenty-four technical committees were set up and an annual conference was initiated in 1981. This conference was unique in that it was associated with an exhibition of the latest hardware and software from leading vendors. This element was critical in keeping the ASME community well informed about the current state of engineering computing. It is, therefore, not surprising to see that this Division was heavily industry dominated—21 out of 24 Technical Committee Chairs were from industry. Sadly, today industry participation in CIE has sagged. Did CIE change because industry participation diminished, or did industry reduce its participation because CIE became less relevant to their needs? We can only speculate about the reasons.

CED soon became the fastest growing Division within ASME. The CED/CIE conference and exhibition attracted participants from a wide range of areas, not just CAD/CAM and FEA but kinematics, robotics, heat transfer, and fluid mechanics. This diverse community only had one thing in common, the application of computational methods to problems in their respective fields. As traditional conferences and journals gradually came around to seeing computational methods as valuable contributions in their own fields, they became more accepting of papers of this nature. Thus began the return of computational researchers back to their own discipline communities, shrinking the size of CIE conferences. Finally, in 1994, the CIE conference was colocated with Design Engineering Technical Conferences (DETC).

The founders of CED debated the type of journal they needed to have. They felt that given the rapid evolution of computing technologies, an archival journal like an *ASME Transactions* was not appropriate. At the same time, they wanted their journal to be more technical than a trade magazine. They ended up creating a "hybrid" quarterly publication called CIME (*Computers in Mechanical Engineering*), with Ali Seirig as its editor. This magazine was produced in full color and was very informative about the latest developments in engineering software. In the words of the editor, CIME was "user-oriented" not "research oriented." Unfortunately, this philosophy did not command much respect in academia and eventually CIME was merged into ASME's monthly magazine *Mechanical Engineering*.

And so it came to be that unlike all other ASME conferences and Divisions, CIE did not have any associated journal. Over the years, CIE leaders made several attempts at getting a *Transactions* journal approved, but to no avail. Reasons for rejection ranged

from "computing technologies have no archival value" to the failure to sustain *CIME* magazine.

In 2000, a small group of CIE Division "activists" decided to make another push for a journal. Yong Se Kim, David Lee, Simon Szykman, and David Rosen were the principals in this effort. They came up with a strategy based on lessons from past failures. That included building alliances with three other Divisions (Design, Manufacturing, and Systems & Controls), and demonstrating that an editorial board could be formed with well known researchers who had extensive publication records. I became aware of this effort when I received a call out of the blue, asking me the intriguing question "How would you like to be the Chief Editor of an ASME *Transactions*?" Of course, the very next sentence brought me down to earth quickly "…the problem is that the journal doesn't yet exist – will you help us get it approved by ASME?" Thus began my involvement with this journal. We put together an impressive editorial board that included two NAE members and research leaders in each of our targeted areas. Phil Divitero, ASME Director of Publications, immediately saw the marketing potential of this journal, and became a key ally. Bahram Ravani, DED Chair, gave valuable advice on writing our proposal to ASME. Art Erdman, himself a CIE pioneer, happened to be the Chair of ASME Publication Committee, which had authority of approving new journals, which gave us a much needed sympathetic ear on the committee to make our case. In a café in Chicago, before our presentation, we brainstormed various names for the journal and settled on *Journal of Computing & Information Science in Engineering* (JCISE). The journal was approved and began publishing in the first year of the new millennium, 2001. The CIE Division finally had an archival journal of its own with three cosponsoring Divisions. In 2005, after much lobbying and deliberation, the Design Engineering Division became an equal partner with CIE—an important step in going mainstream.

From the very beginning we decided to focus sharply on computational methods for mechanical product development. This set us apart from journals from private publishers that accepted everything and anything related to computing—from gaming to geology, from biology to every branch of engineering. We did not want to dilute our journal with such a wide and general scope. We stipulated that every paper submitted to JCISE must demonstrate applications of its techniques to mechanical design, mechanical analysis, product manufacturing, or quality assurance. Through several iterations we settled on eight major categories to include within the scope of our journal: solid modeling (including parametrics), computational geometry (including reverse engineering), computational metrology (including CMM and tolerance modeling), haptics and virtual reality, engineering informatics, simulation (including FEA, meshing, and optimization), AI/Knowledge based systems, and computer aided manufacturing. Given the practical nature of our field, we also decided to publish papers along two tracks: Research and Application. The latter has subcategories of Software Reviews, Technology Reviews, Tech Notes, and Industry Pilot Projects. The idea was to keep the journal relevant to industry as well as academia. We instituted a three-level rigorous review process for appointment of Associate Editors. We owe it to the founding editorial board for setting sound policies that resulted in quick recognition of JCISE as an archival publication of high quality. That group consisted of Paul Wright, David Rosen, Nick Patrikalakis, Deba Dutta, Susan Urban, Martti Mantyla, Dana Nau, S. Jayaram, Pradeep Khosla, Harry Cheng, and Ravi Rangan. Since we see ourselves as being at the intersection of computer science and mechanical engineering, it was appropriate to have about half of the AEs from each field, and we managed to do so.

ACM (Association for Computing Machinery) approached us in 2001 to become an official cosponsor—an offer we gladly accepted in order to strengthen the linkage with our computer science colleagues. From 2001 to 2004, we published a special issue annually drawn from the best papers of the ACM Solid Modeling conferences. Unfortunately, this conference series became too broad, and it was difficult to accommodate their best papers in JCISE without violating our objective of serving the engineering community; this annual tradition of ACM special issues had to be discontinued.

ISI included JCISE in its data collection in 2004; after 3 years of this process, the first Impact Factors for JCISE became available in 2007 (for the 2004–2006 period). With respect to ISI Impact Factors, JCISE ranks in the top third of all *ASME Transactions;* it is better than many long established journals in CAD/CAM and AI areas. Our Impact Factor has continued to improve each year. How meaningful are such statistics in gauging the quality of a journal is debatable. More meaningful metrics are in the offing and we hope they will supplant bean counters of today.

When we opened shop in 2000, ASME did not have any web based tool for paper submission and review management. Being the journal focused on computing and information science, we refused to conduct paper reviews the old fashioned way and began developing eLane. With the help of one of our associate editors, Susan Urban, a database expert, and one of her brilliant students, Anish Shah (no relation), we designed and implemented eLane over a period of 3 years. For the past 10 years, we have hosted, maintained, and continuously improved eLane to support not only JCISE but also other journals, such as *Research in Engineering Design*, and CIE, DTM, and NSF Grantees conferences. eLane blazed a new trail and guided ASME to develop its own "Journal Tool." Data security and confidentiality is a critical issue in online systems. I am particularly indebted to one of our founding associate editors, Simon Szykman, who provided valuable advice on security aspects of the system by constantly trying to enter the system through unintended holes. It is no surprise that Simon went on to become the first Director of the Cyber-Security group at US Department of Homeland Security and is now the CIO of the Department of Commerce.

With Bahram Ravani taking over as the new chief editor of JCISE, we have begun the process of gradually migrating from eLane to ASME's Journal Tool. Although the Journal Tool still lacks some functionality available in eLane, the reasons for migration are that this will provide greater visibility to JCISE through ASME websites, set JCISE at par with other Transactions, make it easier to transfer papers between ASME journals and, most importantly, have 24/7 support from ASME's IT professionals.

My tenure as chief editor is ending as it started, with a special issue providing snapshots of each of the technology areas within our scope. In both cases, I put together a wish list of papers and expert groups to co-author the state of art reviews. I had hoped to have every area covered, but some papers did not materialize this time around. Nevertheless, this special issue will be a good reference for most, if not all of the areas JCISE covers. For V1 N1, I invited each of our founding Associate Editors to write state-of-the-art surveys of their fields in collaboration with other experts in their respective areas. This special issue contains survey papers not only in some well-established CIE areas but also in a few emerging fields.

Computational methods and information technologies related to engineering product development have come a long way. CAD, CAM, FEA, CFD, VR, Reverse Engineering, Computational Metrology, Optimization, and many other simulation techniques are

now pervasive in industry. Even traditional fields, such as thermal science, fluid mechanics, and solid mechanics, have embraced numerical methods and computer visualization. What started on the fringes is now the mainstream. We owe it to the founders of the CED/CIE Division who saw this potential more than 30 years ago. Let us recognize Ali Seireg (Wisconsin), J. Callahan (McDonnell Douglas), V. Tipnis, T. Shoup (Santa Clara), D. Dietrich (Swanson), L. Hulbert (Battelle), E. Heer (NASA), S. Rhode (GM), R. Fulton (Georgia Tech), J.Cokonis (GE), R. Arvikar (Bell Labs), J. Lemon (SDRC), D. Riley (U. Minnesota), and R. Raghavan (Foster Wheeler).

A high quality archival journal is extremely important to any research community. A conference alone cannot be sufficient. Conferences, at least in engineering, serve the purpose of quick dissemination of work in progress. Having an archival journal aids the maturation of a research community. Not all conference papers are suitable for archival in a journal. An additional complication in computing and IT is the rapid rate of development and consequent obsolescence of ideas and methods. What then should we archive? There certainly are many techniques in our field that have withstood the test of time. B-Rep solid models, B-splines, and NURBS, regularized Boolean algorithms, Attributed Adjacency Graph based feature recognition, and bipartite graphs for constraint solving are but a few examples. But most research is incremental, and it is important to archive snapshots of major milestones in each area. NURBS did not just come about suddenly. There were B-splines, rational B-splines before the idea of nonuniform knot spacing.

JCISE associate editors serve 3 year terms, renewable for an additional 3. In addition to the founding group of AEs, I want to take this opportunity to thank all our current and past AEs. They are the ones that do the bulk of the work and get the credit for maintaining our high quality. I am very grateful to the following individuals: J. Michopoulos, K. Saitou, A. Goel, I. Grosse, K. Law, X. Qian, J. Oliver, S. McMains, S. Gao, A. Fischer, J. Vandenbrande, C. Geiger, Y. Kitamura, C. McMahon, A. Joneja, S. K. Gupta, R. Crawford, K. Lee, J. Corney, N. Dorighi, L. Joskowicz, and S. Callahan.

I am sure that our new chief editor, Bahram Ravani, will take JCISE to new heights. My very best wishes to JCISE readers, authors, and reviewers. For me, this has been a labor of love.

Jami J. Shah
JCISE Editor, 2000–2010