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EDITORIAL NOTES

About This Issue

Peter Rony & Scott Keeler

A pleasant task for the editor appears in this summer issue, the announcements of the CAST Division Award winners for the year. We have a bumper crop of awardees: five total associated with three divisional awards. Michael F. Doherty and Michael F. Malone jointly receive the 1996 CAST Computing in Chemical Engineering Award for their collaborative work at the University of Massachusetts; James J. Downs receives the 1996 CAST Computing Practice Award; and Bhavik R. Bakshi and Kenneth R. Muske share the 1996 CAST Ted Peterson Student Paper Award for their equally outstanding papers. Readers should observe that we have made a strong effort to explain the basis of all of these awards. We invite all division members to participate in the CAST Banquet at the Chicago AIChE Annual Meeting, at which occasion our five award winners will be honored.

In this issue, we present Part II of Tom Edgar's summary of his 1995 Computing in Chemical Engineering Award address at the CAST banquet that year. We also present an introductory paper on "Data Compression for Process Historians," by Peter A. James of Chevron Research and Technology Company. Though more technically written than the typical CAST newsletter manuscript, we publish it with the hope that it presents a different topic in these newsletter pages. We have had this manuscript since November 1995, and believe that the summer issue is the proper place for industrial contributions of this type.

As a final point, we observe that AIChE meetings, with the Chicago AIChE Annual Meeting (November 1996), are now moving to the Internet age. You will be able to access the meeting authors, sessions, papers, and abstracts through Dale Kirmse's University of Florida Chemical Engineering Web site. Authors submitted abstracts directly to Dale through the Internet. Finally, the heavy, expensive Extended Abstracts books are now being replaced by a CD-ROM, at a savings of tens of thousands of dollars to AIChE. Your friendly CAST editor is creating this CD-ROM based upon Dale's Web site. As a bonus, several hundred megabytes of demos and files from the Volume 2 CACHE CD-ROM -- which was distributed to students and faculty starting April 1996 -- will be included. 1996 is, indeed, the year when AIChE entered the Internet bandwagon.

Michael F. Doherty and Michael F. Malone are Joint Winners of the 1996 CAST Computing in Chemical Engineering Award

Michael F. Doherty

Michael F. Malone

"For their development and implementation of a new, explicit design procedure for azeotropic, extractive, and reactive distillation processes," Michael F. Doherty and Michael F. Malone were selected as the joint winners of the 1996 CAST Computing in Chemical Engineering Award. Both are professors in the Department of Chemical Engineering at the University of Massachusetts. Mike Doherty is currently the head of the department.

The nomination statement for the award winners states the following:

"Azeotropic and extractive distillation are widespread problems that have been recognized to be of great industrial importance for many years, and modern simulation methods are now very effective for describing these complex systems. However, this development of a geometric approach for use in conjunction with simulation has given important new insights into this class of problems. The practical use of this approach has been facilitated by the development of efficient and robust computational tools for their implementation. Doherty and Malone's joint contributions in this area are a unique combination of analysis and computation that has also proven to be useful in the broader context of reactive distillation."

"The overall framework has been in the clever application of modern nonlinear analysis to simplify, classify and explain the results of complex models for azeotropic, extractive and reactive distillation. An excellent illustration of the approach can be found in their papers with Z. T. Fidkowski (1993). In fact, this latter paper was awarded Best Paper in 'Computers and Chemical Engineering' in 1993."

"These geometric methods have been developed further by Doherty and Malone and their students to give explicit design procedures for a wide variety of azeotropic mixtures. A starting point for the design is the residue curve map, which is used to estimate the feasibility of various separations at total reflux (Foucher, Doherty and Malone, 1991). More detailed studies of conditions away from total reflux lead to more precise estimates of feasible compositions, as described by Fidkowski, Doherty and Malone (1993), which appeared shortly after a similar development by Wahnscraft and Westerberg. This part of the procedure is very important because often certain splits are not possible with one entrainer, whereas they might be with another. Hence, a procedure for the initial screening of entrainers is available. Fidkowski, Doherty, and Malone (1991) developed an explicit design procedure based on bifurcation theoretic methods. This new procedure can be used to give good, efficient column designs. That is, a desired split is specified within the feasible region, the minimum reflux ratio is calculated explicitly, and for the various values of reflux above the minimum, the number of trays above and below the feed are calculated. This design approach is much more efficient than a trial-and-error approach, and is generally applicable. Two examples are the problem of breaking azeotropes and problems where separations are very difficult because of the presence of tangent pinches."

Supporting letters elaborate on the significance of their work as follows:

"The well established, by now, residue curve maps, which have allowed them to identify distillation boundaries and very simple criteria for determining the feasibility of splits in distillation systems, have led to one of the most significant developments over the last 10 years in the area of process design. I have seen the touch of their work on a large number of industrial applications in the U.S., Japan, and the UK, all of which have demonstrated the dramatic improvements that their insights can produce."

"Extension of their work to reactive distillation problems has produced one of the most interesting results that I have seen over the last 10 years, namely, the invariant transformations which make reactive distillation problems share the same representational structure as conventional distillations. The value and impact of these results cannot be stressed strongly enough since, besides their design consequences they have led to a paradigm that bridges reactions and separations within the same 'unit operation.' Extension to other systems involving reaction and different separation method, for example, extraction or absorption, is at early stages and promises to be of as profound significance as their earlier work on reactive distillation."

"Initially, the focus was on residue curves and the importance of simple-distillation boundaries. With Van Dongen, Doherty provided important perspectives on multiphase equilibria, emphasizing the multiplicity of solutions. This led to papers that explain how liquid-phase splits cross distillation boundaries, thereby justifying heterogeneous azeotropic distillations, and subsequently showing how to simulate the dynamics and control of these towers. Throughout these studies, Doherty and coworkers addressed the limiting cases of minimum and total reflux. His papers with Julka, in which he applied geometric theory to locate the fixed points of operating lines, provide wonderful insights and techniques for locating the limits of operation at minimum reflux (infinite stages)."

"In recent years, I have been impressed by Mike Doherty's paper with Barbosa in which he defined the reactive azeotrope and showed how to compute phase and chemical equilibria using transformations and computer programs for phase equilibrium alone. His recent paper, with Fidkowski and Mike Malone, which won the 1993 Best Paper Award for papers published in 'Computers and Chemical Engineering,' presented an excellent application of the homotopy-continuation method to locate all of the azeotropes in a multicomponent mixture."

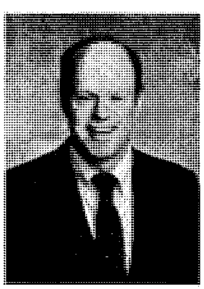
"The contributions of Mike Malone in the area of distillation are also substantial. Malone's work concentrates on the synthesis of separation trains; more specifically, on the selection of entrainers, the location of feasible regions for the distillate-and bottoms-product compositions, and, more recently, on the sequencing of distillation towers. His contributions were very significant in the award-winning-paper referred to above."

"The first papers by Doherty and Perkins set the stage for what was to follow. That early work established topological insights that permitted one to establish a relationship among the number of nodes and saddles for a ternary composition diagram. The next work demonstrated the geometry of minimum reflux computations and how to carry out very fast design computations for these columns. We were also treated to ways to show that some very plausible flowsheets one would easily propose could not function, as they subtlely violated material balances. We were shown how to look at the behavior of solvents for breaking binary azeotropic mixtures, thus giving us criteria for looking for good solvents. The recent work on reactive distillation has again led to many others to follow. Using a variable transformation, we were shown that reaction could remove or introduce azeotropic behavior and that, in certain situations, we could use all the previous analysis tools for ordinary distillation to study reactive systems. Industry is now looking at reactive distillation as an alternative processing scheme. I believe their awareness of this approach is almost entirely due to the work at U Mass. Finally, the Mayflower software created at U. Mass based on this work is very well known throughout industry and academia. It represents a significant contribution in itself as it makes this complex technology available to practitioners."

"Through their able students and their short courses, these advances in enhanced distillation have been quite quickly reflected in improved industrial practice. Processes specifically exploiting concepts developed by the Doherty-Malone team are in actual operation. Many of their developments have been included in the experimental computer codes, MAYFLOWER and FORTUNE, which in turn have inspired directly the commercial software, HYCON, and also indirectly another commercially available program, SPLIT. In our conceptual process design group, the techniques of Doherty and Malone are called upon and used more frequently than flowsheet simulation. These techniques have proven to be extremely useful in the analysis of operability, flexibility, and resiliency as well as separation scheme synthesis and column design."

"There is another dimension to their work that I believe is very important. These important results have come from the close and effective collaboration of two professors and their students. They have provided a tremendous model for their students, whether they choose academia or industry. The problems that we face today in industry are too complex for a single person to solve, and consequently the days of the 'Lone Ranger' are over. I suspect that some folks may feel uneasy about giving this award to two people, but I would argue that this would be the ideal time with this award to acknowledge the importance and value of teamwork, as exemplified by Doherty and Malone."

James J. Downs Receives the 1996 CAST Computing Practice Award



James J. Downs

James J. Downs, Engineering Associate at the Eastman Chemical Company, has been selected to receive the 1996 CAST Computing Practice Award "for leading the advancement of plant-wide control strategy design, integration of control and process design, dynamic simulation, and model predictive control at Eastman Chemical Company." The citation reads as follows:

"Dr. James Downs is nominated to receive the CAST Division's Computing Practice Award in recognition of: (1) the key role he has played in defining the development and application of process control technology within the Eastman Chemical Company, and (2) his influence on the chemical process control community. Jim's contributions fall into four main areas:"

"Plant-wide Control: Jim has led Eastman's control group to develop control systems from the plant-wide perspective rather than from the unit operations perspective. With his methodology, process variation is directed to locations of minimum consequence."

"Integration of Control and Process Design: Jim has influenced many Eastman process designs by considering controllability at the flow sheet and equipment design stage. As a result, Eastman now includes the process control group as an integral part of the plant design process."

"Dynamic Simulation: Beginning more than 10 years ago, Jim has led the development of dynamic process simulation software at Eastman. These in-house programs are used for control system design and evaluation. The functionality of these tools is still not available commercially."

"Model Predictive Control: Jim has incorporated model predictive control technology from the literature into an in-house package that Eastman uses for constraint control on several processes."

"In addition to his leading role within Eastman, Jim has also set process control directions outside his company by promoting process control education. He serves on graduate student committees, presents papers, participates in panel discussions, serves on journal advisory boards, and teaches short courses. Jim's promotion of plant-wide control and the integration of control and process design has influenced both the academic and industrial control communities."

"Perhaps Jim's most noteworthy educational contribution has been the Tennessee Eastman Process Control Problem. The problem is a rigorous dynamic model of a small, but complex, chemical process, which can be used for a wide variety of process control studies. The problem has been distributed to 100-200 people all over the world and already many papers have been published from academia on this problem. This problem is one of the few serious attempts to bridge the 'gap' between industry and academia and it has influenced the direction of some academic research."

Letters supporting the candidacy of James Down state:

"Jim has made many contributions, not the least of which is his philosophy of process modeling and control personified in his Advanced Controls Technology group at Eastman Chemical Co. His group is recognized as one of the top industrial process control groups in the country, and played a significant role in Eastman winning the prestigious Baldridge Award for quality in 1993. Jim organized and manages this group around the philosophy that process control should be much more than mathematical solutions to control problems. Jim and his group have done an exceptional job of integrating process control with process design, process analysis, process improvement, and process safety. Jim's group understands the role for advanced control technology; however, their success at Eastman stems largely from Jim's determined effort to keep process control accessible to the plant engineer by keeping it grounded in the fundamentals of chemical engineering."

"One important element of the success of Jim's group within Eastman has been the development and implementation of a family of process modeling tools. This software has revolutionized how Eastman does process design, process analysis, and process control. Perhaps one of the most remarkable aspects of the software is its user friendliness. It is a rigorous dynamic plantwide simulation package; however, it is widely used by engineers throughout Eastman. It is a tool that empowers Eastman engineers to work on their own problems and enables the central control group to focus on the more difficult and challenging problems. While these software tools are highly proprietary and not available outside of Eastman, Jim has been very open in discussing the philosophy that has driven the software development. He has unselfishly participated in numerous open forums through invited papers and presentations. Through such interactions, Jim has had and will continue to have a positive influence on the development of commercial as well as other proprietary software."

"He has had a profound effect on my own approach to control education and practice. I could cite many examples, but I will just mention three:"

1. "In the 'plantwide' continuing education course, he described examples of potential problems due to uncontrolled component inventories, then outlined a systematic approach for avoiding them. The concepts were not new or particularly difficult, but he presented them in such a clear manner--starting simply and building up to complex cases--that it finally crystallized for me. I now use this approach in my undergraduate teaching."

2. "In an invited talk at CPC IV, he described a simple problem in control system configuration for a multivariable system (vaporization process), making the point that this problem was a good 'test' to see whether a student or potential employee was capable. It was the usual, thought-provoking presentation. I went home and tried it on my own students, and it was eye-opening to see how many of them had trouble. I have since made a point to do a better job of teaching that aspect of process control."

3. "The Eastman Challenge problem (described in 'Computers & Chemical Engineering 17', pp. 245-255, 1993) has haunted my professional life ever since I first heard of it in 1991. The problem was formulated in a clever way, providing fodder for those interested in plantwide control, nonlinear control, configuration of decentralized systems, modeling, identification, fault detection, and on-line optimization. I can document that there is a growing, world-wide interest in the problem. I maintain a database of requests for information on my related publications, and it contains over 30 names--from China to Eastern Europe to Norway, the UK, Brazil, and the U.S. These are only the people who have bothered to write to me. I am sure there are many others. It is also a good challenge! I learned a lot about process control in my various attempts to solve it. This ultimately filters down to our undergradu-

ates. In fact, I used it as a case-study problem in the most recent undergrad control course."

"His knowledge of design basics for various unit operations has provided a rare linkage between conceptual steady-state design, and design for operability. It is not at all accidental that his entire group is physically housed right in the middle of the Process Design group for the entire Company. Due to his efforts to develop in-house simulators for key unit operations as well as for overall plants, we now have the capability to simulate entire process operations prior to actual concrete-and-steel construction, and this capability has saved the Company untold amounts of money and headaches during plant start-up. A pleasant side effect is that we can now operate a plant model at conditions well outside expected norms, so that we can evaluate the performance of process safety and emergency shutdown systems."

"Secondly, Jim has made a significant effort to focus people's attention on the need for considering control issues at the process design stage. Although today we have sessions and even conferences devoted to this topic, Jim was pushing this issue before the bandwagon was rolling. I was a reviewer for the paper that accompanied Jim's presentation of this issue at the FOCAPD conference, and I have first-hand knowledge of how effectively Jim made this case. The simple fact that this issue has resurfaced as a hot topic of research demonstrates Jim's impact in the design and control community."

"Outside of Eastman, Jim is recognized as an effective champion of advanced process control. For him it has not become a platform to display his mathematical skills, but rather he has demonstrated the quality of capturing the key ideas and using them effectively to make money for Eastman. He has a real knack for getting to the heart of the technical issues that he has displayed in plenary lectures at recent CPC meetings. He is also involved as an advisor on Ph.D. thesis committees and he serves our community as a member of the editorial advisory board of two leading journals."

Bhavik R. Bakshi and Kenneth R. Muske Share the 1996 CAST Ted Peterson Student Paper Award

Bhavik R. Bakshi

Kenneth R. Muske

In a decision that is unprecedented for the CAST Division, the Ted Peterson award committee and the CAST Executive Committee have decided that two student papers are equally worthy of receiving the 1996 Ted Peterson Student Paper Award. Consequently, Bhavik R. Bakshi (assistant professor at Ohio State University) – "for his 2-part published work, 'Representation of Process Trends. Parts III and IV,' which appeared in 'Computers and Chemical Engineering 18,' pp. 267-332 (1994)" and Kenneth R. Muske (staff engineer at Phillips Petroleum Co.) – "for outstanding contributions to the theory and application of model predictive control of chemical processes" -- were selected to share the 1996 award.

For Kenneth Muske, the citation reads: "The paper ('Model Predictive Control with Linear Models') that is the basis for the Ted Peterson Award nomination appeared in the February 1993 issue of 'AIChE Journal.' This paper establishes how to apply a new model predictive control theory to handle challenging industrial process control applications. The paper treats stable and unstable linear plants, constraints on the states and inputs, nonzero target tracking, output feedback with sensor noise, state estimation, disturbance modeling and removing steady-state offset, measured disturbances, and plants with unequal numbers of inputs and outputs. This paper develops a framework for the future development of linear model predictive control technology. The paper provides a design philosophy based on a rigorous theoretical foundation with which industrially implementable controllers can be developed."

Supporting letters for Dr. Muske state:

"The paper authored by Ken Muske in the 'AIChE Journal' provides coherence for many contributions in model predictive control (MPC). As someone who has watched the field of process control mature over the past decade, I think it is safe to say that MPC is the single most important industrial development of that era, in that multivariable constrained control problems have been solved successfully in many commercial applications. Ten years ago, we thought that 2 x 2 unconstrained control problems were challenging enough, so to speak of treating 8 x 8 control systems is mind-boggling, to say the least. As Ken's outstanding works show, the Shell and DMC, Inc. efforts could have easily been failures because of the lack of a unifying theoretical basis, and the academic process control community would be a shadow of itself today. However, history has been kind to us, and now with the Muske-Rawlings papers we have a clear understanding of how to make MPC work in theory and in practice. We also have better insight on how to attack nonlinear model-based control as well."

"Over the last several years Eastman Chemical Company has maintained high interest in the model predictive control field. Literally hundreds of papers have been published in this area due to its importance and industrial success in the process control area. Amongst the papers that I have read and surveyed, I have found that Dr. Muske's paper, 'Model Predictive Control with Linear Models,' AIChE Journal, 39 (2), 262, (1993), is one that truly makes a significant advancement. While most papers in this area make marginal algorithmic improvements or marginal increases in understanding, Dr. Muske's paper reveals much deeper insight. From an industrial perspective, I regard this paper as relevant and important to the advancement of model predictive control technology applications. Dr. Muske has described an approach to model predictive control implementation that addresses most of the shortcomings of the current implementations."

For Bhavik Bakshi, the extensive citation reads as follows:

"This work is an important one , with contributions of long-lasting value to the area of systems theory and computer-aided technology as follows:"

I. "Contribution to Systems Theory: Bhavik developed a formal and mathematically sound methodology for the analysis of process signals and the automatic extraction of qualitative, semi-quantitative and fully quantitative distinguishing features contained in a record of data. This wavelet-based approach provides the concise framework for the multi-scale extraction and description of temporal process trends. His theory has generalized the scale-space filtering approach and has led to a plethora of research papers by him and others, and to a series of highly successful industrial applications."

II. "Contributions to Computer-Aided Technology: Bhavik's work on the multi-scale extraction of temporal trends from process data has led to a series of new developments in computer-aided technology. Typical examples are the following, which originated with Bhavik's subsequent work and have been adopted by many researchers:

   A. Compression of process data by functional approximation and feature extraction
   B. Induction of real-time patterns from data for diagnosis and control
   C. Wave-Net: Hierarchical Neural Networks with wavelets as basis functions
   D. Multi-scale models for stochastic processes."

III. "Contributions to Industrial Practice: The ideas and methodologies contained in the work for which he is nominated have found broad applicability in the chemical and biochemical industry. Here are a few examples:

   A. Eastman Kodak uses the methodologies on induction of real-time patterns from data to diagnose the onset of failure in reactive crystallizations
   B. Texaco used the same induction methodology to diagnose the impending H_2-flaring of column operations
   C. International Biosynthetics employed induction of real-time patterns to diagnose and control the operation of large, industrial-scale penicillin frequenters
   D. Japan Energy Corp. is using Bhavik's ideas on process trends extraction to diagnose weeping in distillation columns, while Honeywell is experimenting with Bhavik's work on data compression
   E. DuPont has been pursuing the application of Bhavik's methodologies to proprietary applications and expects significant competitive advantages."

"Finally, it should be noted that a comment, which has been repeated in all supporting letters, in various wordings, is far more important: Bhavik Bakshi is worthy of the Award not only for the originality and lasting impact of his published work, but for the excellence in research and intellectual leadership he has demonstrated as an academic."

Selected excerpts from supporting letters include:

"The basis of my support for this pair of papers is:

I. The novelty and innovative nature of the ideas presented, and
II. The excellent combination of theory and practice"

"The theory of wavelets is adapted from the applied mathematics literature to provide a novel framework for feature extraction and subsequent pattern classification by decision trees. The methods are then extremely well illustrated by application to three industrial problems. To have such a combination of attributes in a pair of papers is rare. Furthermore, the papers are well written and some difficult ideas are explained clearly using a series of illustrative examples."

AIChE is entering the electronic age. Starting with the Chicago 1996 Annual Meeting, AIChE has asked the CAST Division to require that all programming transactions be done electronically. This includes (a) receipt of proposals-to-present and extended abstracts, (b) conduct of the centralized review and acceptance process, (c) notification of authors, and so forth.

"Professor Bakshi's paper, 'Representation of Process Trends. III. Multiscale Extraction of Trends from Process Data,' develops a mathematically sound approach based on wavelet theory combined with other feature extraction and analysis tools to extract process trends at multiple scales. This work becomes even more valuable when combined with the triangular representation of the trends to provide quantitative, semi-quantitative, and qualitative representations of features in the process data. New developments in computer-aided technology are direct outgrowths of this seminal paper."

"In the second paper, 'Representation of Process Trends. IV. Induction of Real-Time Patterns from Operating Data for Diagnosis and Supervisory Control,' Professor Bakshi demonstrates the applicability of his work to examples drawn from fine chemical manufacturing, reactive crystallization, and fed-batch fermentation. In these works, he uses induction to develop pattern recognition models based on the quantitative and qualitative features produced by his multi-scale methods. Although extremely powerful, the computational burden is small, and this makes it attractive for implementation on already existing computers."

CAST-Sponsored Information Technology Sessions at the Fifth World Congress of Chemical Engineering

Given the current trend towards global competition, and the corporate 're-engineering' taking place in order to become more responsive to this competition, the efficient and effective application and management of a company's information base is quickly becoming a means to developing a competitive advantage. Approached from a chemical engineering perspective, the application of this information to create knowledge about a process and its operation becomes critical.

With this theme in mind, CAST sponsored two sessions at the Fifth Word Congress of Chemical Engineering held July 14-18, 1996 in San Diego.

The two sessions on Information Technology, as part of the Technology Management and Transfer Block of sessions, contained papers and posters that addressed the issues of recent experiences and future challenges and plans in the development and application of information technology from a chemical engineering perspective.

The Wednesday morning session, "Information Technology - Approaches and Applications", contained reports and posters by approximately two dozen groups from around the world. Topics ranged from current 'state-of-the-art' industrial applications, to leading edge research. The Wednesday afternoon session, "Information Technology - Information Processing, Simulation and Artificial Intelligence", addressed future directions, both technologically and philosophically, in the use of Information Technology in a chemical engineering arena. This session also included presentations outlining examples of current applications and research.

Specific subjects covered in these sessions included: the design and implementation of a real-time, event-based control system; evolutionary optimization of nonlinear time-dependent processes by combining neural net models with genetic algorithms; modeling and optimization of fed-batch bioreactors; and the application of neural nets for the closed loop control of refining processes. The keynote address at the Wednesday afternoon session was given by Dennis Spriggs, President of Matrix Process Integration, and addressed Technology Base Management for a Sustainable Competitive Advantage.

The representation at these sessions was truly global, with experts participating from Europe, the Middle East, the Pacific Rim, and North and South America.

The conference itself was well attended, as were both of the CAST sponsored sessions, with most of the 20 parallel sessions attracting an audience of between 40 and 100 people. Greater than fifty percent of the attendees were from outside the U.S. Of the plenary sessions and keynote presentations, David Buzzelli gave an enlightening report from an industrial perspective on the recommendations from the President's Committee on Sustainable Development (of which he is co-chair), and Congressman Bob Filner, who has training as a Chem. Eng. undergrad, shared some of the difficulties in dealing with what he perceives to be the current "anti-intellectual, anti-science" Congress.

ARTICLES AND COMMUNICATIONS

Modeling and Control—Back to the Future, Part II

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[Part I of Prof. Edgar's article was published in the Winter 1996 issue]

What is coming next in MPC?

My colleague, Jim Rawlings, has suggested the following items:

1) Faster hardware: MPC control of units with as many as 10 inputs and 10 outputs is already established in industrial practice. Computing power is not causing a critical bottleneck in process control, but larger MPC implementations and faster sample rates will probably accompany faster computing.

2) Better MPC algorithms: Do not underestimate the potential improvement here. The improved algorithms could easily have more impact than the improved hardware for the next several years. The presence of many tuning knobs does not appear to be a liability yet.

3) MPC appearing at the lowest level in the DCS: What will be the ratio of PID to MPC loops designed if this happens?

4) Nonlinear Models. When will control based on nonlinear models become part of industrial practice? Nonlinear MPC theory and algorithms are improving steadily as are nonlinear model identification technologies.

Some of the new versions of MPC are incorporating model adaptation, but to this time adaptive control has not had much impact. This is due to problems in keeping such loops operational, largely because of the sensitivity of multivariable adaptive controllers to model mismatch. On the other hand, there has been considerable success with adaptive PID controllers, which can be purchased for a small incremental cost over the standard non-adaptive PID controller from many instrument companies. Unfortunately, adaptive control algorithms are not readily available from DCS vendors.

Recently I have had the opportunity to interact with several microelectronic companies in the area of process modeling and control. The microelectronics industry shares many common features with the chemical industry, especially from the unit operations viewpoint. The establishment of SEMATECH in Austin, Texas has provided a focal point for developing modern, intelligent production systems for microelectronics manufacturing. Since microelectronics firms now manufacture products with smaller feature sizes, previous etching and deposition processes have been replaced by specialized reaction systems including plasma etching and chemical vapor deposition. However, these processes are essentially empirical and not well understood. Significant yield losses occur for no apparent reason. Process specifications and windows are exceedingly rigid and tight, which requires very precise processing techniques. Currently, process control usually consists of end point detection (open-loop programming of manipulated variables), which often results in low yields, and statistical process control. Manual rather than automatic feedback control is normally employed.

The obstacles to new process control approaches for solid state device processing are similar to those faced by the chemical industry during the past 20 years and include:

1) There is clearly insufficient fundamental understanding of most complex chemical processes used in microcircuit fabrication. Mathematical models are very poorly developed and are needed for each piece of equipment.
2) On-line process monitoring tools for the determination of gas phase composition and film properties are not readily available.
3) The lack of trained personnel hinders systems analysis and implementation.

Cooperative projects between academia and industry are making considerable progress in upgrading the level of process control in this industry [1].

Computer-integrated manufacturing (CIM) is a more general approach than that described earlier. CIM is defined as a unified network of computer hardware and software systems that combines the business and process functions (such as administration, economic analysis, scheduling, design, control, operations, etc.). It provides general access to a common data base and produces reports for managers, engineers, and operations so that optimum decisions can be made and executed in a timely and efficient manner. Process control provides the lower levels in a pyramid-like structure (Figure 1). CIM is recognized as an important tool for improving the competitiveness of the U.S. process industries, but we are a decade away from seeing CIM implemented on a large scale. Cooperation among computer vendors will be required to develop a satisfactory computer/ communication system. While technology exists to carry out the tasks involved in CIM, no single computer vendor currently has equipment to support completely such a comprehensive network.

In the factory of the future, the industrial environment where process control is carried out will be different than it is today. In fact, some forward-thinking companies believe that the operator in the factory of the future may need to be an engineer, as is the case in Europe. Because of greater integration of the plant equipment, tighter quality specification, and more emphasis on maximum profitability while maintaining safe operating conditions, the importance of process control will be increased. Very sophisticated computer-based tools will be at the disposal of plant personnel. Controllers will be self-tuning, operating conditions will be optimized frequently, total plant control will be implemented using a hierarchical (distributed) multivariable strategy, and expert systems will help the plant engineer make intelligent decisions (those he or she can be trusted to make). Plant data will be analyzed continuously, reconciled using material and energy balances and nonlinear programming, and unmeasured variables will be reconstructed using parameter estimation techniques. Digital instrumentation will be more reliable and composition measurements which were heretofore not available will be measured on-line. There are many industrial plants that have already incorporated several of these ideas, but no plant has reached the highest level of sophistication over the total spectrum of control activities.

Modeling and Control--Back to the Future

Model Predictive Control serves as a good example where old control ideas have resurfaced as new ones. It is pertinent here to quote Goethe:

"Everything has been thought of before, but the problem is to think of it again"

In some respects MPC for linear systems is simply a revisiting of the LQG problem studied in the 1960's by Kalman and others. In fact, my Ph.D. research in the late 1960's at Princeton involved solving the LQG problem in the presence of linear state and control constraints with variable final time horizons, much the same problem that has been addressed during the 1990's. An analogous early model-based approach favored by statisticians, with discrete time series analysis and noise models instead of disturbance models, was articulated by Box and Jenkins [2].

In the area of linear MPC, perhaps the first model-based controller was the 1957 Smith predictor [3], shown in Figure 2. It used a model of the process, $\tilde{G}_p(z)$, to predict the effect of control actions C(z) and effectively eliminate the process time delays from the characteristic equation. The controller is designed for the process without time delay $\tilde{G}^*_p(z)$ in order to achieve good set point changes. The analytical predictor (Figure 3) was suggested in 1970 by Moore et al. [4] and included a model prediction in the feedback loop (z^{+N}) to give satisfactory performance for both load and set point changes. Both of these block diagrams can be rearranged to form the well-known IMC structure [5] with controller G_c and filter F, shown in Figure 4. Using the IMC structure, the analytical predictor was later generalized by Wellons and Edgar [6] for $G_L(z) \neq G_p(z)$, which in effect yields a two degree of freedom controller (A^* and G_c in Figure 5). Thus in the past 40 years we have seen many variations of the same approach for linear model-based control.

In the area of nonlinear model predictive control, a 1967 reference [7] contains the following statement:

"One technique for obtaining a feedback controller synthesis from knowledge of open-loop controllers is to measure the current control process state and then compute very rapidly for the open-loop control function. The first portion of this function is then used during a short time interval, after which a new measurement of the process state is made and a new open-loop control function is computed for this new measurement. The procedure is then repeated."

Control researchers during the early 1970's addressed the problem of using nonlinear programming to solve optimal control problems, e.g. [8], and even used orthogonal collocation to treat the model as a set of constraints [9], a current popular approach. Hardware and software limitations prevented much progress until the late 1980's, when software advances made nonlinear programming a practical real-time control tool with state-of-the-art workstations.

Cooperative Research in Modeling and Control

The process control community has been quite active in forming research partnerships between academia and industry. At this time the largest research consortia in process modeling and control are at the University of Texas, University of Wisconsin, Lehigh University, University of Maryland, Purdue University, University of Tennessee, Texas Tech University, and MIT. When one also considers single investigator projects supported by industry, it is likely that industrial support of process control research is comparable in scale to that provided by NSF (about $2.5 million), and the industrial percentage is growing due to such new NSF programs as GOALI. This contrasts to the situation in the 1970's, where there was an air of distrust between the two groups and little or no cooperation.

The bigger problem in cooperation is perhaps within the academic community itself. It is well-known that in the process control area, highly critical proposal and paper reviews seem to be the rule rather than the exception. Faculty in other areas such as catalysis and separations seem to feel that more of their colleague's projects are praiseworthy, and indicate so on the review form. Our community, on the other hand, chooses to be very negative about work done by others, and wants to "throw the baby out with the bath water". Several managers at NSF have indicated that without evidence of more proposals rated "excellent" that are not being funded, the process control area is not likely to receive more support from NSF.

This psychology also carries over to such petty issues as who gets referenced (and who does not). One humorous award presented at the end of the 1986 CPC-III Conference was called the Self-Citation Award, which is given to the author with the highest ratio of self-citations to the total number of citations (I have suggested a related award for CPC-V, called the "I'm OK- You're not OK" Award). I believe the process control community can reform itself, especially with so many young researchers who do not have to follow the old traditions. But this reform will have to be done internally and collectively to make real progress. As a glimmer of hope, the recent CPC-V conference (January, 1996) appeared to have considerably less acrimony than other control conferences and technical meetings in the past.

Conclusions

The increased usage of computer modeling and control will have significant implications for the process industries and will undoubtedly increase productivity and quality. However, currently there is much uncertainty and pessimism about the future of basic research funding in the U.S. I remember a conversation with a fellow graduate student at Princeton in 1971, a time when Ph.D. employment opportunities were at a low point. Both of us had accepted faculty positions and were worried about the future of academic research in control. My colleague said that after Pontryagin and Lyapunov, all that was left was the crumbs. So I guess in the intervening 25 years, I have had a pretty 'crumby' career. This vignette should give process control researchers some reason for optimism as we head into the next century. To quote Pogo, "We face insurmountable opportunities."

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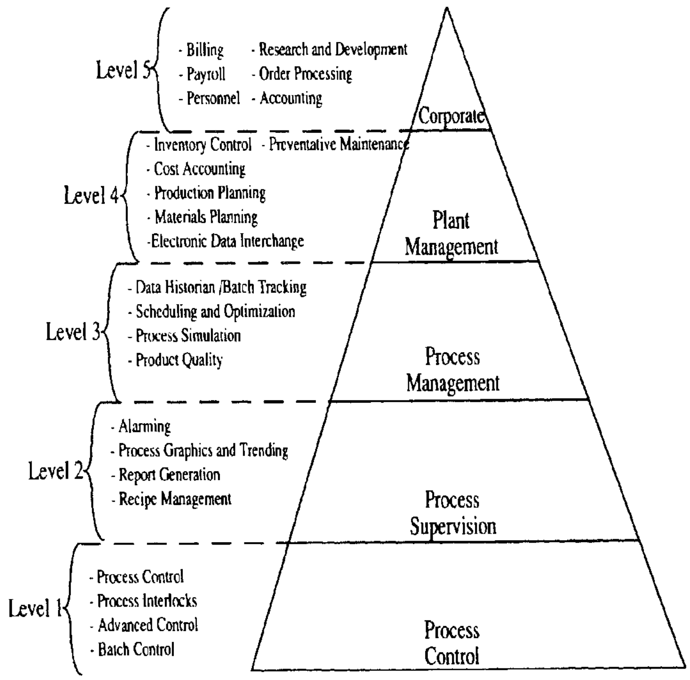

Source: Fisher Controls

Figure 1. Computer-integrated manufacturing (CIM) activities.

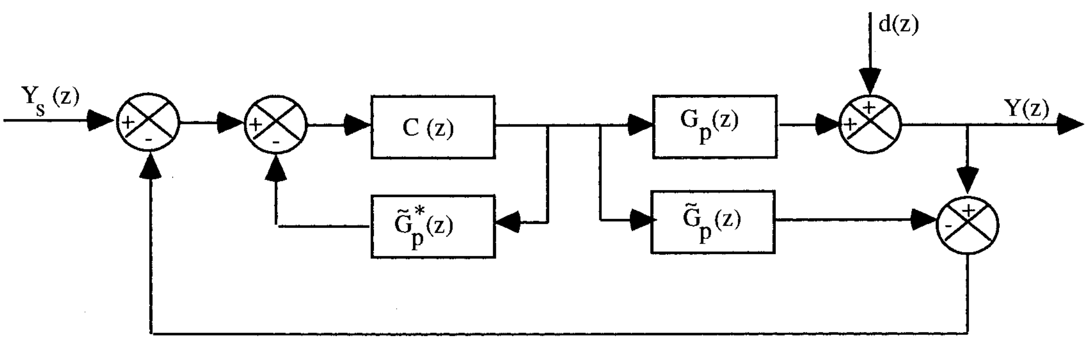

Figure 2. The Smith Predictor.

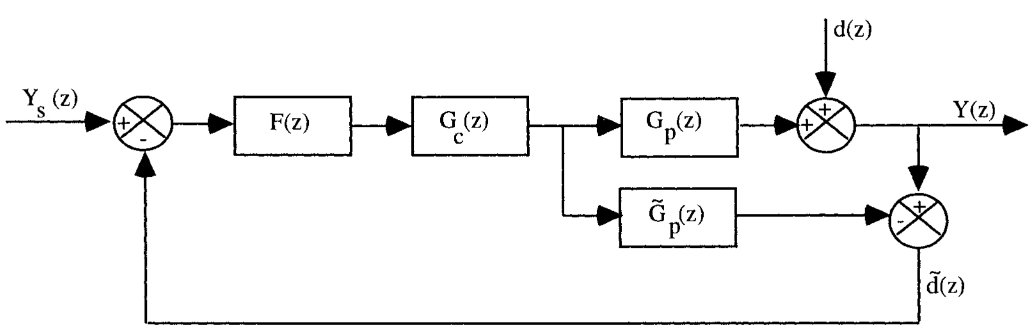

Figure 3. IMC structure with filter.

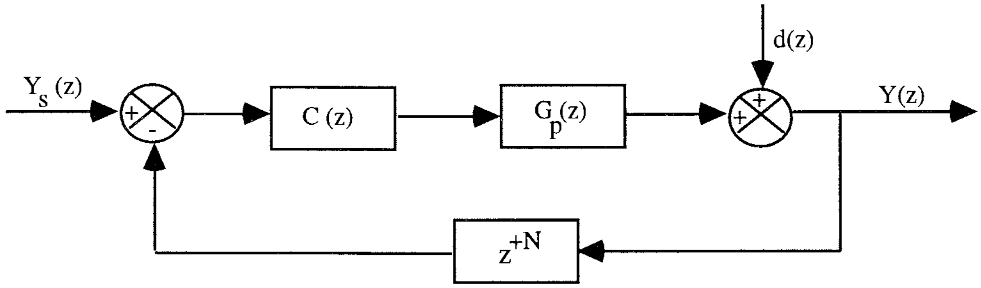

Figure 4. The basic Discrete Analytical Predictor structure

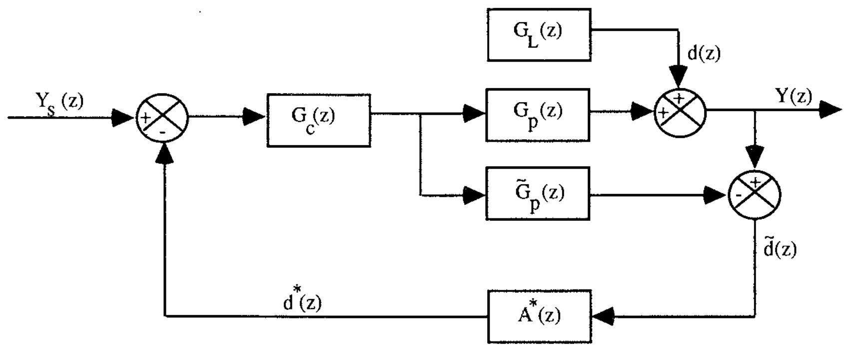

Figure 5. Alternate representation of the GAP

Data Compression For Process Historians

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Historization

This paper deals with storing and retrieving the time history of plant sensor data. Historization is an important part of modern plant monitoring and information systems. Operators look at real-time multivariable trends for clues to "what's going on", post-mortem committees need to reconstruct the circumstances leading up to plant "incidents", and engineering studies benefit from a way-back look at a not-so-recent mode of operation.

Compression

Why compress, why not just store all data? The reasons are pretty obvious:

- to conserve storage space
- to live within limited channel bandwidth -- this could be the input-output channel to disk or the message channel from a data collecting/filtering process to a history storage process.

Efficient utilization of storage space is important even with today's huge storage volumes. Operations and Engineering want months of data on-line in addition to last shift's. Compression is not the only means to fulfill this need: storage of "averaged" data, for example, hourly, shift, daily, weekly averages may fulfill the really long term data storage requirement. Nonetheless, for some "short" time scale most clients want "raw" data or some really close approximation thereto. And "short" may mean months or longer to some clients.

Data compression is not effective at dealing with limited I/O bandwidth at all times. This is because there will be intervals during which little or no compression will take place: for example, computer or instrumentation subsystem startup, plant upsets, neurotic sensors, etc. Compression can only help insofar as memory buffers are able to provide a temporary repository when the I/O channels are "maxed out."

Compression is not the only means to deal with limited I/O bandwidth. Multiple channels can be provided. This approach is especially convenient when used along the lines of data type (e.g. analog versus discrete) since the different data types are usually dealt with separately anyway.

Who's the Client?

The client is an operator, an engineer, a plant supervisor, an accountant, a government agency -- in short, anybody or any body that may want a peek at the historical record. Choosing a compression method is as much a matter of clientele proclivity as mathematical proof.

The Customer is Always Right

Our clients ask three questions about each compression method:

- How good a representation of the original data will I get?
- What will it look like (when reconstructed from the historical record)? Some reconstructed data looks digitized. Other plots appear "sharper" than the original data, or have suspicious "glitches" in them. These subjective assessments may, in the end, carry far more weight than mathematical or statistical reassurances.
- How efficient is it in terms of reducing the amount of storage I have to buy?

Details vary from client to client, but two views cover the gamut. Which one of the following views do your clients espouse?

View # 1 – "My only requirement is that any reconstructed point be within ±max_dev of the actual value (as originally presented to the historization process)." This requirement will hereafter be referred to as *the iron-clad guarantee.* Note that the iron-clad guarantee eliminates store-every-nth point, time slicing (periodic sampling), and averaging methods.

View # 2 – "I want two criteria to be met. First, any reconstructed point must be within ±max_dev of the actual value (the iron-clad guarantee). *Second, any point stored in history must be exactly the value as received from the scanner.*"

If you subscribe to view #1 then you can use any of a wide variety of compression methods including some very efficient ones. View #2 does not lead to quite the same economies.

Time and Time Again

Bear in mind that a data point is a time-value pair. The compression algorithm may have permission to alter a value (but by no more than ±max_dev). But the scanning subsystem indelibly time-stamps a value and this time-stamp must pass to the historical record unscathed--if it makes it into the record at all. Probably some economies could be achieved by relaxing this requirement. In one view the compression process should have complete freedom to invent time stamps. For instance, a historical record that represents the data by a spline fit does not explicitly contain any time-value pairs at all.

STATUS and other qualifiers/modifiers

Operational requirements may dictate a maximum age (max_age) as well as a maximum deviation. Thus, a new data point may be stored simply because it is more than one hour older than the last stored point. This is both a credibility issue (e.g. a point that is scanned once a minute but hasn't been stored in 2.5 months because it hasn't changed enough...nevertheless raises eyebrows) and a backup to whatever other ways the program designer provides for failure-tolerance.

The compression methods we use accommodate maximum age and status gracefully, with an unavoidable toll on efficiency. While they add to other interesting problems (such as startup, normal shutdown, and sudden shutdown) for the system designer and programmer, they are not dealt with further in this paper.

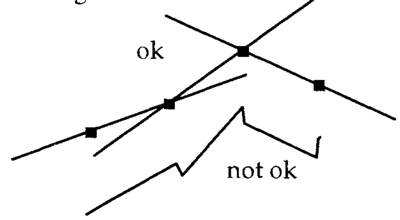
Compression Methods

Space telemetry needs motivated researchers to devise and analyze data compression schemes in the 1960's and 70's (1), and the methods developed were screened with real telemetry data (2,3,4). In the early eighties, Hale and Sellars (5) promoted the "boxcar" and "backslope" compression algorithms (predictors), which have since seen some service in process monitoring historians (6,7). New schemes are described from time to time (e.g. 8). Recently "Swinging Door" algorithm(s) were introduced and to some extent popularized (9,10,11). Today, much data compression research is focused on image compression—for example, by wavelet-based spectral transformations (12). Possible application of the latter to process historians has not been considered by this author and is not covered by this paper.

The methods we have found particularly useful are the "fan interpolators" (2), which we nicknamed SLIM (Straight-Line-Interpolative-Methods). A definition of these and other methods is contained in the Appendix.

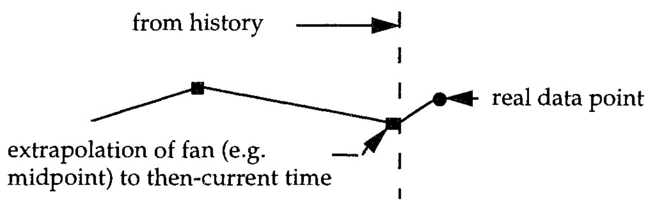
Table I lists the properties of several compression methods. Table II gives some indication, at least, of relative compression efficiencies in terms of compression ratio, which is the number of points received divided by the number of points stored. Depending on max_dev, the compression ratio for any particular set of data can vary between 1.0 and infinity.

In choosing a compression method, we need to consider how we intend to recreate the historical record (retrieval). This will always be by interpolation, or something like interpolation, because of trending:

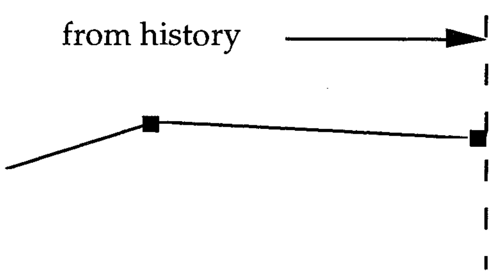


The downside to choosing joined line segments is that it may exacerbate oscillating situations (ref. 3, p. 84).

Let's create a strip chart, starting from historical data, moving the "curve" to the left each time a new point is stored and a real "uncompressed" point is plotted.



If we then replot the data, now entirely from the historical record, we may get:



Which shows that retrieval is like scuba-diving; you have to be careful on decompression or you'll get the bends!

It is probably not a good idea to recreate the unclosed reconstruction epoch each time the chart is bumped to the left by a new data point, because this would result in noticeable vertical wobble of the existing trace (as the slope of the best-fit line changes), and would require more coordination between storage and retrieval.

Retrieval versus Storage

A curious dichotomy possesses many compression methods. When the compression process receives a new point it compares it to one or more extrapolators.

If the extrapolator does not predict the value to within ±max_dev, then some action is taken, for example, the extrapolator(s) is(are) terminated at the prior point's time stamp. The line or function may still be an extrapolator. However, because of its value there may be an extrapolation of previous values, not the value as received.

The decompression process, however, is purely one of interpolation. Why? Because it looks better on a trend.

Does the disparity between compression by extrapolation and decompression by interpolation pose a problem? Yes, if it leads to a breakdown of our iron-clad guarantee.

For Value and for Modified Boxcar compression, extrapolation results in a staircase appearance, which is unacceptable for trending. At least the staircase meets our iron-clad guarantee for reconstructed data. Straight line interpolation may not. In order to use straight line interpolation to reconstruct data, we may have to halve the value of max_dev used during compression. This applies to Modified Boxcar, Modified Backslope, and SLIM2 (see the Appendix), and unavoidably reduces the compression ratio. But happily, if we always reconstruct by interpolating, we no longer need to remember which of the methods was used to compress the data.

More Gotchas

Retrieved data carries more meaning if you're aware of what value for max_dev was used. Indeed max_dev probably doesn't change very often, if ever. Nevertheless, provision must be made for recovering that number with certainty.

The instrumentation system may itself impose limits on a value (clamping). It is possible for reconstructed points to lie outside the clamped range by as much as max_dev. In this way, a trend of absolute pressure might dip below zero, whereas the "live" engineering values were originally non-negative. SLIM1-compressed data suffers from this anomaly.

The compression ratio experienced depends on the method chosen, on the nature of (e.g. variance in) the data, and on max_dev. It can also be highly serendipitous. Take for example a constant process subjected to some sort of sinusoidal disturbance and sampled frequently:

$$y = C + \sin(t)$$

and

$$\text{max\_dev} = 1.0$$

We discover that the compression ratio is large indeed, limited only by max_age, provided the very first point falls on $y = C$, as will happen if we start at $t = 0$. Otherwise, the compression ratio could be as low as one.

Finally, we note that send-on-change instrumentation systems may introduce their own error which is not covered by our iron-clad guarantee unless specifically accommodated by reducing the value of max_dev. This could be important where substantiating environmental compliance is an issue.

And the Winner is...

It comes down to choosing between SLIM3, with its faithful reproduction of original data points, and SLIM1 with its higher compression ratio. Both methods guarantee that any reconstructed points will be within ± max_dev of the original value.

When a sensor is likely to yield measurements very close to an implausible region (e.g. subzero absolute pressure), use SLIM3. Otherwise enjoy the maximum compression SLIM1 offers. But check with the historian's owner first!

Appendix -- Compression Algorithms

Pseudocode is used to describe the first few methods.

1. Value Compression

```
IF   the value of the current point differs from
     the last recorded point by more than max_dev
THEN {
     IF   previous point is later than last recorded point
     THEN {
          record projected point =
               (previous point's time, last recorded
               point's value)
          record current point
     }
     ELSE    record current point
}
```

Although this is basically an extrapolative method, an interpolative reconstructor can be used transparently.

2. Hale and Sellars (5) Box Car

```
IF   the value of the current point differs from
     the last recorded point by more than max_dev
THEN {
     IF   previous point is later than last recorded point
     THEN record previous point
     ELSE record current point
}
```

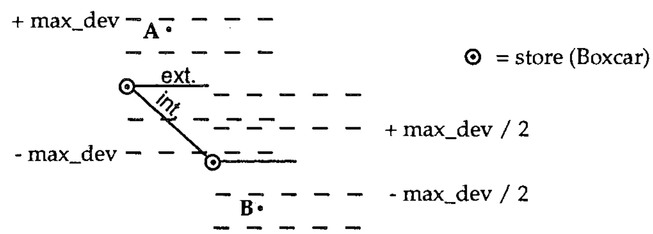
3. Hale and Sellars (5) Backward Slope

Project the last two recorded (time, value) points to the current time.

```
IF   the value of the current point differs from
     the projected point by more than max_dev
THEN {
     IF previous point is later than last recorded point
     THEN record previous point
     ELSE record current point
}
```

4. Modified Boxcar and Modified Backslope

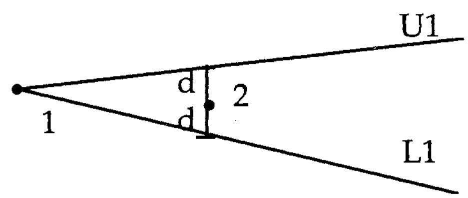
Our ironclad guarantee forces us to modify the boxcar and backslope procedures, which record only the previous point when a current point turns up out of tolerance with the zero or first order projection. We now must also store the current point if its value is beyond ± one-half of max_dev from the projection through the new last recorded point (= previous point). Point B, below, is an example.



Since these are extrapolative methods, we really ought to use an extrapolator for reconstructing data. If an interpolator is to be used (as recommended), our iron-clad guarantee requires us to set the tolerance bands to ± one-half of max_dev. Point A, above, illustrates why.

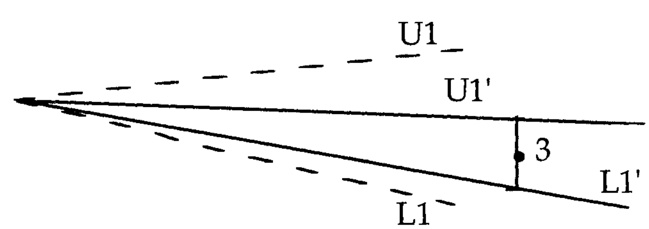
5. SLIM1

We'll describe this method by working through an example.



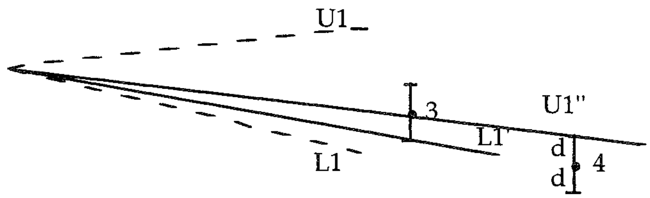
Given points 1 and 2, i.e. (t_1, y_1) and (t_2, y_2), we construct a pair of lines of slope L_1 and U_1 as in the above sketch (d is max_dev and defines upper and lower limits or "tolerance band").

Now point 3 comes along.



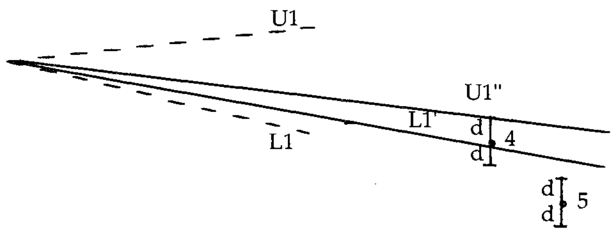
We change slope L_1 to L_1' and U_1 to U_1' to subtend y_3's tolerance band. Notice that we close the fan (reduce slope U1 and/or increase slope L1); we never open it (else we might go outside 2's tolerance band).

Now point 4 arrives



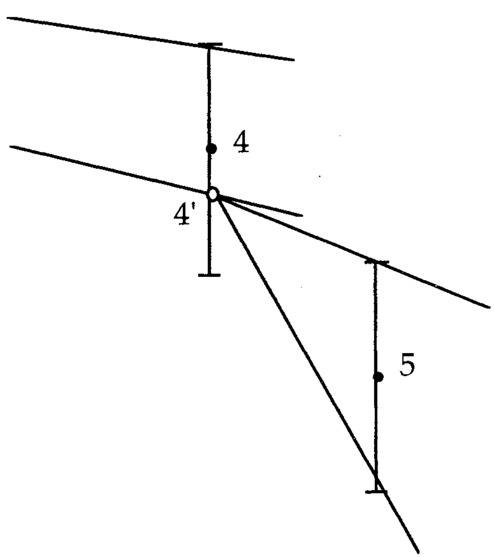
this time we change only slope U_1' to U_1"

When point 5 arrives



we discover that this time we are out of luck. 5's tolerance band does not overlap the region subtended by the two lines at all. So we go back to t_4 and record pseudopoint (t_4,y_4') which is at the intersection of 4's tolerance band and the line of slope L_1'. (Had point 5 lain above line U1, we would have chosen to record the value y_4+d instead.)

Now we start anew, starting with a pair of lines emanating from (t_4,y_4'):



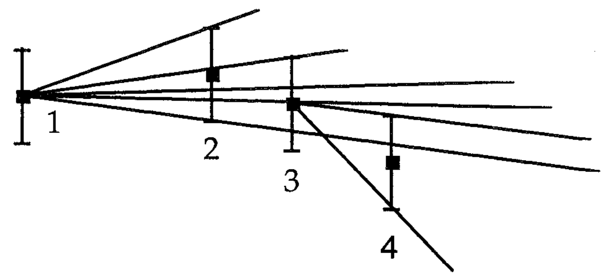
This, then, is SLIM1.

6. SLIM2

SLIM2 is similar to SLIM1 except that we record the actual previous value and time whenever a new point's tolerance band falls outside the "fan". Alas, to meet our iron-clad guarantee we must set the tolerance bands to ± one-half of max_dev.

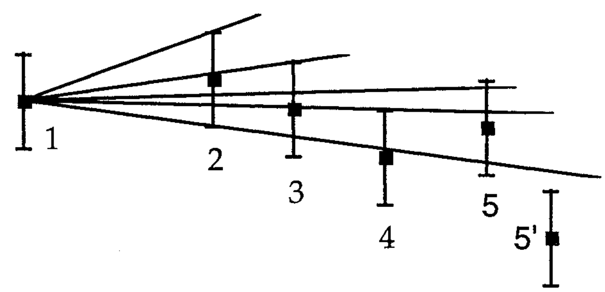
7. SLIM3

We revert to using ±max_dev instead of ±one-half of max_dev for the tolerance bands, and tentatively mark a previous point for recording when its value (rather than its tolerance band) falls outside the "fan". Consider:



When point 4 arrives we go back and store point 3, and start a new fan from point 3 through the extremes of point 4's tolerance band.

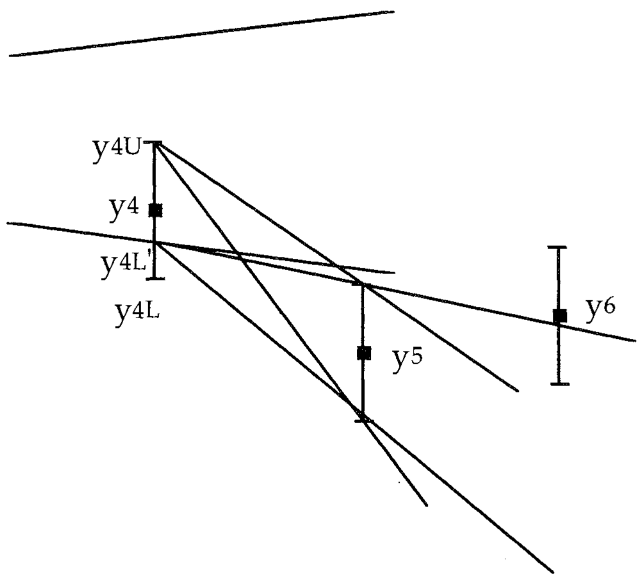
The performance of SLIM3 *could* be improved. When point 4 arrives,



do we *have* to go back and store point 3? Not necessarily because the next point may be such that it is unnecessary to store 3, as for example is the case with point 5. But if we have point 5' instead of point 5, then we must go back and store point 3, and proceed from there. Since we may have to store point 3, we must keep track of the fan emanating from 3 at least until such time we discover that we will not have to store it (i.e. a point within the fan like 5 comes along.) Of course, if point 4's tolerance band had not overlapped the fan, we would have immediately stored point 3. We might expect a small-to-modest increase in compression ratio, at the expense of more complicated programming. We haven't evaluated this proposed improvement.

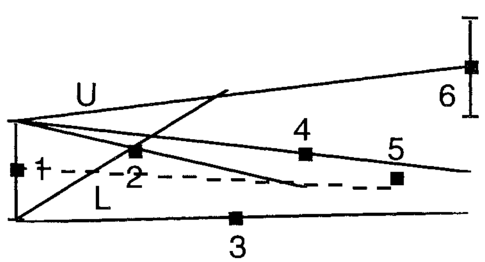
8. SLIMMER

Yet another variant (on either SLIM1 or SLIM2, but illustrated with SLIM1) uses multiple (say, two) fans.



Instead of storing y_4 or $y_4^{L'}$, we remember $y_4^{L'}$ and y_4^{U} Now we start two fans, one at $y_4^{L'}$ and one at y_4^{U}. When we finally eliminate one, (e.g. as when point y_6 comes along) we store the apex of the surviving fan (in this case y_4^{U}) and continue. Indeed there could be any number of fans emanating from points, say, equidistant on the subtended tolerance band of the last recorded point. There results potentially better compression, same or better noise immunity, and same or better fit; but additional fans to keep track of and more complicated logic to program.

6. Swinging Door as described by Bristol (9) with certain modifications.



Starting with points 1 and 2 we construct a pair of lines emanating from the extrema of 1's tolerance band and intersecting at point 2. For each new point we either:

- rotate L clockwise through the new point e.g. point 3,
- rotate U counterclockwise through the new point e.g. point 4,
- do nothing, e.g. point 5

When the lines L and U no longer intersect at some time more recent than point 1 (i.e. the swinging doors swing past parallel), as happens with point 6, we store the line segment (that is, the *two* end points) midway between the *previous* L and U (dotted line in the example) and start new swinging doors at the offending point.

Acknowledgments

I acknowledge my colleagues Roger Humphrey, Art McCready, and George Whittlesey without whose prodding this work might never have been done, leaving our clients to rely on less-satisfying methods for compressing their process data.

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12. *Data Compression (Mar 70 - Present), Citations from the NTIS Bibliographic Database, Published Search PB95-859872*, National Technical Information Service, Springfield, VA, 1995 [one of many NTIS searches on data compression].

TABLE I---COMPRESSION-METHOD GUARANTEES

compression method	reconstruction ±max_dev of actual	actual values stored	continuous line segments
none	YES	YES	YES
boxcar	NO	YES	NO
backslope	NO	YES	YES
modified boxcar	YES	YES	NO
modified backslope	YES	YES	YES
value	YES	NO	NO
SLIM1	YES	NO	YES
SLIM2	YES	YES	YES
SLIM3	YES	YES	YES
modified Swinging Door	YES	NO	NOT REALLY

Table II - Performance

Signal	Pure Sine Wave			Noisy Sine Wave		
Parameters	y[I] = 100 sin(t[I]), sampled 360x per period for four periods, max_dev = 1.5			y[I] = 100 sin(t[I]) + G[I], sampled 360x per period for four periods, max_dev = 1.5 G[I] is a random number normally distributed about 0.0 with standard deviation = 0.5		
Compression Method	Compression Ratio	Max Reconstraction Error		Compression Ratio	Max Reconstruction Error	
		Interpolative	Extrapolative		Interpolative	Extrapolative
None	1	0.00	0.00	1.00	0.00	0.00
Boxcar	1.27	1.37	1.21	1.32	2.35	2.57
Backslope	8.9	0.85	1.40	6.2	2.41	2.63
Modified Boxcar	1.13	0.85	0.55	1.14	1.06	0.73
Modified Backslope	6.2	0.52	0.70	1.47	1.23	0.75
Value	1.20	1.49	1.49	1.28	1.50	1.50
SLIM1	35	1.50	NA	16.7	1.50	NA
SLIM2	22.1	1.17	NA	5.3	1.32	NA
SLIM3	25.3	1.47	NA	9.8	1.50	NA
Modified Swinging Door	17.8	1.48	NA	10.1	1.50	NA

Notes

1. In general adding noise degrades performance as measured by compression ratio. However, if the compression ratio is near unity, almost every point is stored anyway, so noise may actually improve performance by providing data within the tolerance band.
2. Zero order (i.e. zero slope) compression methods (Boxcar, Modified Boxcar) may exhibit a smaller error (e.g. zero error for a triangular waveform synchronous with the sampling function), or a larger error (e.g. for staircase or rectangular signals) for interpolative reconstruction than for extrapolative reconstruction.
3. max_dev is the maximum deviation required. Modified Boxcar, Modified Backslope, and SLIM2 use a tolerance equal to one-half of max_dev in order to meet this requirement (see text).

MEETINGS AND CONFERENCES

To submit a paper for consideration at any event listed below, please contact the symposium coordinator or session chair directly. For further information or details about each of the four CAST Division programming areas, contact the appropriate Area Chair as noted in the masthead. For general information concerning CAST Division sessions and scheduling, or to correct errors in this listing, please contact Jeffrey J. Siirola (CAST Division Programming Chair), Eastman Chemical Company, PO Box 1972, Kingsport, TN 37662-5150, 423-229-3069, 423-229-4558 (FAX), siirola@eastman.com. Many of these postings are archived on the World Wide Web at URL http://www.che.wisc.edu/cast10.

Third Workshop on Discrete Event Systems (WODES '96)
Edinburgh, Scotland
August 19-21, 1996

Discrete event systems has developed to be an interdisciplinary field of shared interest, methodologies, and applications between control and computer science. This workshop, sponsored by the Institution of Electrical Engineers (U.K.), aims to bring together control theoreticians, software engineers, and computer scientists with a view to integrate methodology, techniques, and tools. The workshop will focus on the control of discrete event systems (with emphasis on real time control), computer science (with emphasis on hybrid systems, timed systems, Petri nets, process algebras, software verification, and design), and applications (with emphasis on manufacturing systems and software design). For more information, contact Rein Smedinga, WODES '96, Department of Computer Science, University of Groningen, NL-9700 AV Groningen, THE NETHERLANDS, 31-50- 633800 (FAX), wodes96@cs.rug.nl.

AIChE is entering the electronic age. Starting with the Chicago 1996 Annual Meeting, AIChE has asked the CAST Division to require that all programming transactions be done electronically. This includes (a) receipt of proposals-to-present and extended abstracts, (b) conduct of the centralized review and acceptance process, (c) notification of authors, and so forth.

1996 Portuguese Control Conference
Porto, Portugal
September 11-13, 1996

The Portuguese Society of Automatic Control will hold the 2nd Portuguese Conference on Automatic Control in Porto, Portugal. Held in cooperation with Instituto de Sistemas e Robotica, Instituto Superior Tecnico, and Faculdade de Engenharia da Universidade do Porto, this conference will bring together people working in the fields of control, automation, and related areas. Topics of interest include linear and nonlinear systems, adaptive control, robust control, modeling and simulation, systems identification, optimal control and optimization, stochastic control filtering and estimation, automation systems and control, algorithms and architectures for real-time control, robotics, manufacturing systems, process control, electrical and fluid power actuators, signal processing, artificial vision, fuzzy systems, and neural networks. For further information contact Maria Margarida A. Ferreira, Faculdade de Engenharia da Universidade do Porto, DEEC-ISR, Rua dos Bragas, 4099 Porto, PORTUGAL, 351- 2-2041847, 351-2-2000808 (FAX), control@fe.up.pt.

The Seventh International Workshop on Principles of Diagnosis
Val Morin, Quebec
October 13-16, 1996

This is an annual workshop to encourage interaction and cooperation among researchers in artificial intelligence with diverse approaches to diagnosis. It will take place in Val Morin in the Laurentian Mountains near Montreal, Quebec, Canada with four days of presentations and substantial time reserved for discussion. Topics of interest include theory of diagnosis: abductive, consistency-based, causal, probabilistic, constraint-based, temporal; computational issues: controlling combinatorial explosion, focusing strategies, controlling inference in complex systems, use of structural knowledge, hierarchies; modeling for diagnosis: multiple, approximate, incomplete, probabilistic, functional, and qualitative models, integration of heuristics with model-based diagnosis, principles of modeling, modeling dynamic systems, acquiring models and diagnostic knowledge; the diagnosis process: strategies for repair, monitoring, sensor placement, test selection, resource-bounded diagnosis; interesting connections between diagnosis and other areas, particularly logic programming, machine learning, control theory, and software verification and validation/ debugging/synthesis. Real-world applications are encouraged from a wide range of fields, such as control theory, medicine, chemical, mechanical, structural, electrical, and electronics systems. Of particular interest is the relationship between the techniques applied in practice and formal models of diagnosis. For further information, contact Suhayya Abu-Hakima, National Research Council of Canada, Building M-50, Montreal Road, Ottawa, Ontario K1A 0R6, CANADA, (613) 991-1231, (613) 952-7151 (FAX), suhayya@ai.iit.nrc.ca.

1996 AIChE Annual Meeting
Chicago, Illinois
November 10-15, 1996

Area 10a: Systems and Process Design

Meeting Program Chair: Sangtae Kim, Department of Chemical Engineering, University of Wisconsin, Madison, WI 53706-1691, (608) 262-5921, (608) 262-0832 (FAX), kim@engr.wisc.edu.

The CAST Division is planning the following sessions at the Chicago Annual Meeting which have been approved by the Meeting Program Chair. The entire CAST program in Chicago is being cosponsored by the Society for Computer Simulation.

1. Design and Analysis -- General Papers. Costas D. Maranas, Pennsylvania State University (Chair) and Srinivas K. Bagepalli, General Electric Company (Co-Chair).
2. Synthesis and Analysis of Separation Systems. Sophie Ung, E. I. du Pont de Nemours & Company (Chair) and Oliver M. Wahnschafft, Aspen Technology, Inc. (Co-Chair).
3. Process Synthesis -- General Papers. Vivek Julka, Union Carbide Corporation (Chair) and Matthew J. Realff, Georgia Institute of Technology (Co-Chair).
4. Special Topics in Design and Analysis. Stratos Pistikopoulos, Imperial College (Chair) and Michael L. Luyben, E. I. du Pont de Nemours & Company (Co-Chair).
5. Synthesis and Analysis for Safety and Environmental Concerns. Karen A. High, Oklahoma State University (Chair) and Lionel O'Young, Mitsubishi Chemical Corporation (Co-Chair).

Joint Area 10a and Area 1a Session

1. Educational Initiatives in Molecular Simulation and Computational Chemistry. Peter T. Cummings, University of Tennessee (Chair) and Michael L. Mavrovouniotis, Northwestern University (Co-Chair).

Joint Area 10a and Area 15b Session

1. Design of Food and Pharmaceutical Processes. Matthew J. Realff, Georgia Institute of Technology (Chair) and Stephen P. Lombardo, The Coca-Cola Company (Co-Chair).

Area 10b: Systems and Process Control

1. Nonlinear Control. Francis J. Doyle, Purdue University (Chair) and Yaman Arkun, Georgia Institute of Technology (Co-Chair).
2. Advances in Process Control. Oscar D. Crisalle, University of Florida (Chair) and M. Nazmul Karim, Colorado State University (Co-Chair).
3. Applications of Process Control. Jorge A. Mandler, Air Products and Chemicals, Inc. (Chair) and Thomas A. Badgwell, Rice University (Co-Chair).
4. Integrated Estimation and Control. Fred Ramirez, University of Colorado (Chair) and Michael A. Henson, Louisiana State University (Co-Chair).
5. Plantwide and Decentralized Control. Richard D. Braatz, University of Illinois (Chair) and S. Joe Qin, University of Texas (Co-Chair).
6. Process Performance Monitoring. George N. Charos, Amoco Corporation (Chair) and Masoud Soroush, Drexel University (Co-Chair).

Joint Area 10b and Area 10c Session

1. On-Line Optimization for Control. Karlene A. Kosanovich, University of South Carolina (Chair) and Iauw-Bhieng Tjoa, Mitsubishi Chemical Corporation (Co-Chair).

Joint Area 10b and Area 8f Session

1. Modeling, Monitoring, and Control of Materials/Polymers Manufacturing. Sheyla L. Rivera, Stevens Institute of Technology (Chair) and Richard S. Parnas, National Institute of Standards and Technology (Co-Chair).

Area 10c: Computers in Operations and Information Processing

1. Computer Integrated Manufacturing in the Chemical Process Industries. (Cosponsored by the International Cooperation Committee of the Society of Chemical Engineers, Japan). Bhavik R. Bakshi, Ohio State University (Chair) and Shinji Hasebe, Kyoto University (Co-Chair).
2. Process Monitoring and Data Interpretation. Lyle H. Ungar, University of Pennsylvania (Chair) and Miguel J. Bagajewicz, University of Oklahoma (Co-Chair).
3. Large Scale Dynamic Modeling and Optimization. Paul I. Barton, Massachusetts Institute of Technology (Chair) and Thanos Tsirukis, Air Products and Chemicals, Inc. (Co-Chair).
4. Intelligent Systems for Process Operations. Ajay K. Modi, Massachusetts Institute of Technology (Chair) and James F. Davis, Ohio State University (Co-Chair).

Joint Area 10c and Area 4a Session

1. Computers Across the Curriculum. David B. Greenberg, University of Cincinnati (Chair) and Douglas J. Cooper, University of Connecticut (Co-Chair).

Area 10d: Applied Mathematics and Numerical Analysis

1. Nonlinear Dynamics and Pattern Formation. Hsueh-Chia Chang, University of Notre Dame (Chair) and Vemuri Balakotaiah, University of Houston (Co-Chair).

2. General Papers in Applied Mathematics. Doraiswami Ramkrishna, Purdue University (Chair) and Fernando J. Muzzio, Rutgers University (Co-Chair).

3. Novel Numerical Methods. Marios Avgousti, Stevens Institute of Technology (Chair) and Pedro Arce, FAMU/FSU College of Engineering (Co-Chair).

4. Inverse Problems and Methods in Chemical Engineering. Andrew N. Hrymak, McMaster University (Chair) and B. Erik Ydstie, Carnegie Mellon University (Co-Chair).

Joint Area 10d and Area 15d&e Session

1. Applied Mathematics in Bioengineering. Francis J. Doyle, Purdue University (Chair) and Paul D. Frymier, University of Tennessee (Co-Chair).

CAST DIVISION POSTER SESSION

Section A. Recent News in Systems and Process Design. Michael F. Malone, University of Massachusetts (Chair) and Michael L. Mavrovouniotis, Northwestern University (Co-Chair).

Section B. Topics in Process Control. James B. Rawlings, University of Wisconsin (Chair) and Babatunde A. Ogunnaike, E. I. du Pont de Nemours & Company (Co-Chair).

Section C. Optimization Methodology and Fundamentals. Christodoulos A. Floudas, Princeton University (Chair) and Mark A. Stadtherr, University of Notre Dame (Co-Chair).

Section D. Advances in Applied Mathematics. Hsueh-Chia Chang, University of Notre Dame (Chair) and Kyriacos Zygourakis, Rice University (Co-Chair).

Section E. Demonstrations of Software for Process Control Education. Douglas J. Cooper, University of Connecticut (Chair) and Thomas E. Marlin, McMaster University (Co-Chair).

Educational Computer Software Demonstrations (Joint Effort with Group 4)

Douglas J. Cooper, University of Connecticut (Coordinator) and Susan M. Montgomery, University of Michigan (Coordinator).

1997 AIChE Spring National Meeting
Houston, Texas
March 9-13, 1997

Meeting Chair: E. Dennis Griffith, Brown & Root Energy Services, PO Box 4574, Houston, TX 77210-4574, (713) 575-4582, (713) 575-4321 (FAX), aiche-97snm-mpc@wl.net.

The CAST Division is planning the following program for the Houston National Meeting which has been approved by the Meeting Program Chair. A final call for papers for this meeting appears later in this issue. Deadline for submission of presentation proposals (electronically only) is August 1, 1996. The entire CAST program in Houston is being co-sponsored by the Society for Computer Simulation.

Area 10a: Systems and Process Design

10a01. Challenge Problems in Systems and Process Design. Miguel J. Bagajewicz, University of Oklahoma (Chair) and Gavin Towler, University of Manchester Institute of Science and Technology (Co-Chair).

10a02. Reactive and Catalytic Distillation. Amy R. Ciric, University of Cincinnati (Chair) and Michael F. Malone, University of Massachusetts (Co-Chair).

10a03. New Technology, Needs, and Opportunities in Process Engineering Software. George Stephanopoulos, Massachusetts Institute of Technology (Chair) and Lionel O'Young, Mitsubishi Chemical Corporation (Co-Chair).

10a04. Technology Reviews in Process Design and Analysis. Antonis C. Kokossis, University of Manchester Institute of Science and Technology (Chair) and Luke Achenie, University of Connecticut (Co-Chair).

Area 10b: Systems and Process Control

10b01. Process Control Theory and Applications: Opportunities and Challenges. Charles F. Moore, University of Tennessee (Chair) and Thomas A. Badgwell, Rice University (Co-Chair).

Area 10c: Computers in Operations and Information Processing

10c01. Industrial Applications of Information and Decision Making Systems. Alan B. Coon, Aspen Technology, Inc. (Chair) and Nikolaos V. Sahinidis, University of Illinois (Co-Chair).

In addition, CAST will cosponsor the Second International Plant Operations and Design Conference which will take place in conjunction with this meeting. This topical conference was conceived as a vehicle to bring together chemical engineers engaged in plant operations and design to discuss state-of-the-art engineering methods and technology. The conference will consist of five blocks of approximately six sessions each. The blocks include environmental, process safety, computer applications and process control, operations and maintenance, and design of gas utilization plants. For additional information, contact the conference chair, Victor H. Edwards, John Brown Engineers and Constructors, 7909 Parkwood Circle Drive, Houston, TX 77036-0421, (713) 270-2817, (713) 270-3650 (FAX), ewardvh@bmoa.dnet.dupont.com.

Sessions in the Second International Plant Operations and Design Conference of particular interest include:

Process Safety Sessions

99b01. Upgrading Plant Facilities to Resist Extraordinary Events. David Jones, EQE International (Chair).
99b02. Physical and Information Security. Walter Frank, E. I. du Pont de Nemours & Company (Chair).
99b03. Process Safety in the Age of Reengineering. Michael Perron, PrimaTech (Chair).
99b04. Abnormal Situation Management and Alarm System Management. Peter Yau, John Brown Engineers and Constructors (Chair).
99b05. Identification and Application of RAGAGEP. Tom Tuttle, E. I. du Pont de Nemours & Company (Chair).
99b06. Applications of Property Insurance Practices for Hazard Identification and Risk Reduction. Kerry Ridgway, John Brown Engineers and Constructors (Chair).
99b07. Process Hazards of Environmental Control Systems. David Clark, E. I. du Pont de Nemours & Company (Chair).

Computer Applications and Process Control

99c01. Case Histories of Process Improvements Through Steady State Simulation. Daniel Barberree, E. I. du Pont de Nemours & Company (Chair).
99c02. Case Histories of Plant Operations and Start-up Improvements Through Dynamic Process Simulation. Michael Spuhler, ARCO Chemical (Chair).
99c03. Practical Applications of Advanced Process Control and Analysis. Atique Malik, Air Products and Chemicals (Chair).
99c04. Demonstrations of Practical Modeling, Simulation, and Control Applications. Abel DeSouza, Shell Development Company (Chair).

Operations and Maintenance

99d01. Conceptual Design of Nonideal Distillation Systems - A Tutorial. Michael F. Doherty, University of Massachusetts (Chair).
99d02. Industrial Applications of Residue Curve Maps for Nonideal Distillation. Michael F. Malone, University of Massachusetts (Chair).
99d03. Operations and Maintenance in the Age of Reengineering. Joel Hamlett, Fluor Daniel (Chair).
99d04. Maintenance Excellence. Kenneth Phillips, E. I. du Pont de Nemours & Company (Chair).

First European Congress on Chemical Engineering (ECCE 1)
Third Italian Conference on Chemical and Process Engineering (ICheaP 3)
Florence, Italy
May 4-7, 1997

This first of a series of biannual events launched by the European Federation of Chemical Engineering is being organized by the Italian Association of Chemical Engineering (AIDIC). The congress goal is to discuss sustainable and cleaner technologies (raw material and waste minimization, recycling and energy integration, process intensification, integrated manufacturing, bioprocessing and biochemical engineering, process control, and on-line optimization, etc.) including topics in process engineering, equipment and unit operations, process industry, products and materials design and processing, and fundamentals. Deadlines for abstracts is October 31, 1996. For additional information, contact the AIDIC Secretariat, c/o Ambra Poli, Via Ludovico Muratori 29, 20135 Milano, ITALY, 39-2-551-91025, 39-2-551-90952 (FAX), aidic@ipmch8.chin.polimiit.

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Process Systems Engineering / European Symposium on Computer Aided Process Engineering (PSE 1997 / ESCAPE-7) Trondheim, Norway May 26-29, 1997

PSE 1997 / ESCAPE-7 is a joint event initiated by the Executive Committee of the Process Systems Engineering Symposium Series and the EFCE Working Party on Computer Aided Process Engineering and is being organized by the Center for Process Systems Engineering at the Norwegian University of Science and Technology. The aim of the symposium is to review the latest developments in Process Systems Engineering and Computer Aided Process Engineering, with emphasis on the use of computers and information technology tools and methods in the design and operation of the process industry. The symposium will have both oral presentations and poster sessions in the following areas: design and synthesis; control and operations; modelling and simulation; intelligent systems; and industrial applications and case studies. For further information, contact PSE 1997 / ESCAPE-7 Secretariat, Department of Chemical Engineering, Norwegian University of Science and Technology, N-7034 Trondheim, NORWAY, 47-73-59-5714, 47-73-59-4080 (FAX), prescape-97@kjemi.unit.no, http://www.kjemi.unit.no/psescape-97.

1997 American Control Conference, Albuquerque, New Mexico, June 4-6, 1997

The American Automatic Control Council (AACC) will hold the sixteenth American Control Conference (ACC) Wednesday through Friday, June 4-6, 1997 at the Albuquerque Convention Center, Albuquerque, New Mexico. Held in cooperation with the International Federation of Automatic Control (IFAC), this conference will bring together people working in the fields of control, automation, and related areas. Approximately 1000 presentations are expected.

The 1997 ACC will cover a range of topics relevant to theory and practical implementation of control and automation. Topics of interest include but are not limited to: robotics, manufacturing, guidance and flight control, power systems, process control, measurement and sensing, identification and estimation, signal processing, modeling and advanced simulation, fault detection, model validation, multivariable control, adaptive and optimal control, robustness, intelligent control, expert systems, neural nets, industrial applications, control engineering education, and computer aided design.

The conference will consist of both invited and contributed presentations. Prospective authors of contributed papers should submit 5 copies of the complete manuscript (5 pages maximum) and a manuscript form by 15 September 1996 to the AIChE Review Chair, Babatunde A. Ogunnaike, Experimental Station, E. I. du Pont de Nemours & Company, PO Box 80101, Wilmington, DE 19880-0101, (302) 695-2535, (302) 695-2645 (FAX), ogunaike@esspt0.dnet.dupont.com.

Manuscript forms can be obtained from the AACC home page on http://www.eece.unm.edu/controls/ACC97/welcome.html. For further information view the AACC homepage on http://web.eecs.nwu.edu/~ahaddad/aacc.html or contact Naim A. Kheir, General Chair ACC97, Department of Electrical & System Engineering, Oakland University, Rochester, MI 48309-4401, (810) 370-2177, (810) 370-4633 (FAX), kheir@vela.acs.oakland.edu.

International Symposium on Advanced Control of Chemical Processes ADCHEM 1997 Banff, CANADA June 9-11, 1997

The ADCHEM 1997 meeting will bring together engineers and scientists from universities, R&D laboratories, and the process industries to focus attention on recent advances in the analysis and control of chemical process systems. The main topics of the meeting include system identification using open and closed loop data, robustness issues, linear and nonlinear model-based control, performance assessment of control loops, process monitoring and fault detection, software sensors, industrial applications in petrochemical, pulp and paper, and metallurgical or other continuous/batch processes, batch process control, real time optimization, adaptive control, multivariate statistical-based techniques, neural networks and fuzzy logic systems, and control of discrete-event dynamic systems. Drafts of contributed papers in any technical area relevant to the symposium should be submitted before September 2, 1996 to Sirish Shah, Department of Chemical Engineering, University of Alberta, Edmonton, Alberta T6G 2G6 CANADA, adchem.97@ualberta.ca. Conference related information is available at http://www.ualberta.ca/dept/chemeng/adchem.

Fourth European Control Conference (ECC 97) Brussels, Belgium July 1-4, 1997

The European Control Conference will take place from July 1-4, 1997 at the Brussels campus of the Universiti Catholique de Louvain. The European Control Conference is organized every two years with the aim to stimulate contacts between scientists who are active in the area of Systems and Control and to promote scientific exchange within the European community and between Europe and other parts of the world. The scope of the conference includes all aspects of Systems and Control, and ranges from fundamental research to applications in process control and advanced technology. An industry day, with a special focus on industrial control applications, will be organized within the framework of the ECC 97.

Prospective authors should submit 5 copies of their full paper by 1 September 1996 according to the following format: 6 two column (10 pt) A4 Proceedings pages. The cover page should contain title, affiliation, address, fax number, e-mail address and telephone number of each author, an abstract and 3 keywords from a list available on the WWW (http://www.auto.ucl.ac.be/ECC97.html) or at the conference secretariat in decreasing order of preference. These keywords will be used for session assignment. In case of joint authorship, the first name mentioned will be used for all correspondence, unless otherwise requested. The keyword "industry day" should be added to papers especially submitted for the industry day.

Proposals for invited sessions should be submitted by 1 September 1996. An invited session should comprise 4 or 5 contributions. The proposal should contain the title of each contribution as well as the name, affiliation, address, fax number, e-mail address and telephone number of each proposed author. The papers of the invited sessions should be written under the same format and with the same cover page content as for the regular papers (see above). The papers will be reviewed according to the same procedure as for the regular papers.

Papers and proposals for invited sessions should be sent to the ECC 97 Secretariat, c/o Timshel Conference Consultancy and Management, JB Van Moonstraat 8, B-3000 Leuven, BELGIUM, 32-16-29-00-10, 32-16-29-05-10 (FAX), info@timshel.be. Those who wish to receive the Preliminary Programme of the Conference are invited to send an e-mail to the ECC 97 secretariat indicating their interest and providing their full address. Note that this programme will also be sent by e-mail to all the authors submitting a contribution.

AIChE is entering the electronic age. Starting with the Chicago 1996 Annual Meeting, AIChE has asked the CAST Division to require that all programming transactions be done electronically. This includes (a) receipt of proposals-to-present and extended abstracts, (b) conduct of the centralized review and acceptance process, (c) notification of authors, and so forth.

1997 AIChE Annual Meeting
Los Angeles, California
November 16-21, 1997

Meeting Program Chair: Dianne Dorland, Department of Chemical Engineering, University of Minnesota Duluth, Duluth, MN 55812-2403, (218) 726-7127, (218) 726-6360 (FAX), ddorland@d.umn.edu.

The CAST Division is planning the following sessions at the Los Angeles Annual Meeting which have been approved by the Meeting Program Chair. A first call for papers for this meeting appears later in this issue. Deadline for submission of presentation proposals (electronically only) is March 1 or April 1, 1997 (depending on the Area). The entire CAST program in Los Angeles is being cosponsored by the Society for Computer Simulation.

CAST Division Plenary Session

1. Recent Developments in Computing and Systems Technology. Michael F. Malone, University of Massachusetts (Chair) and James B. Rawlings, University of Wisconsin (Co-Chair).

Area 10a: Systems and Process Design

1. Design and Analysis. Ka M. Ng, University of Massachusetts (Chair) and Jonathan Vinson, University of Massachusetts (Co-Chair).
2. Process Synthesis. Vasilios Manousiouthakis, University of California Los Angeles (Chair) and Priscilla J. Hill, University of Massachusetts (Co-Chair).
3. Advances in Process Integration. Antonis C. Kokossis, University of Manchester Institute of Science and Technology (Chair) and Mahmoud El-Halwagi, Auburn University (Co-Chair).
4. Reactor System Synthesis and Analysis. Luke Achenie, University of Connecticut (Chair) and Gavin Towler, University of Manchester Institute of Science and Technology (Co-Chair).

Joint Area 10a and Area 10b Session

1. Interaction of Design and Control. Michael L. Luyben, E. I. du Pont de Nemours & Company (Chair) and Michael F. Malone, University of Massachusetts (Co-Chair).

Joint Area 10a and Area 8e Session

1. Simulation and Control in the Electronic Materials Processing. B. Wayne Bequette, Rensselear Polytechnic Institute (Chair).

Area 10b: Systems and Process Control

1. Advances in Process Control. Dale E. Seborg, University of California Santa Barbara (Chair) and Dennis D. Sourlas, University of Missouri Rolla (Co-Chair).
2. Nonlinear Control. Masoud Soroush, Drexel University (Chair) and Karlene A. Kosanovich, University of South Carolina (Co-Chair).
3. Applications of Process Control. Thomas A. Badgwell, Rice University (Chair) and Kenneth A. Debelak, Vanderbilt University (Co-Chair).
4. Controller and Process Monitoring. George N. Charos, Amoco Corporation (Chair) and Sheyla L. Rivera, Stevens Institute of Technology (Co-Chair).
5. On-line Dynamic Optimization. Jorge A. Mandler, Air Products and Chemicals, Inc. (Chair) and Oscar D. Crisalle, University of Florida (Co-Chair).
6. Robust Control. Richard D. Braatz, University of Illinois (Chair) and Michael J. Piovoso, E. I. du Pont de Nemours & Company (Co-Chair).

Joint Area 10b and Area 3d Session

1. Control of Particulate Systems. Francis J. Doyle, Purdue University (Chair) and Anthony A. Adetayo, E. I. du Pont de Nemours & Company (Co-Chair).

Joint Area 10b and Area 15c Session

1. Advances in Biosensors and Bioprocess Control. Yuris O. Fuentes, University of Colorado (Chair) and Robert S. Cherry, Idaho National Engineering Laboratory (Co-Chair).

Area 10c: Computers in Operations and Information Processing

1. Computer Integrated Manufacturing in the Chemical Process Industries (Cosponsored by the International Cooperation Committee of the Society of Chemical Engineers, Japan). Bhavik R. Bakshi, Ohio State University (Chair) and Shinji Hasebe, Kyoto University (Co-Chair).
2. Industrial Applications of Plant and Enterprise-Wide Optimization. Vicky Papageorgaki, Air Products and Chemicals, Inc. (Chair) and Alan B. Coon, Aspen Technology, Inc. (Co-Chair).
3. High Performance Computing in Chemical Process Engineering. Mark A. Stadtherr, University of Notre Dame (Chair) and Thanos Tsirukis, Air Products and Chemicals, Inc., (Co-Chair).
4. Computer-Aided Strategic Decision Making in the Supply Chain. Nikolaos V. Sahinidis, University of Illinois (Chair) and Chris Wilhelm, Dow Chemical Company (Co-Chair).

Joint Area 10c and Area 4a Session

1. Teaching Using Multimedia. David B. Greenberg, University of Cincinnati (Chair) and Susan M. Montgomery, University of Michigan (Co-Chair).

Joint Area 10c and Area 15a Session

1. Computational Methods in the Food Processing Industry. Joseph F. Pekny, Purdue University (Chair) and Steve Lombardo, The Coca Cola Company (Co-Chair).

Area 10d: Applied Mathematics and Numerical Analysis

1. Nonlinear Dynamics and Pattern Formation. Vemuri Balakotaiah, University of Houston (Chair) and Hsueh-Chia Chang, University of Notre Dame (Co-Chair).
2. Chemical Engineering Applications of Stochastic Processes. Doraiswami Ramkrishna, Purdue University (Chair) and Kyriakos Zygourakis, Rice University (Co-Chair).
3. Parallel Computing Applications in Chemical Engineering. Antony N. Beris, University of Delaware (Chair).
4. Discretization Methods in Computational Strategies for Chemical Engineering Applications. Pedro Arce, FAMU/FSU College of Engineering (Chair) and Andrew N. Hrymak, McMaster University (Co-Chair).

Joint Area 10d and Area 8a Sessions

1. Polymer Processes and Rheology. Andrew N. Hrymak, McMaster University (Chair).

Joint Area 10d and Area 15d/e Session

1. Applied Mathematics in Bioengineering. Sriram Neelamegham, Baylor College of Medicine (Chair) and Paul D. Frymier, University of Tennessee (Co-Chair).

CAST DIVISION POSTER SESSION

Section A. Recent News in Systems and Process Design. Michael L. Mavrovouniotis, Northwestern University (Chair).

Section B. Topic and chairs to be chosen from one of the previous Area 10b sessions.

Section C. Statistical Aspects of Process Operations and Information Processing. Karen Yin, University of Minnesota Duluth (Chair) and Scott E. Keeler, DowElanco (Co-Chair).

Section D. Advances in Applied Mathematics. Kyriakos Zygourakis, Rice University (Chair).

Educational Computer Software Demonstrations (Joint Effort with Group 4). Susan M. Montgomery, University of Michigan (Coordinator) and John T. Bell, University of Michigan (Coordinator).

1998 CAST Division Programming

The CAST Division is expected to be actively participating in the 1998 AIChE Spring National Meeting in New Orleans and the 1998 Fall Annual Meeting in Miami Beach. Programming for these two meetings will be planned at the Chicago AIChE meeting in November. Everyone interested in CAST program development is encouraged to attend the Area Programming Meetings at locations and times published in the Committee Meetings Directory available at the Meeting Registration Area. Those who cannot attend the area program meetings are encouraged to bring their ideas to the attention of the Area Chairs at the addresses indicated on the masthead.

Dynamics and Control of Processes (DYCOPS '98)
Corfu, Greece
May 25-27, 1998

This IFAC conference was formerly known as DYCORD+, Dynamics and Control of Reactors, Distillation Columns, and Batch Processes. For preliminary information and deadlines, contact the international program committee chair Christos Georgakis, Chemical Process Modeling and Control Research Center, Lehigh University, Bethlehem, PA 18015-4781, (610) 758-5432, (610) 758-5297 (FAX), cg00@ns.cc.legigh.edu.

European Symposium on Computer Aided Process Engineering (ESCAPE 8)
Ostend-Bruges, Belgium
May 31 - June 3, 1998

The 1998 ESCAPE event will be held in Ostend, a city on the North Sea coast of Belgium. A social event will be held in the famous city of Bruges which is within a short distance of Ostend. The symposium will focus on recent developments requiring substantial computer power and on new challenges in the more traditional topics of the ESCAPE meetings. Focus topics include molecular dynamics and modeling in process design, use of computational fluid dynamics in process modeling, integration of processes on an industrial site, on line management of process operations, and industrial applications and case studies. For more information, contact the conference secretariat Rita Peys, Desguinlei 214, B-2018 Antwerp 1, BELGIUM, 32-3-216-0996, 32-3-216-0689 (FAX), escape8@ ti.kviv.be.

CALL FOR PAPERS

Final Call for CAST Sessions
1997 AIChE Spring National Meeting
Houston, Texas
March 9-13, 1997

The names, addresses, and telephone numbers of the session chairs are given on the next several pages, as are brief statements of the topics to receive special emphasis in selecting manuscripts for these sessions. Prospective session participants are encouraged to observe the deadlines which have been established by the Meeting Program Chair, Dennis Griffith. A complete call for papers for all sessions at this meeting may be accessed at http://www.aiche.org/meeting/1997/spring/cfp/.

AIChE is currently soliciting electronic submission of proposals-to-present via e-mail or the World Wide Web. To submit via the Web, access http://www.aiche.org. For information and instructions about submitting via e-mail, send the following message to listproc@www.aiche.org:

get spring97ptp_general
get spring97ptp_form
get spring97ptp_instructions

When submitting electronically, make note of the unique session number shown with each session title below. E-mail submissions must be sent directly to listproc@www.aiche.org. Do not send proposals to present to the session chair e-mail addresses listed.

Houston Meeting deadlines:

August 1, 1996: Submit a proposal to present including an abstract to AIChE via e-mail to listproc@www.aiche.org or via Web access at http://www.aiche.org.

September 1, 1996: Session content is finalized authors are informed of selection.

February 1, 1997: Authors submit final manuscript to AIChE.

March 9, 1997: Speakers bring 60 hard copies of visual aids to be distributed to the audience at the presentation. (This is a CAST Division policy, intended to improve the quality of the presentations and the benefit to the audience.)

Please note that there is an AIChE limitation that no person may author or co-author more than four contributions at any one meeting nor more than one contribution in any one session.

Authors submitting by the above deadlines will be notified of decisions on acceptance as close to September 1 as the schedules of the session chair, the Meeting Program Chair, and AIChE permit. Abstracts of accepted proposals will be placed on the Web for browsing shortly before the meeting.

Area 10a: Systems and Process Design

10a01. Challenge Problems in Systems and Process Design.

In this session, speakers from industry will pose challenge problems that they would like to see addressed by the design research community. These problems will be open-ended in nature and might include new design methods or tools that are needed, specific process design problems, environmental design problems, etc. Each presentation will be followed by extensive discussion to facilitate exchange of ideas and to help the audience appreciate the subtleties of the problem. We hope that this will then provide researchers from industry and academia with a "wish list" of challenging problems that address real commercial and industrial concerns, and hence set the stage for promising technology development and transfer programs. We seek suggestions of challenging industrial problems of an open-ended nature that can be posed in such a way as to involve no proprietary information. We would also consider overviews of specific areas or topics indicating what is perceived in industry as the area where research is most needed. Participation of industrial speakers is preferred; however, all contributions will be given consideration. Any difficult design problem or aspect of the design process will be considered suitable.

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Co-Chair
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10a02. Reactive and Catalytic Distillation.

Papers are sought for a session on reactive and catalytic distillation. Potential topics include industrial applications of reactive distillation processes, novel design and analysis techniques, advances in steady state or dynamic simulation, the results of experiments in reactive distillation, and recent developments in process control for reactive distillation. Critical reviews of the area are also welcome.

Session Chair (For Information Only)
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Co-Chair
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(413) 545-1133 (FAX)
mmalone@ecs.umass.edu

10a03. New Technology, Needs, and Opportunities in Process Engineering Software.

Papers are invited to address the software engineering and process engineering view points, within the scope of designing, developing and deploying computer-aided tools to the processing industries. New software technologies, novel software tools, integration with existing tools, open software development environments, new software needs in process development and design, technology transfer from the research labs to the market place, are typical examples of the areas of interest for this session. This session is envisioned as a semi-open forum with active involvement of the participants. The presentation of papers will be accompanied by an extensive discussion period.

Session Chair (For Information Only)
George Stephanopoulos
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geosteph@mit.edu

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10a04. Technology Reviews in Process Design and Analysis.

This session will invite technology reviews in the area of process design and analysis. Over the last decade a large number of contributions have been proposed and applied in reaction processes, separation systems, heat integrated processes, time integrated processes and systems in which steady state and dynamic features are addressed simultaneously. Though some contributions maintain a targeting or shortcut perspective, others represent computationally intensive techniques which exploit the potential of algorithmic and modeling developments. The invited papers will review the various technologies in terms of their technical content, range of applications and industrial impact. Important future directions will also be highlighted in terms of recent and promising developments.

Session Chair (For Information Only)
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44-161-236-7439 (FAX)
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Co-Chair
Luke Achenie
Department of Chemical Engineering
University of Connecticut
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(860) 486-2959 (FAX)
achenie@eng2.uconn.edu

Area 10b: Systems and Process Control

10b01. Process Control Theory and Applications: Opportunities and Challenges.

This session will be the only control session at the Spring 1997 AIChE meeting. Its purpose is to highlight the progress being made in applying modern control technology to improve process operations in the chemical process industries. We are soliciting papers that demonstrate how industry has benefited from applying modern control technology and/or present current industrial challenges that are not addressed adequately by existing control methods. The session will include a small number of overview papers from invited speakers from industry and academia and a larger number of submitted papers. We intend for this session to present a broad view of the state of industrial process control in the chemical industry. We are especially hopeful that it will provide a unique opportunity for industrial control engineers and young academic control researchers to establish contacts that lead to useful collaborations.

Session Chair (For Information Only)
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Co-Chair
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Area 10c: Computers in Operations and Information Processing

10c01. Industrial Applications of Information and Decision Making Systems.

Papers are solicited which address the different roles of information and decision systems in various phases of process engineering (including planning and scheduling, supply chain operations, etc.). Of additional interest are papers which address the integration of the various tools used in these phases, and methodologies for the automated use of such integrated systems. The objective of the session is to share information on current and proposed industrial practices for using process engineering tools and information and decision making systems throughout the process life cycle. A broad range of applications is desired, and examples and/or case studies are particularly welcome.

Session Chair (For Information Only)
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Co-Chair
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Final Call for Papers for the 1997 American Control Conference
June 4-6, 1997
Albuquerque Convention Center
The Albuquerque Hyatt Regency and Doubletree Hotels, New Mexico

The American Automatic Control Council (AACC) will hold the sixteenth American Control Conference (ACC) Wednesday through Friday, June 4-6, 1997 at the Albuquerque Convention Center, Albuquerque, New Mexico. Held in cooperation with the International Federation of Automatic Control (IFAC), this conference will bring together people working in the fields of control, automation, and related areas from the American Institute of Aeronautics and Astronautics (AIAA), American Institute of Chemical Engineers (AIChE), Association of Iron and Steel Engineers (AISE), American Society of Civil Engineers (ASCE), Institute of Electrical and Electronics Engineers (IEEE), American Society of Mechanical Engineers (ASME), International Society for Measurement and Control (ISA), and the Society for Computer Simulation (SCS). Approximately 1000 presentations are expected.

The 1997 ACC will cover a range of topics relevant to theory and practical implementation of control and automation. Topics of interest include but are not limited to: robotics, manufacturing, guidance and flight control, power systems, process control, measurement and sensing, identification and estimation, signal processing, modeling and advanced simulation, fault detection, model validation, multivariable control, adaptive and optimal control, robustness, intelligent control, expert systems, neural nets, industrial applications, control engineering education, and computer aided design.

Papers will be classified as either "contributed" or "invited" and as either "regular" or "short." When an individual paper is submitted for consideration, it is "contributed." "Invited" papers are specifically solicited by an organizer of a specific session. "Regular" papers are allotted 5 pages in the Proceedings and are to be a complete description of finished work. "Short" papers are allotted 2 pages in the proceedings and are to be an exposition of a novel idea or preliminary results. Based on reviewers' direction, the Program Committee may move regular papers into the short paper category. For all papers, review criteria include: significance of the problem, novelty, clarity, completeness, and accuracy.

Albuquerque, on the Rio Grande River and near to the Sandia Mountains, offers historic missions, art galleries, southwest charm, a diverse heritage, and tasty New Mexico cuisine. Trips to neighboring Santa Fe will be uniquely remembered by participants and their families.

Call for Contributed Papers

Prospective authors of regular papers should submit 5 copies of the complete manuscript and a manuscript form to a Society Review Chair. Submit 5 copies of short papers and a manuscript form to the Program Vice-Chair for Contributed Sessions. Manuscript forms can be obtained from the ACC home page on
http://www.eece.unm.edu/controls/ACC97/welcome.html

Call for Invited Sessions

Papers in each invited session should present a cohesive and comprehensive focus on a relevant topic. Before August 15, organizers should contact the Vice Chair, Invited Sessions for instructions and forms. Submit 5 copies of the proposal (per instructions, with a clear motivation for the session, and not less than a 1000 word summary of the results for each paper) to the Vice Chair.

Industry and Applications

The AACC is particularly interested in enhancing the applications and industrial perspective of the ACC. Prospective authors from industry are encouraged. For more information contact the Vice Chair, Industry and Applications.

Student Best Paper Award

To be eligible primary, first-listed author and presenter of regular contributed papers must be students at the time of submission. Up to five finalists based on their written papers will be awarded limited travel grants to the Conference. To apply, send a copy of the paper, with a cover letter on University letterhead from your professor (certifying eligibility), to the Program Chair by September 15, 1996.

1997 ACC Workshops

The Operating Committee intends to arrange tutorial workshops to be held in conjunction with the 1997 ACC. Suggestions are solicited for appropriate subjects. Potential organizers should contact the Workshop Chair by Sept. 1, 1996.

Proceedings

Registered attendees will obtain the Proceedings as both a CD-ROM and paper volumes. Registered student/retiree attendees will get the CD-ROM only.

Schedule Summary

August 15, 1996: Deadline for contacting the Program Vice-Chair, Invited Sessions, regarding invited sessions.

September 15, 1996: Deadline for submission of contributed papers and invited session proposals.

January 20, 1997: Authors notified and author's kits distributed.

March 15, 1997: Deadline for camera ready mats or electronic format for Proceedings.

For further information view the AACC home page on
http://web.eecs.nwu.edu/~ahaddad/aacc.html
or contact:

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AIChE is entering the electronic age. Starting with the Chicago 1996 Annual Meeting, AIChE has asked the CAST Division to require that all programming transactions be done electronically. This includes (a) receipt of proposals-to-present and extended abstracts, (b) conduct of the centralized review and acceptance process, (c) notification of authors, and so forth.

Vice-Chair, Industry & Applications
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First Call for Papers for CAST Sessions
1997 AIChE Annual Meeting
Los Angeles, California
November 16-21, 1997

The names, addresses, and telephone numbers of the session chairs are given on the next several pages, as are brief statements of the topics to receive special emphasis in selecting manuscripts for these sessions. Prospective session participants are encouraged to observe the deadlines which have been established, but may be changed, by the Meeting Program Chair, Dianne Dorland.

As you will have noted, proposals-to-present for the 1996 Chicago Annual Meeting and the 1997 Houston National Meeting were accepted electronically either by e-mail or via World Wide Web access. These procedures are presently experimental and are subject to modification and refinement. For the latest information, consult AIChExtra or access http://www.aiche.org. For special CAST Division procedure updates, access http://bevo.che.wisc.edu/cast10b/.

SPECIAL NOTE TO AUTHORS SUBMITTING ABSTRACTS FOR ANNUAL MEETING SESSIONS SPONSORED BY CAST AREAS 10A, 10B, and 10C:

Because of the large number of anticipated presentation proposals for annual meetings and the limited symposia space available, to maximize the number of good proposals that can be accepted and generally improve programming quality, all proposals for Fall 1997 programming in Areas 10a, 10b, and 10c must be accompanied by an extended abstract and submitted to AIChE ONE MONTH EARLIER than the generally published deadline in order to accomodate the CAST Division Review process. Please note that CAST Area 10d and CAST sessions cosponsored with other AIChE programming groups DO NOT participate in this process.

CAST Division Review Procedure for Areas 10a, 10b, and 10c:

1. Extended abstracts will receive anonymous reviews by three or four session chairs and/or co-chairs and/or the Area Chair and Vice-Chair, for technical content, novelty and style. Submissions may be shifted between sessions or other CAST areas as appropriate.

2. Each area will sponsor one section of the Division Poster Session. Some areas may develop a topical theme for their section while others may have a more general scope to accomodate late news. Unless directed otherwise by the author, all proposals will be considered for both symposium and poster sessions.

Submission procedure for Area 10d and CAST sessions cosponsored with other AIChE programming groups:

The submission procedure for Fall Annual Meeting sessions not involved in the Division Review Process is identical to that for all sessions at Spring National Meetings. In summary, submissions are made to AIChE by the published deadline, but abstracts need not be extended.

Los Angeles Meeting Deadlines:

March 1, 1997 (10a, 10b, and 10c): Submit a proposal to present including extended abstract to AIChE via e-mail to listproc@www.aiche.org or via Web access at http://www.aiche.org.

April 1, 1997 (10d, and sessions cosponsored with other programming groups): Submit a proposal to present including abstract to AIChE via e-mail to listproc@www.aiche.org or via Web access at http://www.aiche.org.

May 1, 1997: Session content is finalized and authors are informed of selection.

September 10, 1997: Authors submit final manuscript to AIChE.

November 16, 1997: Speakers bring 60 hardcopies of visual aids to be distributed to the audience at the presentation. (This is a CAST Division policy, intended to improve the quality of the presentations and the benefit to the audience.)

Please note that there is an AIChE limitation that no person may author or co-author more than four contributions at any one meeting nor more than one contribution in any one session.

Authors submitting by the above deadlines will be notified of decisions on acceptance as close to May 1 as the schedules of the reviewers, Session Chairs, the Meeting Program Chair, and AIChE permit. Abstracts of accepted proposals will be placed on the Web for browsing shortly before the meeting.

CAST Division Plenary Session

1. Recent Developments in Computing and Systems Technology.

Plenary papers describing recent advances, and new challenges in each of the CAST areas (Systems and Process Design, Systems and Process Control, Computers in Operations and Information Processing, and Applied Mathematics and Numerical Analysis) will be invited by the CAST programming board. The papers are intended to be accessible to a wide audience with interests in any and all of the CAST areas. It is anticipated that this session will be scheduled on Monday morning and that no other CAST sessions will be scheduled in parallel in order to facilitate the broadest possible communication.

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Area 10a: Systems and Process Design

NOTE: THE FOLLOWING SESSIONS PARTICIPATE IN THE CAST DIVISION REVIEW PROCESS.

1. Design and Analysis.

Papers are solicited on recent developments in process design and analysis. Areas of interest include, but are not limited to, new process modeling methodologies, design and analysis of integrated continuous and/or multipurpose plants and tightly coupled process sub-systems, techniques for the design of specific units, design under uncertainty, use of molecular structure and properties in design, techniques to analyze the operability (flexibility, controllability, reliability) of process plants, design and analysis of novel separation systems, and design for waste minimization.

Design methodologies based on short-cut design methods, conceptual design applications, and algorithmic approaches are welcome. Industrial process applications are particularly encouraged.

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2. Process Synthesis.

This session will address all aspects of process synthesis including heuristic strategies, conceptual approaches, methodologies, mathematical programming approaches, etc. Since choosing between process alternatives involves taking process economics, environmental regulations, controllability, and safety issues into consideration, papers in all these areas are welcome. Also, these papers may focus on current problems or on future trends and challenges in process synthesis research.

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3. Advances in Process Integration.

Papers are solicited related to recent developments in process integration. The contributions can be new approaches or industrial applications and are expected to demonstrate useful and efficient methods in the context of process design and optimization of chemical processes. The contributions can address grassroots or retrofit problems. The area of application is open.

Examples include overall plant efficiency, yield enhancement, energy conservation, and pollution prevention. Priority will be given to papers that are systematic in nature and can be applied to a wide variety of chemical process industries.

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4. Reactor System Synthesis and Analysis.

There has been considerable recent progress in the design of systems for carrying out chemical reactions. This session will address all aspects of reactor system design, including algorithmic design of reactor networks, graphical and artificial intelligence approaches to reactor design, design of combined reaction-separation processes such as reactive distillation, design of multi-phase reactors, etc. Whenever possible, industrial success stories should be reported.

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Joint Area 10a and Area 10b Session

NOTE: THE FOLLOWING SESSION PARTICIPATES IN THE CAST DIVISION REVIEW PROCESS.

1. Interaction of Design and Control.

This session focuses on the general topic of the interaction between process design and process control. Poor control of a chemical process can sometimes be the result of limitations in the plant design. Significant improvements in dynamic process controllability can often be achieved at the design stage by examining issues such as disturbance rejection, startup/shutdown, and variable grade/rate production. Both industrial and academic papers are sought which address the problem of incorporating controllability and operability into the process design (general procedures, methodologies, tools, case studies, etc.).

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Joint Area 10a and Area 8a Session

1. Simulation and Control of Electronic Materials Processing.

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Area 10b: Systems and Process Control

NOTE: THE FOLLOWING SESSIONS PARTICIPATE IN THE CAST DIVISION REVIEW PROCESS. IT IS EXPECTED THAT ONE OF THE FOLLOWING TOPICS WILL BE DEVELOPED INTO THE AREA 10B SECTION OF THE CAST DIVISION POSTER SESSION.

1. Advances in Process Control.

All interested persons are invited to submit papers that address recent advances in the area of chemical process control. Priority will be given to papers that present new theoretical results, innovative strategies, new applications and new problem areas. Prospective authors are required to clearly state the contribution of their work to the advancement of the current state of knowledge in the field. The topic and research area is open, although prospective authors are strongly discouraged from submitting papers that would be better suited for presentation in one of the other sessions sponsored by the Area 10b of CAST.

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2. Nonlinear Control.

Contributions are sought in the general area of nonlinear control. Papers presenting new theoretical and/or application results are solicited. Areas of interest include, but are not limited to, model predictive control, differential geometric control, adaptive control, robust control, and nonlinear dynamic analysis of control systems.

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3. Applications of Process Control.

This session will focus on applications of process control theory to the solution of industrial control problems. Its purpose is to highlight the progress being made in applying modern control technology to improve process operations in the chemical process industries. We are soliciting papers that demonstrate how industry has benefited from applying modern control technology and/or present current industrial challenges that are not addressed adequately by existing control methods. The session will include a small number of overview papers from invited speakers from industry and academia and a larger number of submitted papers.

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4. Controller and Process Monitoring.

The focus of this session is on the theoretical and application studies related to control system performance monitoring and process performance monitoring and diagnosis. It covers the methods to ensure process safety, high product quality, process operability, optimum process performance, economic viability, and process profitability. Industrial implementations are particularly welcome. Topics include but are not limited to multivariate statistical methods, neural networks, process chemometrics, fuzzy logic, artificial intelligence for monitoring and diagnosis, and statistical process control.

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5. On-line Dynamic Optimization.

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6. Robust Control.

This session covers topics in which model uncertainty is explicitly addressed within the controller design procedure. Papers highlighting novel approaches, industrial experience, or comparisons between theoretical predictions and experimental observations are especially welcome. Some areas of interest include, but are not limited to, quantifying model uncertainty based on plant input-output data and/or physical considerations, formulations for addressing model uncertainty in systems with constraints and nonlinearities (e.g., robust model predictive control), controller design for tolerance to model uncertainty and potential actuator/sensor faults and failures, computational difficulties associated with robustness analysis and/or synthesis, and real time applications to industrial scale processes.

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Joint Area 10b and Area 3d Session

1. Control of Particulate Systems.

Contributions are sought describing work in the areas of measurement, modeling, and control of particulate processes. Subjects of particular interest are: population balance modeling, advanced measurement technology (including, but not limited to, optical methods), model-based control studies, and experimental studies in particle size control. Presentations of industrial experiences with particle size control and critical discussions of limitations/advantages of current approaches are also welcomed. Abstracts should summarize the scope of the work, the methodology employed, and significant conclusions and accomplishments.

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Joint Area 10b and Area 15c Session

1. Advances in Biosensors and Bioprocess Control.

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Area 10c: Computers in Operations and Information Processing

NOTE: THE FOLLOWING SESSIONS PARTICIPATE IN THE CAST DIVISION REVIEW PROCESS.

1. Computer Integrated Manufacturing in the Chemical Process Industries (Cosponsored by the International Cooperation Committee of the Society of Chemical Engineers, Japan).

Contributions are sought describing methodological developments, implementations, and experiences with all aspects of CIM in the process industries. Subjects of particular interest include integration of application areas such as plant information systems, monitoring, diagnosis, control, scheduling, planning, optimization, and design, as well as developments within application areas themselves that focus on integration issues. Presentations of industrial experiences with CIM technology and critical discussions of limitations/advantages of current approaches are also welcomed.

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2. Industrial Applications of Plant and Enterprise-Wide Optimization.

Papers are solicited which describe the application of methods for plant-wide or enterprise-wide optimization in industrially significant contexts. Application areas of interest include, but are not limited to, on-line optimization, planning and scheduling, feedstock selection, etc. Papers which describe the integration of optimization strategies across multiple functional areas or levels (for example, integration of on-line optimization with advanced and regulatory control) are also solicited. Papers dealing with actual industrial applications are encouraged.

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3. High Performance Computing in Chemical Process Eng.

Impressive gains in computer hardware technology, including the widespread availability of parallel and vector processing architectures, as well as recent advances in the enabling software technology, are making possible today the solution of large-scale, realistically modeled chemical process engineering problems, even in a real-time environment. Papers are sought that describe: (i) novel numerical algorithms and codes that promote the use of high performance computing in process engineering, and (ii) applications of high performance computing technology and techniques to solve large-scale process engineering problems, including process simulation, on-line and off-line optimization, and control. Industrial applications are particularly welcome.

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4. Computer-Aided Strategic Decision Making in the Supply Chain.

Papers are invited to address issues in the development and implementation of computer-aided tools for strategic decision making in the supply chain. Topics of interest include location and sizing of facilities, production planning and scheduling, distribution of products and services in the process industries, as well as methodologies and applications to problems that span the gamut of supply chain management. We will consider new problem representations, mathematical and heuristic solution approaches, and novel software tools. Of particular interest are case studies that demonstrate how industry can benefit from the study of these problems.

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Joint Area 10c and Area 4a Session

1. Teaching Using Multimedia

Co-sponsored by Area 4a (Undergraduate Education) and 10C (Computers in Operations and Information Processing). We seek challenging and innovative approaches to presentations in the classroom: special courseware, harware, software, interactive computation, cd-roms, etc. If you are interested in making a presentation, please contact the session chair and provide a 200 word abstract.

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Joint Area 10c and Area 15a Session

1. Computational Methods in the Food Processing Industry.

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Area 10d: Applied Mathematics and Numerical Analysis

1. Nonlinear Dynamics and Pattern Formation.

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2. Chemical Engineering Applications of Stochastic Processes.

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3. Parallel Computing Applications in Chemical Engineering.

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4. Discretization Methods in Computational Strategies for Chemical Engineering Applications.

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Joint Area 10d and Area 8a Sessions

1-2. Polymer Processes and Rheology I and II.

Prospective authors are invited to submit proposal to present forms and abstracts for this jointly-sponsored session in care of Area 8a.

Joint Area 10d and Area 15d/e Session

1. Applied Mathematics in Bioengineering

The fields of bioengineering and biotechnology have witnessed the increased application of advanced mathematical methods to data analysis and model building. These advances include robust correlation methods in data analysis, cybernetic model development, reflex circuitry modeling using control principles, parameter estimation in biophysical models, fluid-mechanical models of drug delivery devices, mathematical modeling of microbial transport and environmental interactions, combinatorial methods in genetic engineering, and pharmacokinetic modeling applications. Proposals are solicited which address the general theme of applied mathematics in bioengineering, with special emphasis on experimental results and computational simulation results.

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CAST DIVISION POSTER SESSION

Section A. Recent News in Systems and Process Design.

Posters describing recent original results of interest in the area of process design are solicited. In order to accomodate late-breaking news, submissions will be accepted up until September 1, 1997, although earlier submissions are helpful and welcome. Accepted proposals submitted by the advanced deadline of March 1, 1997 will appear in the printed meeting program.

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Section B. Topics in Systems and Process Control.

One of the topical areas previously outlined in the Area 10b call for papers above will be selected for this section of the CAST Poster Session.

Section C. Statistical Aspects of Information Processing and Process Monitoring, Operation, and Control: Methodology, Applications, and Education.

This poster session is meant to demonstrate both the wealth of statistical tools available to the industrial practitioner, and the significant impact the application of these tools can have on the bottom line. Posters discussing theoretical developments and/or industrial applications of statistics in process operations and information processing are sought. Topics may include, but are not limited to, decision support systems, process chemometrics, on-line statistical process control, process performance monitoring and diagnosis, dynamic model identification, process optimization, process fault detection and classification, quality management and safety, and applied statistics and chemical engineering education. Industrial applications are particularly welcome.

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Section D. Advances in Applied Mathematics.

Posters describing recent original results of interest in the areas of applied mathematics and numerical analysis are solicited. In order to accomodate late-breaking news, proposals will be accepted up until September 1, 1996, although earlier submissions are helpful and welcome. Accepted proposals submitted by the normal deadline of April 1, 1997 will appear in the printed meeting program.

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