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CAST Communications - Spring 2004

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Editorial Notes

by Peter Rony and Karl Schnelle

We welcome you to the Spring 2004 issue of *CAST Communications*, in which we provide three feature articles, two of which are associated with the CAST Division 2003 awards. The first article is **"From the Macroscopic to the Microscopic World through Mazes of Process Graphs, and From the Microscopic World to the Mesoscopic World Through Drunkards' Paths"** by Professor L. T. Fan -- University Distinguished Professor and Margaret H. Hulings Chair in Engineering at Kansas State University – our AIChE 2003 Computer in Engineering Award recipient and November 2003 banquet lecturer. This is a unique article in which Professor Fan describes his "journeys" in two areas, namely, (1) computer-aided process synthesis, design, and optimization, and (2) stochastic, statistical, fractal, and chaos analysis.

I listened to L.T.'s lecture at the 2003 CAST division banquet; his article here captures the lecture very well. As editor of this newsletter, I appreciate the care with which Professor Fan has crafted his manuscript.

The second article is **"Eli Lilly and Co.'s Fermentation Process Control and Data Historian Computer System: A Model in 'The Practice' of Implementing New Computer Science Techniques and Technologies"**, co-authored by Joseph S. Alford, who is our AIChE 2003 Computing Practice award winter. Joe is Engineering Advisor at the Eli Lilly and Co. He has also helped guide Lilly into an international leadership position in the use of computer bioprocess control, on-line analytical instrumentation, process modeling, computer validation, artificial intelligence, and data mining.

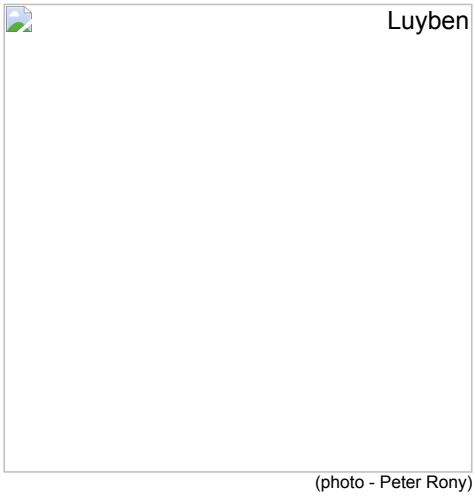
Finally, the third article is **"Is a Symbolic Math Program for You?"**, by Lee R. Partin of Voridian, a Division of Eastman Chemical Company. Lee has written a very hands-on article - if you want to move from basic spreadsheet math into the world of symbolic math, please take a look.

The CAST Division banquet at the AIChE Annual Meeting in November 2003 was a very pleasant event; your photographically-inclined editor took the opportunity to take photos of our award winners and their wives.

Professor L. T. and Eva Fan | Dr. Joseph and Marti Alford | Professor William and Janet Luyben

(photo - Peter Rony)

(photo - Peter Rony)



(photo - Peter Rony)

And don't miss the Quote of the Day on bugs.

Articles

(photo - attachment 4)

From Macroscopic World to Microscopic World through Mazes of Process Graphs and from Microscopic World to Mesoscopic World through Drunkards' Paths
by L. T. Fan

This is a narrative of my 2003 Computing in Engineering Award lecture. It essentially comprises two parts: graph-theoretical approach to process-network synthesis and stochastic analysis and modeling of random phenomena in process systems. These areas are two focuses of my research and teaching endeavors in recent years.

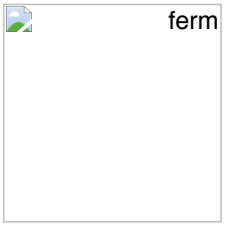
The award citation states, "For broad and outstanding contributions to the analysis, synthesis, and control of process and material systems." This citation implies that my contributions have encompassed many areas of "Computing and Systems Technologies" in Chemical Engineering in the nearly 50 years of my professional career. These areas include: 1. Computer-Aided Process Synthesis, Design, and Optimization; 2. Process Identification, Dynamics and Control; 3. Stochastic, Statistical, Fractal, and Chaos Analyses; and 4. Modeling, Simulation and Numerical Solution. The list of my publications submitted in support of my nomination contains 5 books, 1 book chapter, and 374 refereed journal articles in these areas. I am at the ripe "old (?) or young (?)" age of 74, and am half-retired; however, I continue to work at about the same pace as when I was a full-time faculty member of 40 years, chairing the department for exactly 30 years.

The title of my lecture reflects the sub-areas of two areas, specifically the first and third, on which my collaborators and I have been focusing in recent years. The graph-theoretic approach originally established by my collaborators and me for the optimal synthesis of process networks has been extended eventually to the identification of catalytic-reaction or metabolic pathways through mimicking their synthesis in nature. Obviously, the process networks are macroscopic, and the catalytic-reaction or metabolic pathways are microscopic, thus, the front part of the title. While our group's effort on stochastic analysis and modeling was originally prompted by my interest in the motion of molecular species and the reactions among them and while some meaningful results were obtained, we came to the realization that it would be far more fruitful to concentrate our effort mainly on the motion and behavior of gas bubbles, liquid droplets or solid particles and the interactions among them. Clearly, the molecular species are microscopic, and the gas bubbles, liquid droplets or solid particles are mesoscopic, thus, the back part of the title. It is worth pointing out that these mesoscopic objects are ubiquitous in a wide range of process systems and in nature.

The full article [1401KB] may be downloaded in pdf format. Smaller downloads are also available: main text [256KB] , Publications [82KB] , Attachment 3 [988KB] , and Attachment 4 [163KB] .

Eli Lilly and Co.'s Fermentation Process Control and Data Historian Computer System; a model in "the practice" of implementing new computer science techniques and technologies
by J. Alford and D. Clapp

Editor's Note: One of the author's, Dr. Joseph Alford, Jr, is one of the winners of the 2003 Computing in Practice Award. The following paper is the history of the development of a large computer system.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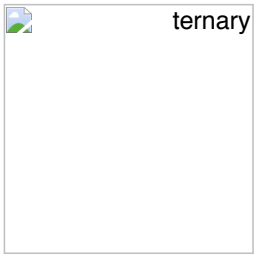
(photo - J. Alford)

In the early 1970s, Eli Lilly and Co. had a dilemma. As one of the leading fermentation companies in the world, they realized that the fermentation process, (e.g., making penicillin), was as much art as science. Making antibiotics wasn't much more sophisticated than making wine. Ingredients were put into a tank which was then manually sterilized, manually inoculated with living cells, and then agitated and aerated for several days. The only automated feedback control was a pneumatic controller used for temperature. Data recording consisted of operators walking through the production floor, periodically recording values from gauges onto a clipboard sheet and hand entering a few values onto the paper manufacturing ticket.

Most of the parameters of real value to the fermentation culture (e.g., pH, dissolved oxygen, nutrient concentrations) were not monitored or controlled on-line. Further, Lilly scientists could not pursue their vision of an automated, well understood, and controlled low variability process, due to lack of appropriate tools and support systems. Sometimes, the best indicator as to how well a fermentation was progressing was the subjective analysis of an experienced employee looking through a tank site glass at the color and texture of the foam layer riding on top of the liquid broth.

Lilly scientists, engineers, and management decided they could, and should, do something about this. Since no commercial computer system & application software existed that could do the job, Lilly decided to develop their own system, based on a hierarchical architecture of HP minicomputers. The 1st layer of the system would consist of multiple process control computers, each capable of managing up to 10 fermentors. The 2nd layer would be a single computer/plant and contain the data historian.

The full article [58KB] may be downloaded in pdf format.


ternary

(image - full article)

Is a Symbolic Math Program for You?
by Lee R. Partin

I find numerous applications for symbolic math software in my chemical engineering career. I initially purchased Maple™ by MapleSoft a decade ago when I purchased my first PC for home, so I have many examples that I could discuss. Maple performs symbolic and numeric mathematics for a wide range of tasks. It also has extensive graphic functions and an integrated programming environment with open architecture. Mathematica™ by Wolfram Research is a good alternative to Maple. I teach seminars on modeling topics within the CPI. It's easy to promote seminars on applying Microsoft Excel™ to engineering tasks but I see very few engineers using Maple or Mathematica. Maybe, I will be able to pique your interest enough that you will try it. I use it for many tasks and it has enabled me to perform projects that I would not have done otherwise.

The full article [96KB] may be downloaded in pdf format.

Latest News

ELECTRIC PAPER - Researcher Nicholas K. Sheridon of Xerox subsidiary Gryicon LLC is convinced that true digital paper is at most five years away, and predicts that the technology will go mainstream with a six-inch tube that fits into anyone's pocket. Paper will roll in and out of the tube like a window shade, with the tube's innards serving as a writing mechanism, pixels will be rearranged on ultra-thin plastic screens, and a satellite will beam signals to the tube so that people can read their e-mail and surf the Web. Sheridon says, "I can see everyone on the globe having one of those." (Washington Post 12 Feb 2004)

Communications

CAST Policy on Technical Papers

The CAST Policy on Technical Papers has been revised.

Three New Areas of Emphasis for AIChE
by Karl Schnelle

After AIChE experienced a serious decline in its Net Asset Value, the AIChE Board of Directors took action to maintain the Institute's sustainability. They concluded that AIChE's immediate course of action should be to *Focus on the Essentials.*. The Essentials include: providing the latest and most accurate technical information, offering concise, targeted award-winning publications, delivering meetings that set industry standards, making available attractive/affordable insurance programs, and expanding networking opportunities. AIChE has also identified these Emerging Technologies: Sustainability, Nanotechnology, and Biological Engineering, to emphasize. Therefore, three New Technological Communities are being formed: Institute for Sustainability (IfS), Nanoscience and Engineering Forum (NSEF), and Society for Biological Engineering (SBE).

SBE was discussed in the previous Fall newsletter and has a new website. Sustainability is presented in this newsletter (see below). In the next issue, we will take a look at the new Nanoscience Forum.

SUSTAINABILITY ENGINEERING

Sustainability has emerged as a driving force in transforming business practices and public policy. AIChE is striving to provide its members with a voice in shaping these transformations by providing the intellectual forum and stimulus for defining the roles chemical engineers can play in support of achieving sustainable development. Clearly incorporating the concepts of intergenerational equity and ecological capabilities would be a challenge for scientists and engineers in designing processes and products. The Institute for Sustainability (IfS) will do its part to add some scientific rigor to analyzing sustainability and to use appropriate metrics to determine comparative merits of alternatives.

One important goal of the Institute is to seek collaborative work in programming and education objectives with other professional societies, both national and foreign. Specific focus areas include:

- metrics for sustainability;
- developing approaches for designing products and processes that can be optimized to desired metrics criteria and that incorporate environmental and societal benefit factors;
- assessing impacts of resource use (energy, material, and cost) on environmental and social benefits (or otherwise) of products, processes, and services;
- designing new processes or products that are comparatively benign (such as via green chemistry and engineering approaches);
- technology developments in response to socioeconomic measures such as emission trading; and
- educational elements relative to all previous points.

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Fax: 212-591-8897
xpress@aiche.org

Insurance Programs and other Member Benefits

For answers to questions, try one of the following AIChE staff:

Felicia Guglielmi Director of Volunteer & Membership Activities 212.591.7329	Bette Lawler Director of Operations (212) 591-7207
Joe Cramer Director of Technical Programming (212) 591-7950	Anette Ngijol Volunteer & Membership Activities (212) 591-7478
Sarah Fewster Manager, Communications 212.591.7527	Steve Smith Director of Technical Activities & Journals (212) 591-7335

CAST10 E-Mail List

The following items are used to participate in the list:

1. To post messages to the list, please send mail to cast10@ench.umd.edu.
2. Subscribe/unsubscribe messages should be mailed to emailman@ench.umd.edu.

3. Archived messages can be found at www.ench.umd.edu/cast10.
4. Specific instructions on (un)subscribing and posting messages are located at www.ench.umd.edu/cast10/subscribe.shtml.
5. Include keywords as the first line of your message: **Keywords: software, jobs, education, meetings** using any or all of the keywords.

The list moderator, adomaiti@Glue.umd.edu, would like to invite comments on the operation of the e-mail list and archive website, especially suggestions for new services.

2004 Award Nomination Form

The Award Nomination Form [451 KB, PDF] should be completed by April 15. See CAST Division Awards for more information.

Quote of the Day

The bug, that perverse and elusive malfunctioning of hardware and later of software, was born in the nineteenth century. It was already accepted shop slang as early as 1878, when Thomas Edison described his style of invention in a letter to a European representative: 'The first step is an intuition and it comes with a burst, then difficulties arise -- this thing gives out and then that -- "Bugs" -- as such little faults and difficulties are called -- show themselves, and months of intense watching, study and labor are requisite before commercial success -- or failure -- is certainly reached.'

Why Things Bite Back : Technology and the Revenge of Unintended Consequences
Edward Tenner, 1996

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Production Details:	Retain your original art, please. Submit an e-mail containing a WORD or PDF version (contact editor for preferred formats) of your advertisement, to the CAST newsletter editor: Peter R. Rony.
Deadlines:	December 1 for the Winter issue; July 1 for the Summer issue.
Payment	Prior to publication of advertisement, please submit check payable to CAST Division, AIChE to:

Details:	Scott Keeler CAST Secretary/Treasurer Dow AgroSciences 9330 Zionsville Road Indianapolis, IN 46268
~~Questions:~~	Peter R. Rony, Telephone (703) 231-7658 (W); Telephone (703) 951-2805 (H); FAX (703) 231-5022

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Already a member? Please ask a colleague to join.

The Computing and Systems Technology (CAST) Division of AIChE is responsible for the wide range of activities within AIChE that involve the application of computers and mathematics to chemical engineering problems including process design, process control, operations, and applied mathematics. We arrange technical sessions at AIChE Meetings, organize special conferences, and publish this newsletter - *CAST Communications* - twice a year. These activities enable our members to keep abreast of the rapidly changing fields of computing and system technology. The cost is $10 per year, and includes a subscription to this newsletter. Shouldn't you join the CAST Division now?

To join the CAST Division, please contact AIChE Customer Service at the above address. You may also download and print Join a Division or Forum -- Membership Application [30 KB, PDF] from AIChE.
