GREETINGS FROM THE GENERAL CHAIR

On behalf of the American Automatic Control Council (AACC) and the Program and Operating Committees, I am very pleased to welcome you to the 2004 American Control Conference (ACC). Held under the auspices of AACC, the US National Member Organization of the International Federation of Automatic Control (IFAC), the ACC brings together people working in 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), American Society of Mechanical Engineers (ASME), Institute of Electrical and Electronics Engineers (IEEE), the International Society for Measurement and Control (ISA), and the Society for Computer Simulation (SCS).

The 2004 ACC is being held Wednesday through Friday, June 30 to July 2, 2003 at the Boston Sheraton, Boston, Massachusetts. This 1100-room conference hotel is in the Back Bay area of Boston near downtown Boston and its many historical sites, Symphony Hall where the Boston Pops will be playing, Newbury St. where there are outdoor cafes, restaurants, and art galleries, the Museum of Fine Arts, and the Boston Public Library. The Conference ends two days before the Fourth of July. The evening of the Fourth there will be an Esplanade concert by the Boston Pops followed by fireworks display on the Charles River. Conference highlights include:

- 1796 papers submitted. Based on peer review, there are 1031 papers selected for publication (invited and contributed technical papers)

- Several one-day and two-day workshops held June 28th and 29th

- 3 plenary speakers

- Industrial and publisher exhibits

A number of special sessions:

- Systems Engineering of Systems Biology – Wednesday – 9:30 am – 11:00 am
- Women in Control Panel Discussion on “The Faculty Candidate Interview” – Wednesday – 12:00 pm – 1:30 pm
- Summary of the NSF Workshop on Control and System Integration of Micro- and Nano- Scale Systems – Wednesday 1:30 pm – 3:30 pm
- Winning that Academic Job – Wednesday – 6:00 pm – 7:30 pm
- Resume Exchange Session – Wednesday – 7:30 pm -8:30 pm
- History of Control Session – Thursday – 6:30 pm – 8:00 pm, and
- Writing a Winning NSF CAREER Proposal – Friday – 11:30 am – 12:00 pm

- **LCD projectors for notebook computers in every session (overhead projectors are not available unless previously requested)**

- 4 Interactive sessions – Wednesday and Thursday

- Opening reception Tuesday evening will honor Apollo contributors on the 35th anniversary of the first Apollo landing – sponsored by Mathworks

- Optional Thursday evening social event with the Boston Pops at Symphony Hall

- Wireless service will be available in the hotel lobby

Boston, the capital of Massachusetts and the seat of Suffolk County, lies on Boston Bay (an inlet of Massachusetts Bay), at the mouth of the Charles River in the eastern part of the state. Boston has attractions and activities for a family on vacation or someone just attending a conference. These include rich history, culture, sophistication, old world charm, and academic and medical excellence. Please plan on spending time in the Boston area and enjoy the many outdoor and cultural activities.

Jason L. Speyer (speyer@seas.ucla.edu), General Chair, 2004 ACC

TECHNICAL PROGRAM OVERVIEW

The 2004 ACC technical program reflects the continued interest in the field of control engineering and its applications in emerging technologies and theoretical developments that are needed to meet the ever increasing demands placed on control systems. The variety of program sessions should be of value to conference attendees with diverse backgrounds and interests. There are also a number of applications sessions, ranging from control of micro and nano-systems, biological and chemical processes, to spacecraft and aircraft systems. A plethora of control theory sessions are offered, including topics involving adaptive, infinite-dimensional, nonlinear, hybrid, robust, stochastic and time-delay systems. The 2004 ACC technical program consists of both contributed and invited paper sessions, organized in 19 parallel tracks. The 1031 papers included in the 174 technical sessions were selected from a record 1796 paper submissions after a peer-review process.

The 2004 ACC also offers a number of special sessions. There are four interactive sessions where presenters will make use of a combined media of computers, demonstrations, and posters, so as to promote a stimulating interactive exchange between the speakers and the audience. There are a record ten tutorial sessions featuring tutorial presentations on relatively new control techniques followed by presentations from industrial participants discussing the implementation, application, and benefits of the new techniques. There are also several special sessions including a couple on emerging areas of control, the history of control focusing on control work in the Boston area, writing winning NSF CAREER proposals, an invited evening session that convenes a panel of chairs and deans to discuss the tangible and intangible elements of "Winning that Academic Job," a Women in Control Luncheon that addresses "The Faculty Candidate Interview," and a resume exchange session to facilitate information exchange between employers and students. As in the past ACC's, several workshops on important areas of control are also being held. This ACC also continues the tradition of holding a Best Student Paper Award competition. These are described in detail in the corresponding sections of this program.

PLENARY LECTURES

Optimization II - the Rise of Distributed Intelligence
Yu-Chi Ho, Harvard University and Tsinghua University
Wednesday, June 30, 8:00 am – 9:00 am - Grand Ballroom

This talk will be a self-contained sequel to my 1999 IFAC World Congress Plenary lecture on "Optimization - A Many Splendored Thing". Emphasis here will be on distributed intelligence and agent based cooperative control systems. We shall discuss the near impossibility of totally centralized control for complex systems and hence the need for decentralized control, in particular, decentralized control using simple strategies. Starting from first principles and using examples from Nature for inspiration, we speculate on the principles for, and future of, such systems.

Yu-Chi (Larry) Ho received his S.B. and S.M. degrees in Electrical Engineering from M.I.T. and his Ph.D. in Applied Mathematics from Harvard University. Except for three years of full time industrial work, he has been on the Harvard Faculty where he is the T. Jefferson Coolidge Research Chair in Applied Mathematics and the Gordon McKay Research Professor of Systems Engineering. He has published over 140 articles and four books. He is on the editorial boards of several international journals and is the editor-in-chief of the international Journal on Discrete Event Dynamic Systems. He is the recipient of various fellowships and awards including the Guggenheim (1970) and the IEEE Field Award for Control Engineering and Science (1989), the Chiang Technology Achievement Prize (1993), the Bellman Control Heritage Award (1999) of the American Automatic Control Council, and the ASME Rufus Oldenburger Award (1999). He is a Life Fellow of IEEE, and was elected a member of the U.S. National Academy of Engineering in 1987 and a foreign member of the Chinese Academy of Sciences and the Chinese Academy of Engineering in 2000. His current research interests lie at the intersection of Control System Theory, Operations Research, and Computational Intelligence. He also co-founded and is currently a director of the firm Network Dynamics, Inc. of Massachusetts. Since October 2001, he has also been acting part time as the chief scientist of the Center of Intelligent and Networked Systems at Tsinghua University, Beijing, China.

Unmanned Aircraft: The Future in Military Aviation

Kevin A. Wise, The Boeing Company

Thursday, July 1, 8:00 am – 9:00 am – Grand Ballroom

The X-45 Joint Unmanned Combat Air System (J-UCAS) is currently under development for the US Air Force and Navy at Boeing. This talk will discuss the emerging need for unmanned military aircraft, technical challenges for network centric operations, levels of adaptive autonomy, and describe Boeing's development of the revolutionary X-45A experimental aircraft.

Kevin A. Wise is a Senior Technical Fellow in the Boeing Phantom Works. He is currently the Deputy Vehicle Management System (VMS) Lead Engineer on the X-45 J-UCAS program. He received his B.S., M.S., and Ph.D. degrees from the University of Illinois in 1980, 1982, and 1987, respectively. Since joining McDonnell Aircraft in 1982, Dr. Wise has been actively involved in the application of modern estimation and control methodologies in guidance, navigation, and flight control problems for jet aircraft and missiles. He has designed flight control systems for fighter aircraft, missiles, munitions, ejection seats, and unmanned air vehicles. His most recent accomplishment includes the aerodynamically unstable X-45A Unmanned Combat Air Vehicle. His research interests include aircraft and missile dynamics and control, robust adaptive control of linear and nonlinear systems, and robustness theory for parametric and dynamic uncertainties.

He has authored more than 50 technical articles, and teaches graduate level control theory at Washington University, Southern Illinois University at Edwardsville, and at the University of Missouri - Rolla graduate extension and University of Missouri – St. Louis.

Dr. Wise is an Associate Fellow of the AIAA and a Senior Member of the IEEE.

Hybrid Control: from Air Traffic to Fly Wings

Claire J. Tomlin, Stanford University

Friday, July 2, 8:00 am – 9:00 am – Grand Ballroom

Hybrid systems are a suitable model for representing systems that can transition between different behaviors. Many engineered systems are designed to be hybrid in order to simplify function and maintain flexibility in operation. For example, air traffic control systems involve transitions between simple flight modes for multiple aircraft. Hybrid systems are also a good framework for modeling natural systems: in cell biology, the dynamics that govern the spatial and temporal increase or decrease of protein concentration inside a single cell are continuous differential equations derived from biochemistry, yet their activation or deactivation is triggered by transitions which encode protein concentrations reaching given thresholds. In this talk, methods that have been designed to analyze, verify, and control hybrid systems will be presented. The methods use tools from game theory, wavefront propagation, and symbolic predicate abstraction, and rely on an iterative refinement procedure which computes, either exactly or approximately, regions of the system's operating space in which desired behavior is guaranteed. In engineered systems, controllers are designed to keep the system in these regions. In biological systems, knowledge of the actual operating space is used, in conjunction with these methods, to help hypothesize possible models and `reverse engineer' the system. We will focus on two large scale examples: the design and implementation of real time collision avoidance schemes for manned and unmanned air vehicles, and the development of models of cellular regulatory networks in developmental biology.

Claire Tomlin received the Ph.D. degree in Electrical Engineering from the University of California, Berkeley, in 1998. Since September 1998 she has been an Assistant Professor in the Department of Aeronautics and Astronautics at Stanford University, with a courtesy appointment in Electrical Engineering. She was a graduate fellow in the Division of Applied Sciences at Harvard University in 1994, and she has held visiting research positions at NASA Ames and Honeywell Labs. She is a recipient of the Eckman Award of the American Automatic Control Council (2003), MIT Technology Review's Top 100 Young Innovators Award (2003), AIAA Outstanding Teacher Award (Stanford, 2001), NSF Career Award (1999), Terman Fellowship (Stanford, 1998), and the Bernard Friedman Memorial Prize in Applied Mathematics (Berkeley, 1998). She was an invited participant in the National Academy of Engineering's Frontiers of Engineering Program in 2002, and she is currently a member of DARPA's Information Systems and Technology (ISAT) study group. Her research interests are in hybrid systems, air traffic control automation, flight management system analysis and design, and modeling and analysis of biological cell networks.

AACC AWARDS FOR 2004

The American Automatic Control Council presents a series of awards each year to recognize important contributions to the field. The roster of award winners this year includes Harold Kushner, the Richard E. Bellman Control Heritage Award recipient, Mark Spong, the John R. Ragazzini Award recipient, William Powers, the Control Engineering Practice Award recipient, Panagiotis Christofides, the Donald P. Eckman Award recipient, and the O. Hugo Schuck Best Paper Award recipients. These award winners, in addition to the Best Student Paper Award winner, will be recognized at the Awards Luncheon.

Richard E. Bellman Control Heritage Award - Harold J. Kushner

The **Richard E. Bellman Control Heritage Award** is given for distinguished career contributions to the theory or applications of automatic control. It is the highest recognition of professional achievement for US control systems engineers and scientists. The recipient must have spent a significant part of his or her career in the USA.

Citation: For fundamental contributions to stochastic systems theory and engineering applications.

Harold J. Kushner received the Ph.D. in Electrical Engineering from the University of Wisconsin in 1958. Since then, in ten books and more than two hundred papers, he has established a substantial part of modern stochastic systems theory. These include seminal developments of stochastic stability for both Markovian and non-Markovian systems, optimal nonlinear filtering and effective algorithms for approximating optimal nonlinear filters, stochastic variational methods and the stochastic maximum principle, numerical methods for jump-diffusion type control and game problems (the current methods of choice), efficient numerical methods for Markov chain models, methods for singularly perturbed stochastic systems, an extensive development of controlled stochastic networks such as queueing/communications systems under conditions of heavy traffic, methods for the analysis and approximation of systems driven by wideband noise, large-deviation methods for control problems with small noise effects, stochastic distributed and delay systems, and nearly optimal control and filtering for non-Markovian systems. His work on stochastic approximations and recursive

algorithms has set much of the current framework, and he has contributed heavily to applications of control methods to communications problems.

He is a past Chairman of the Applied Mathematics Department and past Director of the Lefschetz Center for Dynamical Systems at Brown University, where he is currently a University Professor Emeritus.

Donald P. Eckman Award – Panagiotis D. Christofides

The **Donald P. Eckman Award** recognizes an outstanding young engineer in the field of automatic control. The recipient must be younger than 35 years on January 1 in the year of the award. Contributions may be technical or scientific publications, theses, patents, inventions, or combinations of the above in the field of automatic control made while the nominee was a resident of the USA.

Citation: For pioneering contributions to analysis and control of nonlinear distributed parameter systems accompanied by creative applications to advanced materials processing, particulate processes and fluid dynamic systems.

Panagiotis D. Christofides was born in Athens, Greece, in 1970. He received the Diploma in Chemical Engineering degree in 1992, from the University of Patras, Greece, the M.S. degrees in Electrical Engineering and Mathematics in 1995 and 1996, respectively, and the Ph.D. degree in Chemical Engineering in 1996, all from the University of Minnesota.

Since July 1996 he has been with the Department of Chemical Engineering at the University of California, Los Angeles, where he is currently an Associate Professor. His theoretical research interests include nonlinear control, singular perturbations, and analysis and control of distributed parameter systems, multiscale systems and hybrid systems, with applications to advanced materials processing, particulate processes, biological systems and fluid flows. His research work has resulted in a large number of articles in leading scientific journals and conferences and two books entitled *Nonlinear and Robust Control of PDE Systems: Methods and Applications to Transport-Reaction Processes*, (Birkhauser, 2001) and *Model-Based Control of Particulate Processes* (Kluwer Academic, 2002). A description of his research interests and a list of his publications can be found at http://www.chemeng.ucla.edu/pchristo/index.html.

Professor Christofides has been a member of the Control Systems Society Conference Editorial Board and is an Associate Editor of *IEEE Transactions on Automatic Control*, the 2004 Program Coordinator of the Applied Mathematics and Numerical Analysis Area of AIChE and the Program Vice-Chair for Invited Sessions for the 2004 American Control Conference.

Professor Christofides has received the Teaching Award from the AIChE Student Chapter of UCLA in 1997, a Research Initiation Award from the Petroleum Research Fund in 1998, a CAREER award from the National Science Foundation in 1998, the Ted Peterson Student Paper Award from the Computing and Systems Technology Division of AIChE in 1999 and a Young Investigator Award from the Office of Naval Research in 2001. He has also received twice the O. Hugo Schuck Best Paper Award in 2000 (with Antonios Armaou) and 2004 (with D. Ni, Y. Lou, L. Sha, S. Lao and J. P. Chang), all from the American Automatic Control Council.

John R. Ragazzini Award – Mark Spong

The **John R. Ragazzini Award** is given to recognize outstanding contributions to automatic control education in any form. These contributions can be from any source and in any media, i.e., electronic, publications, courses, etc.

Citation: For outstanding contributions to control education through course, textbook, and laboratory development, and the invention and commercialization of innovative laboratory experiments.

Mark W. Spong is the Donald Biggar Willett Professor of Engineering, Professor of General Engineering, and Research Professor in the Coordinated Science Laboratory at the University of Illinois at Urbana-Champaign. His current interests include nonlinear control theory, mechatronics, and robotics. He received the B.A. degree, magna cum laude and Phi Beta Kappa, in mathematics and physics from Hiram College in 1975, the M.S. degree in mathematics from New Mexico State University in 1977, and the M.S. and D.Sc. degrees in systems science and mathematics in 1979 and 1981, respectively, from Washington University in St. Louis. In 1984 he joined the faculty of the University of Illinois at Urbana-Champaign.

At Illinois he is the Director of the College of Engineering Robotics and Automation Laboratory, which he founded in 1987, and Director of the John Deere Mechatronics Laboratory, which he founded in 1995. He has held Visiting Professorships at the University of Waterloo, Canada, the CINVESTAV del IPN, Mexico City, the Lund Institute of Technology, Sweden, the Laboratory of Automatic Control (LAG), Grenoble, France, the Technological

University of Compiegne, France, the Katholiek University, Leuven, Belgium, The National University of Singapore, and the Technical University of Munich, Germany, and has served as a consultant to industry and government.

Professor Spong has received several awards including the Senior U.S. Scientist Research Award from the Alexander von Humboldt Foundation, the O. Hugo Schuck Award from the American Automatic Control Council, the Distinguished Member Award from the IEEE Control Systems Society and the IEEE Third Millennium Medal. He is a Fellow of the IEEE and past Editor-in-Chief of the IEEE Transactions on Control System Technology. He served as Vice President for Publication Activities and a member of the Board of Governors of the IEEE Control Systems Society and is President-Elect of the Society for 2004. He has published over 170 technical articles in control and robotics and is co-author of two books, *Robot Dynamics and Control*, John Wiley & Sons, Inc., 1989 (with M. Vidyasagar) and *Robot Control: Dynamics, Motion Planning, and Analysis*, IEEE Press, 1992 (with F. Lewis and C. Abdallah).

In addition, he is President of Mechatronic Systems, Inc., a company that he founded in 1996 to produce and market innovative laboratory experiments for control systems research and education. The experimental devices that he invented, including the *Pendubot* and the *Reaction Wheel Pendulum*, are now in use at more than 100 universities and research laboratories in North and South America, Europe, Africa, Asia, and Australia.

Control Engineering Practice Award – William Powers

The **Control Engineering Practice Award** is given to an individual or team for significant contributions to the advancement of the practice of automatic control. The primary criterion for selection is the application and implementation of innovative control concepts, methodology, and technology, for the planning, design, manufacture and operation of control systems. Achievement and usefulness will be evidenced by the benefit to society and by the degree of acceptance by those who use control as a tool. The work on which the nomination is based must have been performed while the nominated individual or at least one member of the team was a resident of the USA.

Citation: For pioneering contributions to aerospace and automotive controls, ranging from very effective space shuttle controls to some of the first successful applications of optimal control and estimation in the automotive industry.

William F. Powers retired as Vice President – Research from Ford Motor Company on December 31, 2000; he had been with the company since 1979. During his career at Ford, he served in numerous information technology, product development, and research management positions. On February 1, 1996, Dr. Powers assumed the responsibilities of Vice President-Research. Dr. Powers received his B.S. in Aerospace Engineering in 1963 from the University of Florida, and his Ph.D. in Engineering Mechanics in 1968 from the University of Texas at Austin. At NASA Marshall Space Flight Center from 1960-65, he was involved with the development of the Saturn Booster guidance system and Apollo

mission analyses. He consulted on the Space Shuttle Program with the NASA Johnson Space Center during the period 1970-79. From 1968-1980, he was a Professor of Aerospace Engineering and Computer, Information and Control Engineering at the University of Michigan. He served as President of the AACC in 1988-89 and he organized and was the first chairman of the IFAC Automotive Technical Committee. He is a member of the National Academy of Engineering, a Fellow of the Institute of Electrical and Electronics Engineers, the American Society of Mechanical Engineers, and the Society of Automotive Engineers, and a foreign member of the Royal Swedish Academy of Engineering Sciences. He currently is a consultant to a number of companies, and serves on the Secretary of Energy's Laboratory Operations Board, the National Academy of Engineering's Committee on Membership, the National Academies Board on Energy and Environmental Systems, and the National Academies Committee on Alternatives and Strategies for Future Hydrogen Production and Use, in addition to a number of university advisory committees. He and his wife, Linda, reside in Boca Raton and Ann Arbor, and have two children and three grandchildren.

O. Hugo Schuck Best Paper Awards for 2004

The **O. Hugo Schuck Awards** are given to recognize the best two papers presented at the previous American Control Conference. One award is for a paper emphasizing contributions to theory and the other award is for a paper emphasizing significant or innovative applications. Criteria for selection include the quality of the written and oral presentation, the technical contribution, timeliness, and practicality.

The award winning paper for theory is:

"Integrated Direct/Indirect Adaptive Robust Control of SISO Nonlinear Systems in Semi-Strict Feedback Form," Bin Yao. ACC 2003, TM-17-3.

Bin Yao received the B.Eng. in Applied Mechanics from the Beijing University of Aeronautics and Astronautics, P.R.China, in 1987, the M.Eng. degree in Electrical Engineering from the Nanyang Technological University, Singapore, in 1992, and the Ph.D. degree in Mechanical Engineering from the University of California at Berkeley in February 1996. Since 1996, he has been with the School of Mechanical Engineering at Purdue University and was promoted to the rank of Associate Professor in 2002. Dr. Yao was awarded a Faculty Early Career Development

(CAREER) Award from the National Science Foundation (NSF) in 1998 for his work on the engineering synthesis of high performance adaptive robust controllers for mechanical systems and manufacturing processes. He received the Caterpillar Engineering Young Faculty Development Fund in 1997 for his work on the electro-hydraulic control. His research interests include the design and control of intelligent high performance coordinated control of electro-mechanical/hydraulic systems, optimal adaptive and robust control, nonlinear observer design and neural networks for virtual sensing, modeling, fault detection, diagnostics, and adaptive fault-tolerant control, and data fusion. He has published significantly on the subjects with over 90 technical papers while enjoying the application of the theory through industrial consulting. He has been actively involved in various technical professional societies such as ASME and IEEE, as reflected by the organizer/chair of numerous sessions, the member of the International Program Committee of a number of IEEE, ASME, and IFAC conferences that he has served during the past several years, and the Program Co-Chair for the 8th IEEE International Workshop on Advanced Motion Control (AMC'04) in Japan. He was the chair of the Adaptive and Optimal Control panel from 2000 to 2002 and the chair of the Fluid Control panel of the ASME Dynamic Systems and Control Division from 2001 to 2003. He currently serves as a technical editor of the IEEE/ASME Transactions on Mechatronics. More can be obtained from his Web page at http://widget.ecn.purdue.edu/~byao.

The award winning paper for applications is:

"A Method for Real-Time Control of Thin Film Composition Using OES and XPS" Dong Ni, Yiming Lou, Panagiotis D. Christofides, Lin Sha, Sandy Lao, and Jane P. Chang. ACC 2003, WM-18-3.

Dong Ni was born in Hangzhou, China, in 1978. He received the B.S. degree in Control Science and Engineering from Zhejiang University, China, in 2001 and the M.S. degree in Chemical Engineering from the University of California, Los Angeles in 2002. He is currently a doctoral candidate in Chemical Engineering at the University of California, Los Angeles. His research interests include model reduction and control of multiscale systems, real-time control of thin film growth processes, plasma processing and chemical vapor deposition. He is the recipient of a Best Presentation in Session Award at the 2003 American Control Conference. He is a member of AIChE.

Yiming Lou was born in Hangzhou China in 1975. He received the B.S. degree in Electrical Engineering in 1997, the M.S. degree in Control Science and Engineering, in 2000, both from Zhejiang University, China, and the Ph.D. degree in Chemical Engineering from the University of California, Los Angeles, in 2004. His theoretical research interests include model reduction, optimization and control of multiscale systems and distributed parameter systems, with applications to control of thin film growth and microstructure. He has published more than ten articles. He is a member of AIChE, IEEE and Sigma Xi.

Panagiotis D. Christofides was born in Athens, Greece, in 1970. He received the Diploma in Chemical Engineering degree in 1992, from the University of Patras, Greece, the M.S. degrees in Electrical Engineering and Mathematics in 1995 and 1996, respectively, and the Ph.D. degree in Chemical Engineering in 1996, all from the University of Minnesota.
For extended bio information, please see the Donald P. Eckman Award.

Lin Sha received his B.S. degree from Tsinghua University, China, in 1997, his M.S. degree from Washington State University in 1999, and his Ph.D. degree from UCLA in 2003, all in Chemical Engineering. His research interests are on plasma processing, reaction kinetics, novel electronic materials, semiconductor processing, and process integration. He has published eight articles. Dr. Sha received an Intel Ph.D. Fellowship in 2000, a UCLA dissertation year fellowship in 2002, and the Coburn and Winters Award from AVS in 2002. He is a senior process engineer at Intel Corporation, Oregon.

Sandy X. Lao received his B.S. and M.S. degrees in Chemical Engineering from UCLA in 2001 and 2004, respectively. He worked at ITI Electro Optics as an engineer from 2001-2002. His research interests are on the characterization and development of advanced plasma-enhanced chemical vapor deposition and atomic layer deposition processes for the next generation of microelectronic devices. He has co-authored several articles. He will be joining Intel Corporation, Arizona, in May 2004.

Jane P. Chang received her B.S. degree in Chemical Engineering from National Taiwan University, Taiwan, in 1993, and her M.S. and Ph.D. degrees, both in Chemical Engineering, from Massachusetts Institute of Technology in 1995 and 1998, respectively. She was a postdoctoral member of technical staff at Bell Labs, Lucent Technologies, from 1998 to 1999. She has been with the Chemical Engineering Department at UCLA, as an Assistant Professor since 1999, as the William F. Seyer Chair in Materials Electrochemistry since 2000, and as an Associate Professor since 2003. Her research interests are on electronic material synthesis, chemical processing, and micro-fabrication. She has published over 65 articles. Dr. Chang has received the Coburn and Winters Award from AVS in 1997, a Career Award from National Science Foundation in 2000, the TRW Excellence in Teaching Award in 2002, a Teaching Award from the AIChE Student Chapter of UCLA in 2003, and a Young Investigator Award from the Office of Naval Research in 2003.

2005 AACC Awards – Nominations Due December 1, 2004

Nominations for the five AACC awards for 2005 are now being solicited. Each award consists of a certificate and an honorarium and will be presented at the Awards Banquet during the 2005 ACC in Portland, Oregon. Nomination packages should be prepared in accordance with the AACC Award Nomination Form (which can be obtained from the AACC web site at **www.a2c2.org/awards** or from the AACC Secretary, Pradeep Misra) and include the following: biographical information, a statement identifying and evaluating the accomplishments on which the nomination is based (not to exceed two double-spaced pages), a minimum of three and maximum of five reference letters, a current list of publications and patents, and any additional supporting material that could have a bearing on the award. All materials should be collected in a single package and the original together with six (6) copies should be submitted at the same time. The nomination package is due by December 1, 2004, and should be sent to:

Dr. Pradeep Misra
Department of Electrical Engineering
Wright State University
3640 Colonel Glenn Highway
Dayton, OH 45435-0001

Tel: (937) 775-5037
Fax: (937) 775-3936
Email: pmisra@cs.wright.edu

CONFERENCE INFORMATION

Student Best Paper Award

As in past ACC's, the 2004 ACC solicited nominations for the Student Best Paper Award competition. There were 89 submissions through PaperPlaza. Of these, 78 received advisor nominations and were considered for the award. The nominated papers were reviewed through the usual review process and by a panel of experts chosen from the Program Committee. Based on these reviews, the following five papers have been selected as finalists for the Student Best Paper Award competition:

Hakan Yazarel and George J. Pappas, "Geometric programming relaxations for linear system reachability," *Paper WeA08-2*.

Michael B. Reiser, J. Sean Humbert, Mary J. Dunlop, Domitilla Del Vecchio, Richard M. Murray, and Michael H. Dickinson, "Vision as a compensatory mechanism for disturbance rejection in upwind flight," *Paper WeA11-4*.

Islam I. Hussein and Anthony Bloch, "Dynamic interpolation on Riemannian manifolds: An application to interferometric imaging," *Paper WeM02-2*.

Songhwai Oh, H. Jin Kim, and Shankar Sastry, "A sampling-based approach to non-parametric dynamic system identification and estimation," *Paper WeM16-5*.

D.H.S. Maithripala, Jordan M. Berg, and W.P. Dayawansa, "An intrinsic observer for a class of simple mechanical systems on a Lie group," *Paper WeP16-4*.

The winner of the student best paper competition will be selected at the conference and will be based on both the written paper and the final oral presentation by the student. The first listed author of each paper is the student who will make the oral presentation. The winner will be announced at the Awards Banquet on Thursday.

Student Travel Grants

The eligibility conditions and application procedure for the student travel grants were announced on the web, with a deadline of May 3, 2004. At this time, we remind you that the Student Travel Grants will be in the form of reimbursements sent only after the completion of the conference upon receipt of a report on the student's experiences at the conference and proof of registration, hotel and travel expenditures. Students receiving travel grants should plan and document their finances accordingly. Should any questions arise, please contact the Vice Chair for Student Affairs, Dr. Molly Shor, shor@eecs.orst.edu.

Registration

All conference attendees must register. Personal badges will be provided to identify registered participants. On-site registration may be done at the Registration Desk located in the Sheraton Hotel. Packets for all advance registrations will also be available at the Registration Desk. The Registration Desk will be in operation during the following hours:

Sunday, June 27	4:00 pm – 7:00 pm	Wednesday, June 30	7:30 am – 6:00 pm
Monday, June 28	7:30 am – 6:00 pm	Thursday, July 1	7:30 am – 3:00 pm
Tuesday, June 29	7:30 am – 6:00 pm	Friday, July 2	7:30 am – 12:00 noon

Registration Fees

All registered participants will receive a CD-ROM containing the conference proceedings. Member and Non-member registration also includes the Awards Luncheon on Thursday, July 1. The printed proceedings are not included in any of the registration fees, but can be ordered either when registering in advance or at the conference. The conference registration fees are as follows:

Registration Categories	**Registration Fee (June 27 – July 2)**	**CD-ROM Proceedings**	**Awards Banquet**	**Boston Pops Concert**	
				Floor	**Balcony**
Society Member	$450	Included	Included	$65.55	$40.85
Non-Member	$560	Included	Included	$65.55	$40.85
Retiree/Student	$170	Included	No	$65.55	$40.85

There will be eight one-day and two two-day tutorial workshops held on June 28 and June 29 in conjunction with the ACC. The registration fees for each workshop are as follows:

Workshop Type	**Attending ACC**	**Not Attending ACC**	**Retiree/Student**
One-day workshops	$300	$380	$120
Two-day workshops	$460	$580	$180

One CD-ROM containing the conference proceedings will be distributed at the conference with the registration package. There will be no printed proceedings available on site at the conference. The printed set of proceedings will be mailed after the conference to those registrants who pay an additional fee (which includes fourth class/book rate shipping charges). Additional copies of the proceedings, either in printed or CD-ROM format, may be ordered with on-site registration at the following rates:

Proceedings	
Printed *(mailed after the Conference, includes shipping)*	$400
Additional CD-ROM *(available at the Conference)*	$50

Welcoming Reception

Tuesday, June 29 - Sheraton Boston Hotel, Constitution Ballroom - 5:30 -8:00 pm

Plan on attending a celebration of the 35th anniversary of the first Apollo landing and the achievement of the flight control engineering team. Speakers will discuss their experiences of the project. This event will be of tremendous interest to all the conference attendees and their accompanying guests. Starting at 5:30pm, cocktails and light hors d'oeuvres are provided before the program. After the program, please visit the exhibit rooms to view displays and enjoy cocktails and heavy hors d'oeuvres. Point of Contact: Stacey Raffi (stacey@mathworks.com)

Awards Banquet

Thursday, July 1 - Grand Ballroom – 11:30 am – 1:15 pm

The Awards Banquet will feature the presentation of the annual awards sponsored by the AACC. Extra Banquet tickets may be ordered when registering in advance over the web, or they may be purchased at the Registration Desk until 6:00 pm on June 29, subject to availability.

Special Event

Thursday, July 1 - Boston Pops, Boston Symphony - 8pm-10:30pm

Join us as we celebrate the one and only George Gershwin with some of his best known and beloved works including *An American in Paris*, and *Rhapsody in Blue*. Two types of tickets are available. The 1st floor has small tables that seat 5, with all seats facing the stage, where you may order food/drinks. We also have seats in the 1st balcony, with a fantastic view of the stage. Symphony Hall is down the street from the Sheraton Hotel, just a brief 10-minute walk across the great architecture of the Christian Science Center. **Ticket Price: 1st Floor: $65.55, 1st Balcony $40.85. Limited Tickets Available.**

Closing Reception

Friday, July 2 - Sheraton Boston Hotel, Grand Ballroom – 6:30-8:30pm

All registrants and their accompanying guests are invited to attend the closing reception on Friday evening at the Sheraton Hotel. Come, relax, and enjoy the festivities before the weekend of the 4th of July.

Exhibits

The exhibits will take place in the Back Bay Ballroom Area on the second level. A preliminary list of confirmed exhibitors includes:

Adaptics, Inc.

Elsevier Science

Mathworks

IEE Publishing

National Instruments

National Science Foundation

Prentice Hall

Quanser Consulting

Raytheon

SIAM

Springer-Verlag /Birkhauser

Exhibition Hours
Wednesday, June 30: 9:00 am - 5:00 pm
Thursday, July 1: 9:00 am - 5:00 pm
Friday, July 2: 9:00 am - 12:00 pm
For further information, please contact The Exhibits Chair, Prof. Mark Balas, Mark.Balas@colorado.edu.

Interactive Sessions

Interactive Sessions: Wednesday, June 30, 1:30 pm - 3:30 pm and Thursday, July 1, 1:30 pm - 3:30 pm, Back Bay Ballroom D

Interactive session presenters will use a unique medium which combines networked computer simulations, hands-on demonstrations, and poster boards to allow an interactive exchange of ideas with the audience. The session topics include the following:

WeMI: Hardware and Software for Control Education
ThMI1: Biomedical Applications
ThMI2: Modeling and Simulation of Locomotion
ThMI3: Industrial Applications

The interactive sessions are located in the Back Bay Ballroom D next to the Exhibits which are held in Back Bay Ballroom A, B, C.

Special Sessions

Special Session I: Wed., June 30, 9:30am-11:30am, Independence Ballroom West

"Systems Engineering of Systems Biology"

Chair: Karlene Hoo, Texas Tech. University
Co-Chair: Vassily Hatzimanikatis, Northwestern University

Organizers: Douglas Lauffenburger, MIT
Pablo A. Iglesias, Johns Hopkins University
Kris Chan, Michigan State University
Panagiotis D. Christofides, UCLA
Daniel Hammer, University of Pennsylvania
Vassily Hatzimanikatis, Northwestern University

Systems biology is the use of engineering principles that combine biological information from multiple cellular processes and networks in the study of these processes. Theoretical and computational tools are necessary to understand certain aspects of their complex functionalities such as their strong coupling and detailed metabolic mechanisms so as to modify their regulatory and transport processes to improve cellular properties and to guide and accelerate improvements in medical sciences and bioprocess engineering. This session presents cutting edge research emphasizing theoretical and computational tools that analyze multiple cellular processes data, metabolic pathways, and the key elements of their cellular complexity. Five presentations are planned:

1. The first (approximately 30 minute) presentation by D. Lauffenberger (MIT) discusses the challenging problem of understanding and influencing signal network

operations especially when information concerning connectivity and physico-chemical properties of signal networks is incomplete.

2. The second (approximately 20 minute) presentation by P. Iglesias and T. Mu-Yi (Johns Hopkins Univ) will focus on the filtering mechanisms of E. coli in regards to chemotaxis. In particular, a model is introduced that begins to explain how the cell's tumbling affects its response to perceived chemical concentration gradients.

3. The third (approximately 20 minute) presentation by C. Chan and Z. Li (Michigan State Univ) introduces a framework to integrate hepatic gene expression and metabolic profile with the objectives of quantitative prediction of metabolic functions from gene expression data and identification of important genes that participate in hepatic cellular functions.

4. The fourth (approximately 20 minute) presentation by P. Christofides (UCLA) introduces system tools and concepts to analyze and control mode changes in biological networks.

5. The final (approximately 20 minutes) presentation by V. Hatzimanikatis (Northwestern Univ) investigates analysis and design of metabolic regulatory circuits. Two frameworks are discussed to predict how metabolic fluxes in a pathway respond to changes in the activities of the enzymes in the pathway.

Special Session II: Wednesday, June 30, 11:30 am - 1:30 pm, Independence Ballroom East

Women in Control Luncheon, with a panel discussion on "The Faculty Candidate Interview"

The IEEE Control Systems Society Standing Committee on Women in Control will host a luncheon at the ACC. During the luncheon, a discussion on "The Faculty Candidate Interview" with an emphasis on the young female faculty candidate will be addressed by a panel of three speakers - Dr. C. Schrader (Dean of Engineering at Boise State), Dr. R. Rhinehart (Dept. Head of Chemical Engineering, Oklahoma State Univ), and Dr. M. Balas (Prof. of Aerospace Engineering Sciences, Univ of Colorado at Boulder). Please join us for what promises to be an exciting exchange.

Special Session III: Wednesday, June 30, 1:30 pm - 3:30 pm, Independence Ballroom West

"Summary of the NSF workshop on Control and System Integration of Micro- and Nano- Scale Systems"

The US National Science Foundation (NSF) sponsored a workshop in March 2004 to identify open research areas, to foster inter-disciplinary collaborations, and to recommend future research directions to NSF that will enable control and system integration on the micro- and nano- length scales. This special session will summarize the main outcomes of the NSF workshop, including identifying needs and bottlenecks on the path toward system integration: what tools, techniques, collaborations, basic science understanding, and educational resources are needed to enable integrated systems on the micro and nano scales?

Special Session IV: Wednesday, June 30, 6:00 pm - 7:30 pm, Back Bay Ballroom D

"Winning that Academic Job" Sponsored in part by The Dupont Corporation and Cutler Johnson Corporation

Organizer: Karlene Hoo, Texas Tech. University

Chair: Karlene Hoo, Texas Tech. University
Co-Chair: Mark Balas, University of Colorado at Boulder

This session has been organized to help students and recent graduates to determine if an academic job is right for them. A panel will provide advice on numerous issues ranging from cover letter and resume/CV preparation, the initial telephone interview, the on-campus interview, and life during the first few years as an assistant professor.

Panelists include:

Cheryl Schrader, Boise State University
John Bailleuil, Boston University
Andrew Alleyne, University of Illinois
Russ Rhinehart, Oklahoma State University
Steve Yurkovich, Ohio State University

Special Session V: Wednesday, June 30, 7:30 pm - 8:30 pm, Back Bay Ballroom D

"Resume Exchange" Sponsored in part by: United Technology Research Center

Organizer: Molly Shor, Oregon State University

Are you interested in identifying potential job applicants for a job in your organization? Are you looking for a job in control systems in industry or academia? The American Control Conference will provide a time and place for potential employees and employers to meet, exchange resumes/vitae, discuss job openings and qualifications, and set up interview times.

NOTE: ACC will not be responsible for collecting or distributing resumes or other materials.

Special Session VI: Thursday, July 1, 6:30 pm - 8:00 pm, Back Bay Ballroom D

"History of Control"

Organizer: Daniel Abramovitch, Agilent Labs
Co-Organizer: Kent Lundberg, MIT

Chair: Daniel Abramovitch, Agilent Labs
Co-Chair: Kent Lundberg, MIT

Leonard Gould, MIT
Larry Ho, Harvard University
David Mindell, MIT

In a continuation of the series on "Centers of Control", the IEEE CSS History Committee presents a special history session on controls work in the Boston area. Our distinguished panel of speakers includes:

Prof. Leonard Gould (MIT): "The Early Days of Control at MIT"

Leonard A. Gould, Professor Emeritus at MIT, worked in the MIT Servomechanisms Laboratory and was associate director of its successor, the MIT Electronic Systems Laboratory. He has won numerous awards and has authored two famous texts on controls engineering including "Analytical Design of Linear Feedback Controls" (1957) (with George Newton and James Kaiser) and "Chemical Process Control: Theory and Applications" (1969). Professor Gould will recount stories of the early days of controls engineering at MIT

Prof. Larry Ho (Harvard): "Personal recollections of control and system research in the late Fifties and early Sixties in the Greater Boston area"

Yu-Chi (Larry) Ho, Research Professor at Harvard University is a longtime professor of Engineering and Applied Mathematics at Harvard University. He has published over 120 articles and four books, one of which (co-authored with A.E. Bryson, Jr.) has been translated into both Russian and Chinese and made the list of Citation Classics as one of the most referenced works on the subject of optimal control. Professor Ho has won virtually every award available to a controls engineer. He will provide his personal recollections of interactions with other celebrated controls engineers and projects in the 1950s and 1960s.

Prof. David Mindell (MIT): "The Apollo Guidance Computer"

David A. Mindell is the Frances and David Dibner Associate Professor of the History of Engineering and Manufacturing at MIT. He has won several awards for his work on the history of technology. He has authored two books on the subject: *War, Technology, and Experience aboard the USS Monitor* and his more recent book, *Between Human and*

Machine: Feedback, Control, and Computing Before Cybernetics. Professor Mindell will be discussing the history of the Apollo Guidance Computer, which was designed and manufactured in the Greater Boston area.

Special Session VII: Friday, July 2, 11:30 am - 12:30 pm, Liberty A

"Writing a Winning NSF CAREER Proposal"

Organizer: Kishan Baheti, National Science Foundation
Co-Organizer: Masayoshi Tomizuka, National Science Foundation

Chair: Kishan Baheti, National Science Foundation
Co-Chair: Masayoshi Tomizuka, National Science Foundation

In this session, several Division and Program Directors from the National Science Foundation will discuss the goals of the CAREER program and the NSF review process and merit review criteria. A number of CAREER grantees representing broad areas of control engineering will also share their ideas and experience in writing an innovative proposal.

Invited Tutorial Sessions

WeA01: Introduction to Micro- and Nano-Scale Sensors, Actuators and Robots

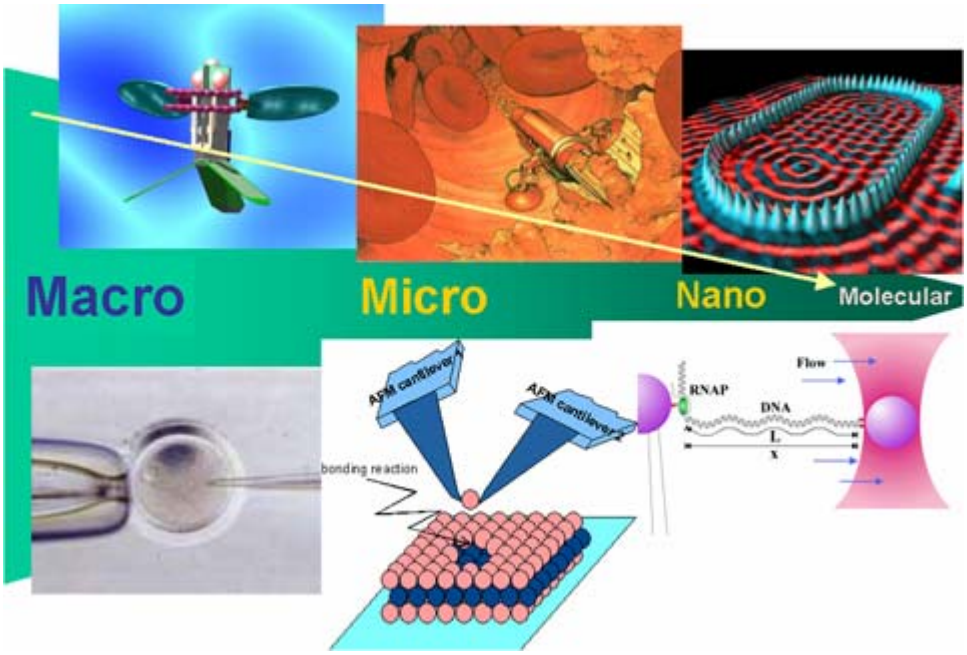
Organizers: Metin Sitti (CMU) and Robert M'Closkey (UCLA)

Micro and nano systems are largely seen as one of the new frontiers of systems and control work. Of late, there has been considerable interest in these areas, but there has been little introductory material to aid those trying to understand the fundamental control issues involved. This tutorial session aims to address that. The tutorial should be of interest to both academics and practicing engineers who are curious as to what the issues are for micro and nano systems

Because the field of Micro- and Nano-Scale Sensors, Actuators and Robots is so new, this session will have two one hour tutorial talks. The abstracts for each are listed below the talk title.

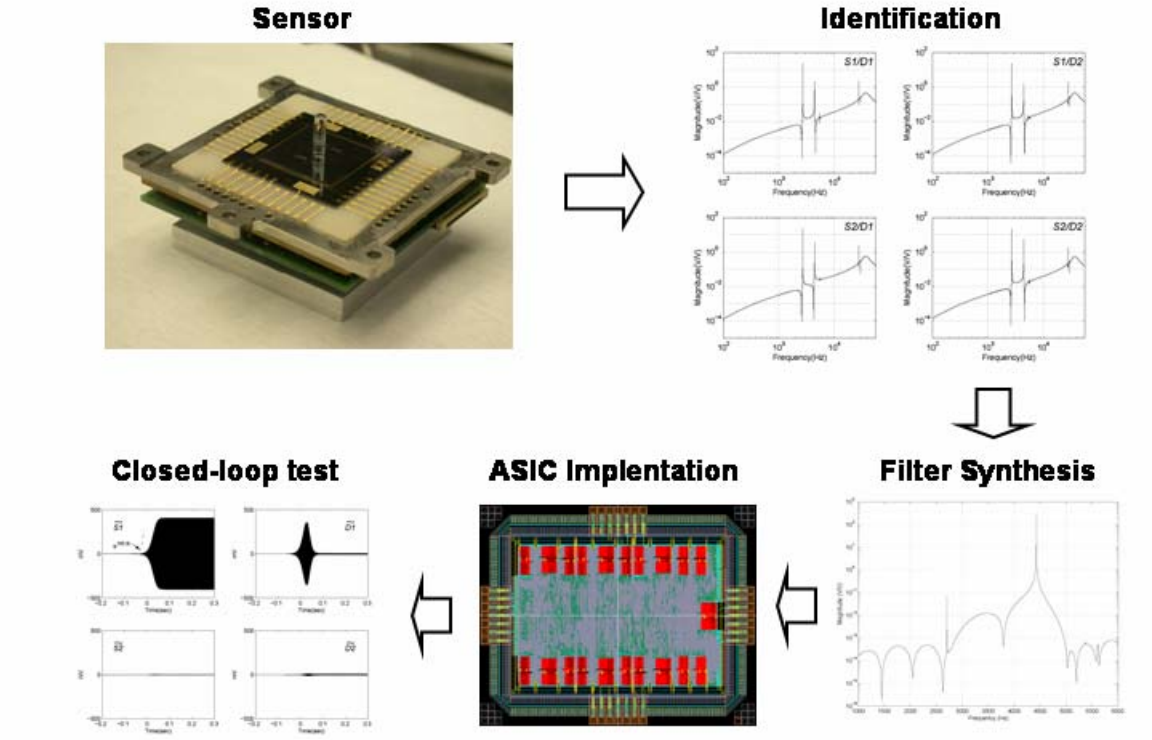
Talks:

- "Introduction to Micro- and Nanoscale Robotics", Metin Sitti (1 hour)



Micro- and nano-scale robotics encompasses: (i) design and fabrication of robots with overall dimensions from the macro-scale down to millimeter and sub-millimeter ranges and made of micro- and nano-meter components; (ii) programmable assembly and manipulation of micro- and nano-scale components; and (iii) programming and coordination of large numbers of micro/nano-robots. The tutorial begins by discussing basic micro/nano-robot design and construction issues. Micro/nano-robot construction addresses sensing, actuation, power source, control, physics, communications, power, and interfacing across spatial scales and between the organic/inorganic and biotic/abiotic realms. Micro/nano-robots are expected to have revolutionary applications in such areas as environmental monitoring, search and rescue, inspection and repair in space, data storage, and health care. The tutorial's focus then changes to micro/nano-assembly by manipulation with Scanning Probe Microscopes, nano-tweezers, and optical tweezers for prototyping micro/nano-systems. Furthermore, as an alternative to precision robotic assembly techniques, directed self-assembly techniques are introduced. Finally, construction challenges of miniature micro/nano-robots are discussed. Example robots such as flying insect robots, E. Coli inspired swimming micro-robots, endoscopic micro-capsules for health inspection in digestive tract, and wall-climbing miniature robots inspired by geckos are explained. The tutorial closes by summarizing the current status and future research directions of micro/nano-robotics area and possible contributions from the controls community.

- "Modeling, Identification, and Control of Micro-Sensor Prototypes", Robert M'Closkey and Dorian Challoner (1 hour)



Micro-sensors provide interesting challenges in identification and control. In identification, one is interested in extracting parameters from test data that give insight into sensor performance, but to do so as rapidly as possible in order to facilitate high-throughput evaluation and sensor tuning. In control, the flexibility of low-power, small footprint specialized digital processors enables the implementation of sophisticated compensation algorithms with the pay-off of higher sensor performance when compared to the traditional, but cumbersome, analog electronics approach. This presentation discusses some of the control and identification issues addressed in micro inertial systems by a cooperative research team from academe (UCLA) and industry (Boeing, JPL, and HRL Labs).

WeM01: The Use of Time and Frequency Domain Methods in System Identification

Organizer: Lennart Ljung, Linköping University, Sweden

The idea behind this Tutorial Session is to explain and illustrate the use of and interplay between time and frequency domain methods in the identification of linear systems.

The interplay between time and frequency domain methods for linear systems is well known and much utilized in, for example, control design. Indeed, this duality is a cornerstone in many design and analysis methods.

For linear system identification, that is, methods to estimate linear models from measured input-output data, the links between time- and frequency domain methods are equally important. However, the tools have traditionally not been quite integrated. Methods using frequency domain data have typically been developed in the ``instrumentation and measurement" community. These methods often use frequency analyzers to collect and compress data. Vibration and modal analysis are common applications of this type. Over a period of time, there was not so much contact between these activities and the control community's methods for time domain data. For example, the fact that the input not necessarily is periodic was perceived as an obstacle to use frequency domain techniques.

Recently, the true duality between time- and frequency domain methods have become clear. Estimating ``initial conditions" in the frequency domain can fully compensate for non-periodic data, and so called subspace methods originally developed for time domain data can also be applied to frequency domain data. The importance and implications of various inter-sample properties (like zero order hold or band-limited) of the input has also been clarified. The relative merits of periodic and non-periodic data have been studied carefully.

It is the purpose of this session to describe the new results, give an overview of the techniques as well as to show how the methods can be used in industrial applications.

Talks:

- "State of the Art in Linear System Identification: Time and Frequency Domain Methods", Lennart Ljung, Linköping University (1 hour)
- "Time domain identification, Frequency domain identification. Equivalences!, Differences?" Johan Schoukens, Rik Pintelon, Yves Rolain. Free University of Brussels. (20 min)
- "Time-domain approaches to continuous-time model identification of dynamical systems from sampled data." Hugues Garnier and Peter Young (20 min)
- "Subspace Methods for frequency domain data", Tomas McKelvey, Chalmers University. (20 min)

WeP01: Theory vs. Practice Forum

Organizers: Zhiqiang Gao and R. Russell Rhinehart

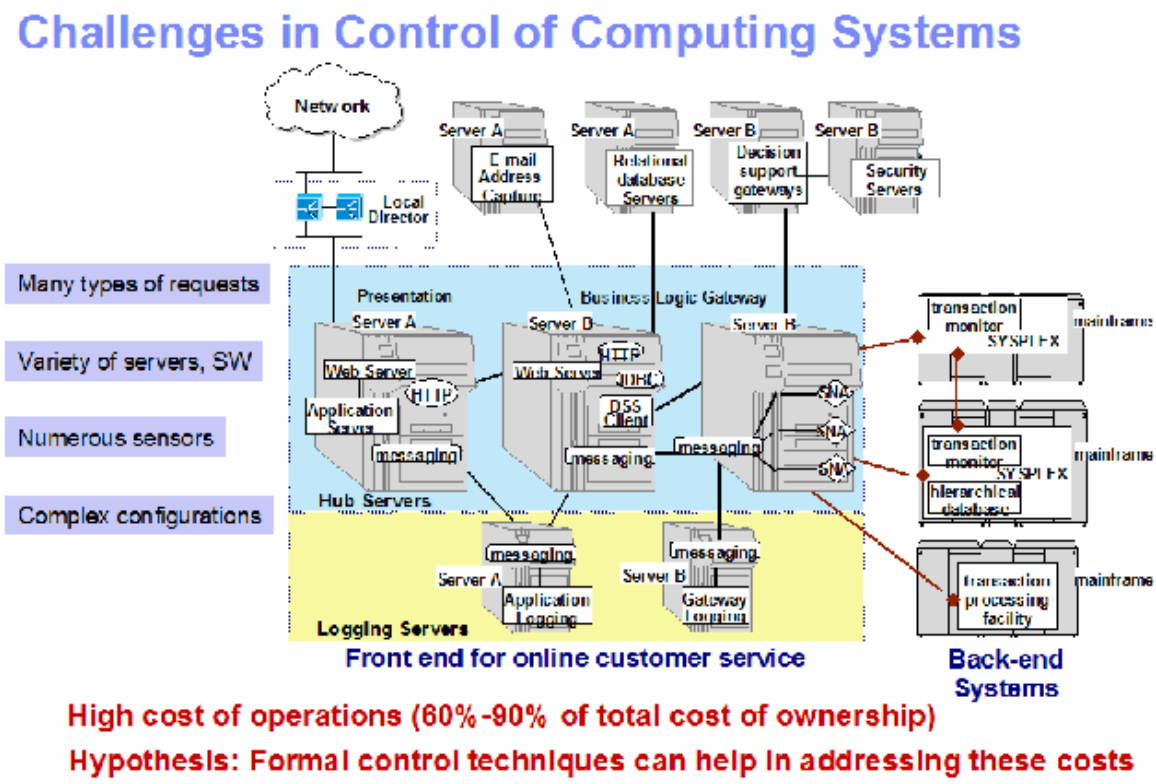
This special session at the 2004 American Control Conference is proposed for the purpose of addressing the gap between theory and practice by bringing academic researchers and practitioners together and sharing each other's view points. In this initial step, a panel of speakers is assembled to provide a glimpse of challenging system and control problems from industry. The presentations and the panel discussion that follows will 1) address the gap between theory and practice from a practitioner's perspective; 2) help academic researchers better understand the issues in engineering practice and make their research more relevant; 3) help practitioners gain a perspective of the potential impact of system and control theory to practice.

Talks:

- **Opening Remarks:** "Theory vs. Practice: More Than Just Applied Research", John Bay
- **Manufacturing Industry:**
  - "Motion/Drive Control in Web Industry", Peter Schmidt
  - "Product End-Use Characteristics Control for Reactive Extrusion Processes", Babatunde Ogunnaike
- **Health Management:**
  - "Vehicle health management", Dimitry Gorinevsky
  - "Abnormal Situation Management in Steel Industry", Michael Dudzic
- **Implementations:**
  - "Logic Control Design in the Automotive Manufacturing Industry", Dawn Tilbury
  - "Implementation of Advanced Algorithms in Modern DSP Chips", Steve Fedigan
- **30 minute discussion session**

ThA01: Challenges in Control Engineering of Computing Systems

Organizer: Joseph L. Hellerstein, IBM Research



The relentless decline in the price of computer hardware and software has led to the widespread use of information technology (IT). As a result, the dependence on and the scale of computing systems has grown dramatically, making it imperative to have stable well-behaved systems. Despite this imperative, formal control methods are rarely used in practice when developing new capabilities for computing systems. For example, it is uncommon to do system identification of the components to be controlled and almost unheard of to analyze the response of the system to disturbances. Recently, there has been considerable success with applying control theory to analyzing and designing closed loops in computing systems. This tutorial addresses the techniques employed and lessons learned in the application of control theory to computing systems, especially middleware (e.g., web servers, database servers).

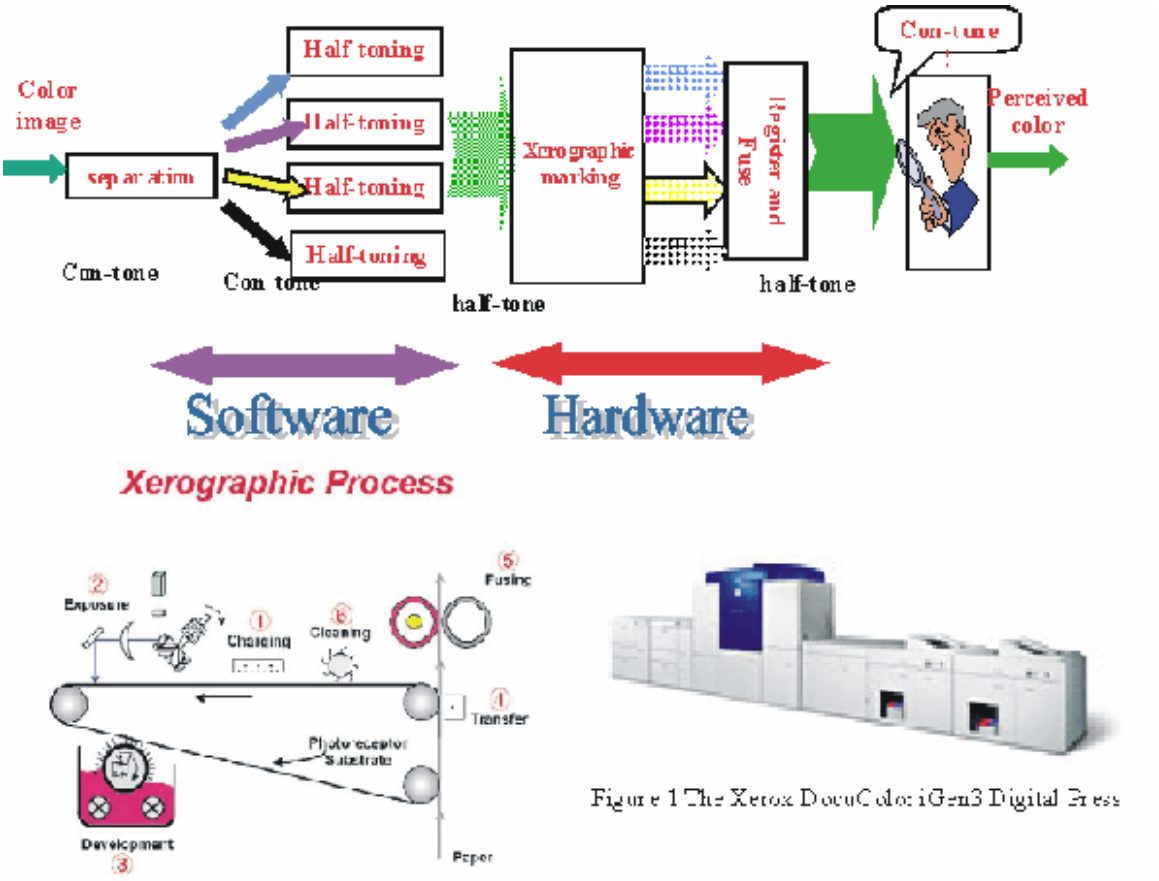
Talks:

- "Challenges in Control Engineering of Computing Systems", Joseph L. Hellerstein (1 hour)
- "Practical Application of Control Theory to Web Services", Tarek Abdelzaher (15 min)
- "Queueing Model Based Performance Control", Lui Sha (15 min)

- "Design and evaluation of load control in web-server systems", Anders Robertsson (15 min)
- "Throttling Utilities in the IBM DB2 Universal Database Server", Sujay Parekh (15 min)

ThM01: Sensing, Modeling and Control of Xerography

Organizers: George T.-C. Chiu (Purdue University), Perry Y. Li (University of Minnesota) and Eric S. Hamby (Xerox Corporaton)



A typical six-step xerographic process

Figure 1 The Xerox DocuColor iGen3 Digital Press

Xerography, also known as electrophotography, is the underlying marking process for photocopiers and laser printers. Historically, stability and performance are achieved via tight tolerances and robust material or hardware designs, with little emphasis on feedback control. As xerography expands into color printing markets, technical challenges associated with image quality, cost, process stability and other requirements become more stringent. Novel sensing and control breakthroughs become a necessity. This tutorial session will present both a case study of how control is currently used in the

industry, and several research topics in which the control paradigm makes impact in model, sensing and artifact reduction.

Talks:

- "A Control-Oriented Survey of Xerographic Systems: Basic Concepts to New Frontiers", Eric Hamby and Eric Gross
- "Time Sequential Sampling and Reconstruction of Reproduction Functions for Xerographic Printing", Perry Li, Teck Ping Sim, and Dongjun Lee (20 min)
- "REA: A Robust Estimation Algorithm for Printer Modeling", Mario Rotea and Carlos Lana (20 min)
- "Incorporating Human Visual Model and Spatial Sampling in Banding Artifact Reduction", Cheng-Lun Chen and George T.-C. Chiu (20 min)

ThP01: Convex Optimization: Overview and New Applications

Organizer: Haitham Hindi, PARC (Palo Alto Research Center)

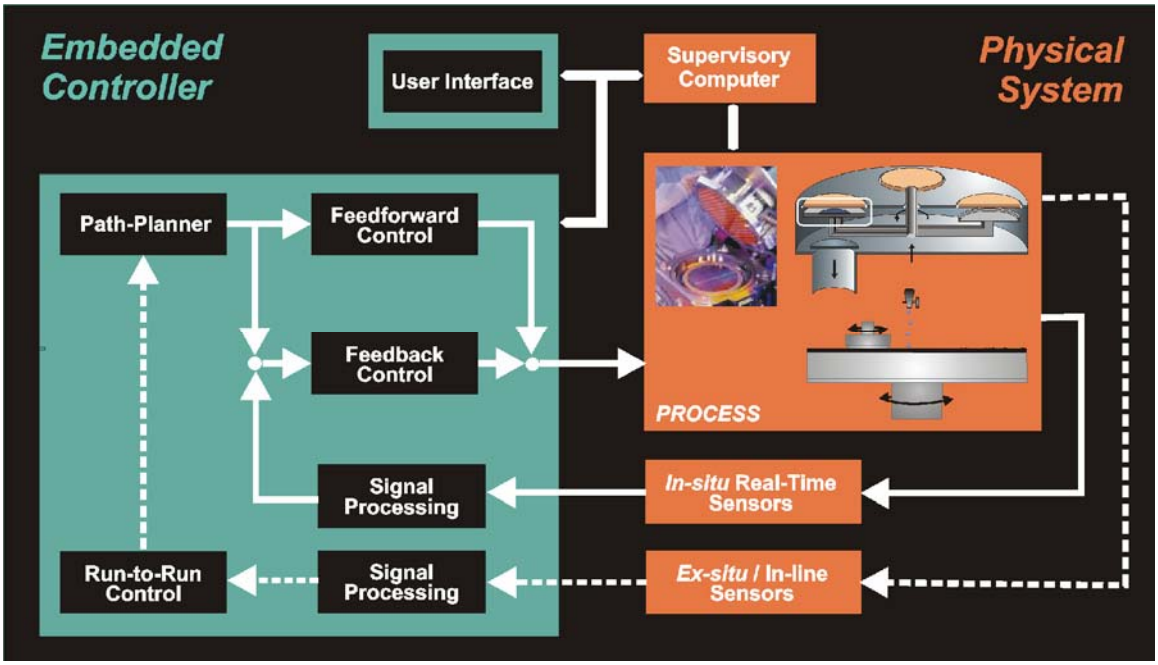
In recent years, convex optimization has become a computational tool of central importance in engineering, thanks to it's ability to solve very large, practical engineering problems reliably and efficiently. The goal of this tutorial is to give an overview of modern convex optimization and to give the audience a flavor for this exciting field, in terms of the kinds of problems one can solve today, and the computational techniques one might use to do so. The session will start with a 1hr tutorial talk on modern convex optimization. Four short 15-20min sessions will then present applications ranging from fully-implemented-company-founded, to cutting edge new theory, in the areas of circuit design, control, networks and combinatorial optimization. This workshop coincides with the publication of a new book by Boyd and Vandenberghe, who have made a large amount of high quality course material freely available on their websites. We will give pointers to these and other websites that also contain free code for convex optimization. This material can be downloaded and used immediately by the audience both for self-study and to solve real problems.

Talks:

- "A Tutorial on Convex Optimization", Haitham Hindi (1 hour)
- "CAD Tools for Circuit Design using Geometric Programming", Mar Hershenson (15 min)
- "Nonlinear Stability via Sum-of-Squares Programming", Dr. Pablo Parrilo (15 min)
- "Weight Design in Markov Chains and Distributed Algorithms", Lin Xiao (15 min)
- "Rank Minimization for Problems in System Theory", Maryam Fazel (15 min)

FrA01: Model-based Control for Semiconductor and Advanced Materials Processing

Organizer: Sarbajit Ghosal, SC Solutions



A semiconductor wafer undergoes a wide range of processes before it is transformed from a bare silicon wafer to one populated with millions of transistor circuits. Such processes include Physical or Chemical Vapor Deposition, (PVD, CVD), Chemical-Mechanical Planarization (CMP), Plasma Etch, Rapid Thermal Processing (RTP), and photolithography. As feature sizes keep shrinking, process control plays an increasingly important role in each of these processes. We have found the model-based approach to be an effective means of designing commercial controllers for both semiconductor and advanced materials processing. It is our experience that the best models for control design are closely based on the physics of the process. In some cases (e.g., RTP), the closed-loop control depends entirely on having very good physical models of the system. For other processes, physical models have to be combined with empirical models or are entirely empirical. The resulting controller may be in-situ feedforward-feedback or run-to-run controller, or a combination thereof.

In this tutorial session, we describe three case studies of model-based control: RTP, CMP, and PVD that are representative of the applications in this industry. Highlights of the session include physical modeling, model reduction and sensor selection, and feedback and run-to-run controller design.

Talks:

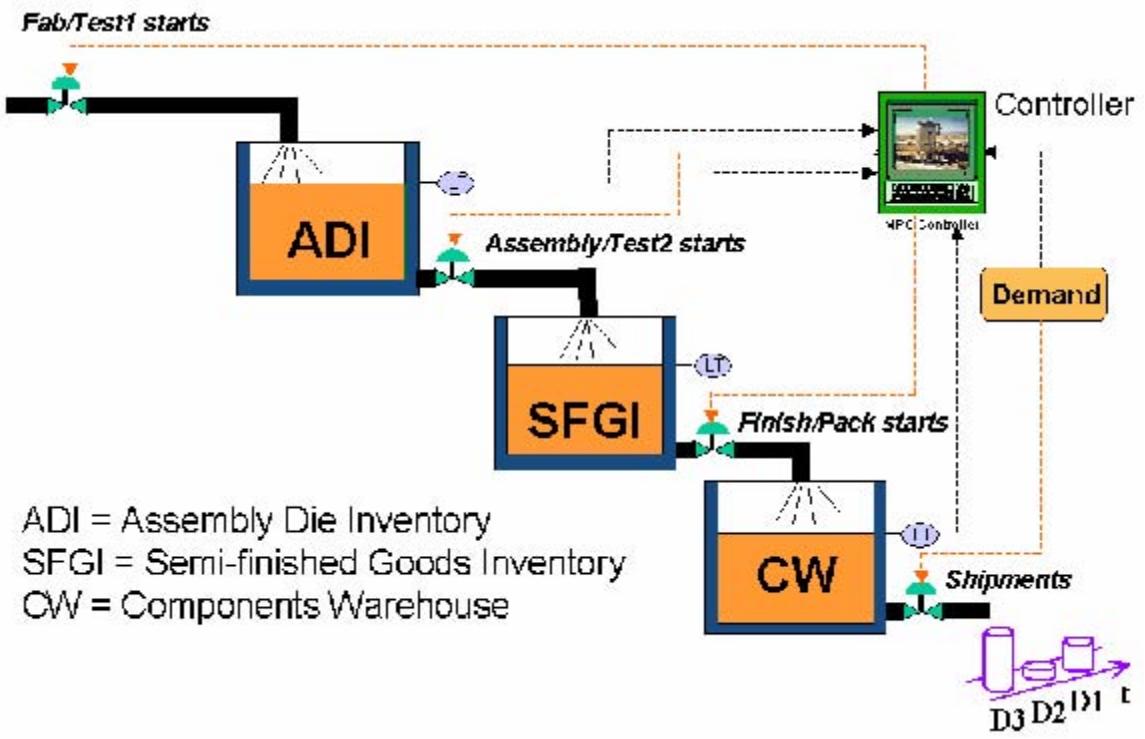
- "Model-based Control for Semiconductor and Advanced Materials Processing: An Overview" A. Emami-Naeini, J. L. Ebert, R. L. Kosut, D. de Roover (30 min)
- "Model-based Control of Rapid Thermal Processing for Semiconductor Wafers" J. L. Ebert, D. de Roover, L. Porter II, V. Lisiewicz, S. Ghosal, R.. L. Kosut, A. Emami-Naeini (30 min)
- "Model-based Control for Chemical-mechanical Planarization Systems" Dick de Roover, Abbas Emami-Naeini, Jon L. Ebert (30 min)
- "Modeling and Control of GMR Thin Film Deposition using RF Diode Sputtering" S. Ghosal, R. L. Kosut, J. L. Ebert, L. Porter (30 min)

FrM01: Control-Oriented Approaches to Supply Chain Management in Semiconductor Manufacturing

Organizer: Daniel E. Rivera (Arizona State University)

Enterprise Resource Planning in general, and supply chain management in particular, have become strategic imperatives for most manufacturers. A supply chain (also known as a value web or demand network) consists of interconnected entities that transform ideas and materials into delivered products and services. An effective supply chain should be designed and operated with the goal of maintaining a high level of customer service, while minimizing costs and maximizing profits. Managing supply chains in the semiconductor industry is a particularly challenging problem for a number of reasons. Long lead times (in the order of months), nonlinearity, and stochasticity in both supply and demand result in safety stock levels that may cover as much as a year's worth of demand. Given the volumes of product involved and the detrimental long-term consequences of failing to achieve customer satisfaction, the incentives for modern, efficient approaches to supply chain management in the semiconductor industry are clear. While supply chains have traditionally been the purview of the business and operations research communities, these are inhenrently nonlinear and uncertain dynamical systems; supply chain management therefore represents a challenging problem for control-oriented dynamic modeling and decision policy development, providing exciting opportunities for the control system engineer. These are explored in this tutorial session.

The principal talk in this session will be presented by Dr. Karl G. Kempf, Fellow and Director of Decision Technologies at Intel Corporation. A series of talks from researchers in business, engineering, and mathematics that draw from the themes of presented by Dr. Kempf make up the second hour of the tutorial.

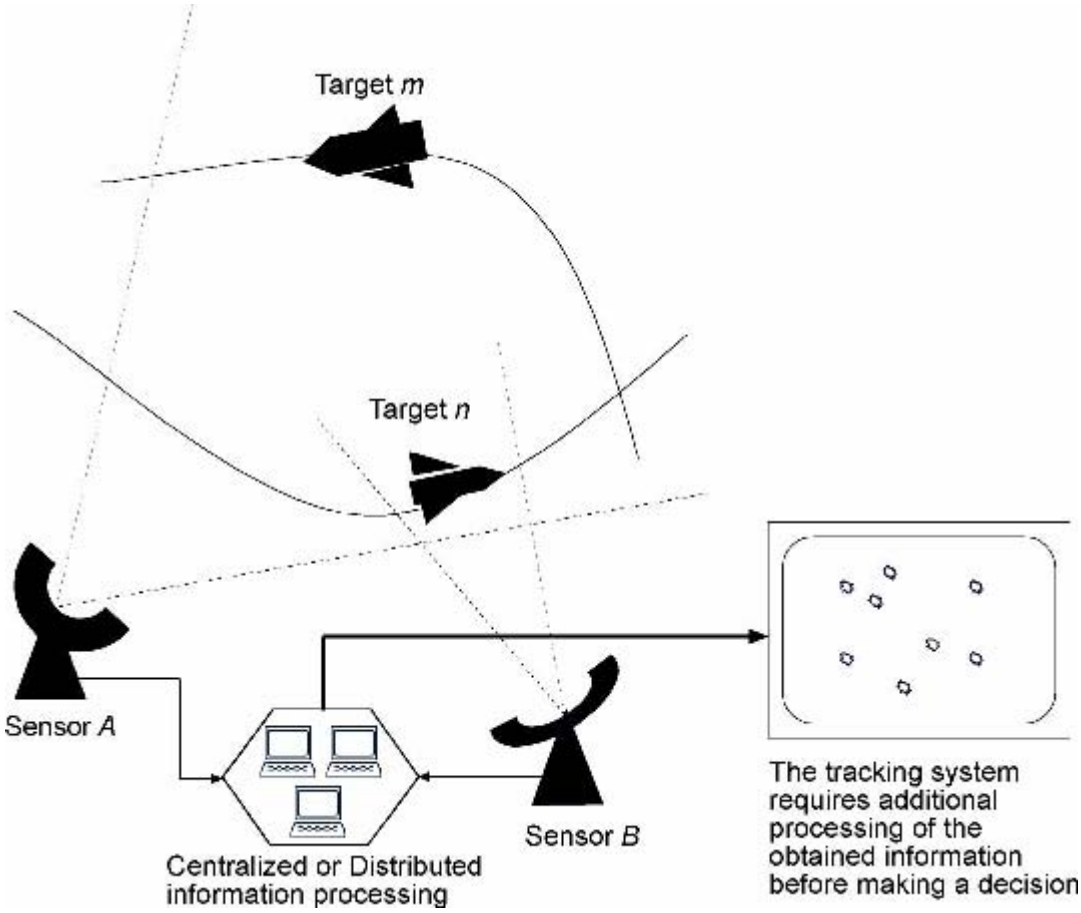


Talks:

- "Control-Oriented Approaches to Supply Chain Management in Semiconductor Manufacturing" Karl Kempf (1 hour)
- "Strategic Inventory Placement in Supply Chains: Recent Developments and New Directions" Sean Willems (15 min)
- "A Model Predictive Control Strategy for Supply Chain Management in Semiconductor Manufacturing under Uncertainty" Wenlin Wang, Daniel E. Rivera*, Kirk Smith, Karl Kempf (15 min)
- "Modeling, Validation and Control of Manufacturing Systems" Erjen Lefeber, Roel van den Berg, J.E. Rooda (15 min)
- "Continuous Models for Production Flows" Dieter Armbruster, Christian Ringhofer, and Tae-Chang Jo (15 min)

FrM06: Multisensor Management and Fusion Algorithms for Target Tracking

Organizers: Lucy Y. Pao (U. of Colorado) and Yaakov Bar-Shalom (U. of Connecticut)



Target tracking is the process of maintaining state estimates of one or several objects over a period of time. These objects can be aircraft, ships, or ground-based targets. Mobile robots can track the location of landmarks in their environment to maintain an accurate estimate of their location, as well. Target tracking algorithms are basically state estimation algorithms, where the estimate of the state is corrected by measurements from various sensors, which can include radar, sonar, and CCD cameras, to name a few. An illustration of tracking multiple aerial targets using sensors such as radars is presented in the Figure. The use of multiple sensors can dramatically improve tracking accuracy in a process known as sensor fusion. This tutorial session will overview common state estimation and target tracking algorithms. A number of difficulties and issues that arise will also be detailed and discussed, including

- data association: when the sensors used (such as radar) produce measurements where there is no clear linkage of measurement to object,
- sensor registration: where imperfect knowledge of the location of each sensor leads to errors common to each measurement from that sensor,
- distributed or decentralized tracking: while more robust to absolute tracking failure than centralized tracking, distributed and decentralized tracking approaches must address correlations of tracks from different processors that represent the same target,

- sensor management: is often required to control the flow of information in order to balance tracking performance with system resources,
- computational complexity issues: must be evaluated carefully so that algorithms can be implemented in real-time for tracking thousands of targets as is commonly required in military surveillance scenarios,
- out-of-sequence measurements: arise in multi-sensor systems in which there is latency between the reports of the sensors, and they must be carefully processed to avoid damaging the overall tracking performance.
- feature level data fusion: where target features are used in conjunction with kinematic data to improve detectability of targets.

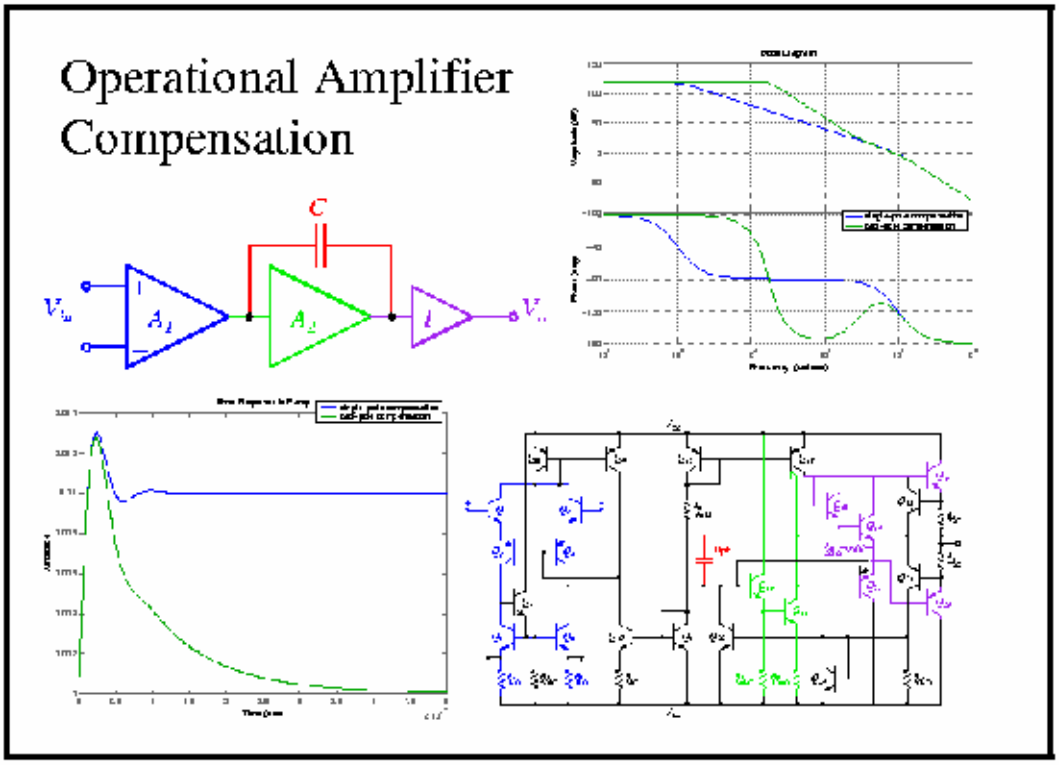
The first hour will consist of a tutorial talk that will provide an overview of the issues as well as major approaches that have been investigated over the last two decades. During the second hour, a series of talks from industrial researchers will discuss particular applications and implementations and results on existing platforms.

Talks:

- "Tutorial on Multisensor Management and Fusion Algorithms for Target Tracking" Michael K. Kalandros, Lidija Trailovic, Lucy Y. Pao, Yaakov Bar-shalom (1 hour)
- "Practical Implementation Issues of Out-Of-Sequence Measurements" Paul J. Lanzkron (20 min)
- "Multiple Hypotheses Tracking Based Distributed Fusion Using Decorrelated Pseudo Measurement Sequence" Mahendra Mallick, Lucy Y. Pao, Kuo-Chu Chang (20 min)
- "Closing the Loop in Sensor Fusion Systems: Stochastic Dynamic Programming Approaches" Michael Schneider, Gregory Mealy, Felipe M Pait (20 min)

FrP01: Operational Amplifier Compensation

Organizer: Kent Lundberg (MIT)



This tutorial covers the control theory behind the design of monolithic operational amplifiers. Modern operational-amplifier circuit topologies require sophisticated frequency-compensation techniques to ensure stability and satisfactory transient performance in end-user applications. These techniques are easily understood using classical control frameworks. Treatment of op-amp compensation as minor-loop feedback, instead of pole splitting, greatly simplifies and generalizes the analysis of op-amp frequency compensation.

The main objective of this tutorial session is to demonstrate the use of control techniques instead of direct circuit analysis in the design of operational amplifiers. Using these techniques the designer gains insight and intuition into the solution. The tutorial paper will outline the use and advantages of control techniques in op-amp design. The industry papers with give examples of the application of these techniques to solve design problems in modern op-amp topologies.

Talks:

- "Internal and External Op-Amp Compensation: A Control-Centric Tutorial", Kent Lundberg (1 hour)
- "A Rail-to-Rail, Input-Output Operational Amplifier", Stefano D'Aquino (15 min)
- "Compensating a Three-Stage Op Amp with Class AB Output", Kris Lokere (15 min)
- "Compensation of a Source Follower LDO", Raymond Barrett, Jr. (15 min)
- "A Feedback Approach to Nested Miller Compensation", Tim Denison and Kent Lundberg (15 min)

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Special Thanks

A few tireless contributors not listed elsewhere:
Pradeep Misra, American Automatic Control Council
Doug Lawrence, CSS Conference Publications Chair
Cheryl Ream, Arizona State University
Angela Copyak, Massachusetts Institute of Tech.

2004 ACC Technical Program Wednesday June 30, 2004

08:00-09:00 Grand Ballroom WeDPL Plenary Session I: Yu-Chi Ho

Track 1	Track 2	Track 3	Track 4	Track 5	Track 6	Track 7	Track 8	Track 9	Track 10	Track 11
Common-wealth	Jefferson	Hampton A	Hampton B	Exeter	Dalton	Gardner A	Gardner B	Clarendon	Berkeley	Fairfax A
09:30-11:30 WeA01 Introduction to Micro- and Nano-Scale Sensors, Actuators and Robots	09:30-11:30 WeA02 Optimal control I	09:30-11:30 WeA03 Motor control	09:30-11:30 WeA04 Model reduction	09:30-11:30 WeA05 Modeling and Control of Powertrain and its Sub-systems	09:30-11:30 WeA06 Power systems	09:30-11:30 WeA07 Estimation	09:30-11:30 WeA08 Linear model predictive control I	09:30-11:30 WeA09 Nonlinear Control Methodolo-gies for Distributed Processes	09:30-11:30 WeA10 Modelling and control of biological systems	09:30-11:30 WeA11 Impact of Network Protocols on Control
13:30-15:30 WeM01 The Use of Time and Frequency Domain Methods in System Identifica-tion	13:30-15:30 WeM02 Optimal control II	13:30-15:30 WeM03 Motion control	13:30-15:30 WeM04 Reduced order modelling	13:30-15:30 WeM05 Modeling and Control of Automated and Manually Driven Highways	13:30-15:30 WeM06 Control of Fuel Cell Power Systems	13:30-15:30 WeM07 System identifica-tion	13:30-15:30 WeM08 Linear model predictive control II	13:30-15:30 WeM09 Simulation and Control of Multiscale Processes	13:30-15:30 WeM10 Biomedical Systems Analysis and Control	13:30-15:30 WeM11 Control and Estimation Methods in Network Security and Survivability
16:00-18:00 WeP01 Theory vs. Practice Forum	16:00-18:00 WeP02 Linear parameter varying systems	16:00-18:00 WeP03 Manufacturi ng and process control	16:00-18:00 WeP04 Stability of linear systems	16:00-18:00 WeP05 Vehicle dynamics and control	16:00-18:00 WeP06 Imaging and visual servo control	16:00-18:00 WeP07 Applica-tions of observer design	16:00-18:00 WeP08 Linear model predictive control III	16:00-18:00 WeP09 Control & Optimiza-tion of Large Scale Complex Systems: Lumped & Distributed Parameter Systems	16:00-18:00 WeP10 Biomedical control systems	16:00-18:00 WeP11 Resource Allocation for Communi-cation Networks

2004 ACC Technical Program Wednesday June 30, 2004

08:00-09:00 Grand Ballroom WeDPL Plenary Session I: Yu-Chi Ho

Track 12	Track 13	Track 14	Track 15	Track 16	Track 17	Track 18	Track 19	Interactive or Special Session	Special Session	Special Session
Fairfax B	Beacon Comp D	Beacon Comp E	Beacon Comp F	Beacon Comp A	Beacon Comp G	Beacon Comp B	Beacon Comp H	Back Bay Ballroom D	Indepen-dence West	Indepen-dence East
09:30-11:30 WeA12 Feedback Control in Electronic Circuit Design	09:30-11:30 WeA13 Nonlinear stability I	09:30-11:30 WeA14 Fuzzy System Analysis	09:30-11:30 WeA15 Mechanical systems	09:30-11:30 WeA16 Dual Stage Actuators and Active Vibration Control for Disk Drives	09:30-11:30 WeA17 Novel Techniques for the Analysis and Control of Hybrid Systems	09:30-11:30 WeA18 Adaptive control I	09:30-11:30 WeA19 Sliding mode control I		09:30-11:30 WeAS Systems Engineering of Systems Biology	
										11:30 13:30 WeNS The Female Faculty Candidate Interview
13:30-15:30 WeM12 Spacecraft Control	13:30-15:30 WeM13 Nonlinear stability II	13:30-15:30 WeM14 Fuzzy Logic Applica-tions	13:30-15:30 WeM15 Control of mechanical systems	13:30-15:30 WeM16 Advanced Controls for Disk Drives	13:30-15:30 WeM17 Complexity issues in hybrid systems	13:30-15:30 WeM18 Adaptive control II	13:30-15:30 WeM19 Sliding mode control II	13:30-15:30 WeMI Hardware and Software for Control Education	13:30-15:30 WeMS Summary NSF Work-shop on Control and System Integration Micro- and Nano-Scale Systems	
16:00-18:00 WeP12 Flight Vehicle Control	16:00-18:00 WeP13 Characteri-zation and stability of nonlinear systems	16:00-18:00 WeP14 Applied fuzzy modeling and control	16:00-18:00 WeP15 Fault tolerant systems	16:00-18:00 WeP16 Information storage and MEMS	16:00-18:00 WeP17 Stability of hybrid systems	16:00-18:00 WeP18 Adaptive control III	16:00-18:00 WeP19 Sliding mode control III			
								18:00 19:30 WeES Winning an Academic Job		
								19:30 20:30 WeLS Resume Exchange		

2004 ACC Technical Program Thursday July 1, 2004

08:00-09:00 Grand Ballroom ThDPL Plenary Session II: Kevin A. Wise

Track 1	Track 2	Track 3	Track 4	Track 5	Track 6	Track 7	Track 8	Track 9	Track 10	Track 11
Common-wealth	Indepen-dence East	Hampton A	Hampton B	Exeter	Dalton	Gardner A	Gardner B	Clarendon	Berkeley	Fairfax A
09:30-11:30 ThA01 Challenges in control engineering of computing systems	09:30-11:30 ThA02 LMIs	09:30-11:30 ThA03 Control applications I	09:30-11:30 ThA04 Linear systems and control I	09:30-11:30 ThA05 Vehicle Estimation	09:30-11:30 ThA06 Optimiza-tion I	09:30-11:30 ThA07 Applied estimation	09:30-11:30 ThA08 Nonlinear model predictive control	09:30-11:30 ThA09 Distributed parameter systems	09:30-11:30 ThA10 Bioengi-neering systems	09:30-11:30 ThA11 Control of communi-cation systems

11:30-13:15 Awards Luncheon Grand Ballroom

13:30-15:30 ThM01 Sensing, Modeling and Control of Xerography	13:30-15:30 ThM02 Uncertain systems	13:30-15:30 ThM03 Control applications II	13:30-15:30 ThM04 Linear systems and control II	13:30-15:30 ThM05 Longitudi-nal vehicle control	13:30-15:30 ThM06 Optimiza-tion II	13:30-15:30 ThM07 Identificatio n of linear systems	13:30-15:30 ThM08 Digital/ sampled-data control I	13:30-15:30 ThM09 Noise and vibration control	13:30-15:30 ThM10 Nonlinear process analysis and control	13:30-15:30 ThM11 Communi-cation networks: conver-gence and stability analysis
16:00-18:00 ThP01 Convex Optimiza-tion: Overview and New Applica-tions	16:00-18:00 ThP02 Robust control I	16:00-18:00 ThP03 Control applications III	16:00-18:00 ThP04 Linear systems	16:00-18:00 ThP05 Automotive Control and Dynamics Using Scale Vehicle Testbeds	16:00-18:00 ThP06 Target tracking & collision avoidance	16:00-18:20 ThP07 Observer theory	16:00-18:00 ThP08 Digital/ sampled-data control II	16:00-18:00 ThP09 Control and Identifica-tion of Large Structural Systems	16:00-18:00 ThP10 Process control	16:00-18:00 ThP11 Wireless networks

2004 ACC Technical Program Thursday July 1, 2004

08:00-09:00 Grand Ballroom ThDPL Plenary Session II: Kevin A. Wise

Track 12	Track 13	Track 14	Track 15	Track 16	Track 17	Track 18	Track 19	Special or Interactive Session 1	Interactive Session 2	Interactive Session 3
Fairfax B	Beacon Comp D	Beacon Comp E	Beacon Comp F	Beacon Comp A	Beacon Comp G	Beacon Comp B	Beacon Comp H	Back Bay Ballroom D	Back Bay Ballroom D	Back Bay Ballroom D
09:30-11:30 ThA12 Multiple vehicle systems	09:30-11:30 ThA13 Control of nonlinear systems I	09:30-11:30 ThA14 Neural network based adaptive control	09:30-11:30 ThA15 Fault detection methodo-logy	09:30-11:30 ThA16 Control of micro-, nano-, and quantum systems	09:30-11:30 ThA17 Hybrid systems	09:30-11:30 ThA18 Adaptive control with constraints	09:30-11:30 ThA19 Sliding mode control IV			

11:30-13:15 Awards Luncheon Grand Ballroom

13:30-15:30 ThM12 Spacecraft and underwater vehicles	13:30-15:30 ThM13 Control of nonlinear systems II	13:30-15:30 ThM14 Control systems analysis and design	13:30-15:30 ThM15 Application of fault detection I	13:30-15:30 ThM16 Control in Atomic Force Microscopy	13:30-15:30 ThM17 Stochastic systems	13:30-15:30 ThM18 Adaptive control applications	13:30-15:30 ThM19 Control education	13:30-15:30 ThMI1 Biomedical Applica-tions	13:30-15:30 ThMI2 Modeling and Simulation of Locomotion	13:30-15:30 ThMI3 Industrial Applica-tions
16:00-18:00 ThP12 Missile and space vehicle control	16:00-18:00 ThP13 Control of uncertain nonlinear systems	16:00-18:00 ThP14 Large scale systems	16:00-18:00 ThP15 Application of fault detection II	16:00-18:00 ThP16 Precision Motion Control	16:00-18:00 ThP17 Stochastic Methods	16:00-18:00 ThP18 Adaptive control of mechanical systems	16:00-18:00 ThP19 Switched systems I			

18:30-20:00 ThES History of Control

2004 ACC Technical Program Friday July 2, 2004

08:00-09:00 Grand Ballroom FrDPL Plenary Session III: Claire J. Tomlin

Track 1	Track 2	Track 3	Track 4	Track 5	Track 6	Track 7	Track 8	Track 9	Track 10	Track 11
Common-wealth	Indepen-dence East	Hampton A	Hampton A	Exeter	Dalton	Gardner A	Gardner B	Clarendon	Berkeley	Fairfax A
09:30-11:30 FrA01 Model-based Control for Semiconductor and Advanced Materials Processing	09:30-11:30 FrA02 Robust control II	09:30-11:30 FrA03 Robotic control	09:30-11:30 FrA04 PID control	09:30-11:30 FrA05 Powertrain control	09:30-11:30 FrA06 Tracking	09:30-11:30 FrA07 Estimation and control	09:30-11:30 FrA08 Time-delay systems I	09:30-11:30 FrA09 Health Monitoring of Large Structural Systems	09:30-11:30 FrA10 Nonlinear Control of Chemical Processes	09:30-11:30 FrA11 Decen-tralized control
13:30-15:30 FrM01 Control-oriented approaches to supply chain manage-ment in semicon-ductor manufac-turing	13:30-15:30 FrM02 Robust control synthesis	13:30-15:30 FrM03 Path Planning	13:30-15:30 FrM04 Con-strained control	13:30-15:30 FrM05 Advances in Automotive and Vehicle Control	13:30-15:30 FrM06 Multisensor Manage-ment and Fusion Algorithms for Target Tracking	13:30-15:30 FrM07 Identifica-tion of nonlinear systems	13:30-15:30 FrM08 Time-delay systems II	13:30-15:30 FrM09 Command shaping for flexible systems	13:30-15:30 FrM10 Process control and identifica-tion	13:30-15:30 FrM11 Networked control systems
16:00-18:00 FrP01 Operational Amplifier Compen-sation	16:00-18:00 FrP02 Robust control applications	16:00-18:00 FrP03 Control of robotic manipula-tors	16:00-18:00 FrP04 Anti-wind up	16:00-18:00 FrP05 Multi-Vehicle Control and Exper-iments	16:00-18:00 FrP06 Sensor fusion	16:00-18:00 FrP07 Filtering	16:00-18:00 FrP08 Time-delay systems III	16:00-18:00 FrP09 Control of flexible structures	16:00-18:00 FrP10 Process Modeling and Control	16:00-18:00 FrP11 Modeling and control of intercon-nected systems

Closing Reception 18:30-20:30 Grand Ballroom

2004 ACC Technical Program Friday July 2, 2004

08:00-09:00 Grand Ballroom FrDPL Plenary Session III: Claire J. Tomlin

Track 12	Track 13	Track 14	Track 15	Track 16	Track 17	Track 18	Track 19	Special Session
Fairfax B	Beacon Comp D	Beacon Comp E	Beacon Comp F	Beacon Comp A	Beacon Comp G	Beacon Comp B	Beacon Comp H	Liberty A
09:30-11:30 FrA12 Networked Autono-mous Agents	09:30-11:30 FrA13 Feedback and feedforward linearization	09:30-11:30 FrA14 Modeling and estimation	09:30-11:30 FrA15 Fault detection and accom-modation I	09:30-11:30 FrA16 Control of Fluid Power Systems	09:30-11:30 FrA17 Control of Discrete Event Systems	09:30-11:30 FrA18 Adaptive Systems	09:30-11:30 FrA19 Switched systems II	
								11:30-12:30 FrNS Writing a Winning NSF CAREER Proposal
13:30-15:30 FrM12 Coopera-tive control	13:30-15:30 FrM13 Nonlinear Time-Delay Systems	13:30-15:30 FrM14 Geometric and computa-tional methods in control	13:30-15:30 FrM15 Fault detection and accom-modation II	13:30-15:30 FrM16 Fluid power control	13:30-15:30 FrM17 Discrete event systems	13:30-15:30 FrM18 Iterative learning control	13:30-15:30 FrM19 Switched systems III	
16:00-18:00 FrP12 Coopera-tive control of UAVs	16:00-18:00 FrP13 Advances in Software Tools for Control System Design	16:00-18:00 FrP14 Computatio nal methods	16:00-18:00 FrP15 Fault Detection/ Accom-modation III	16:00-18:00 FrP16 Control of fluid and acoustic systems	16:00-18:00 FrP17 Scheduling and discrete event systems	16:00-18:00 FrP18 Learning control applications	16:00-18:00 FrP19 Switched systems IV	

Closing Reception 18:30-20:30 Grand Ballroom