The 47th IEEE Conference on Decision and Control

The 47th IEEE Conference on Decision and Control (CDC) was held December 9–11, 2008 at the Fiesta Americana, Grand Coral Beach, in Cancun, Mexico. The hotel is located on a beautiful stretch of the Yucatan Peninsula, a setting that provided an ideal location for the CDC attendees to engage in technical discussions as well as enjoy the city of Cancun and nearby archaeological sites.

The CDC is the premier international conference in the area of systems and control. For the first time, this year’s conference brought together more than 1100 attendees in Latin America. In addition to the main sponsorship by the IEEE Control Systems Society (CSS), the 47th CDC was technically cosponsored by the Society for Industrial and Applied Mathematics, the Institute for Operations Research and Management Sciences, the Japanese Society for Instrument and Control Engineers, and the European Union Control Association. The conference also received financial support for student attendees from the National Science Foundation (NSF).

THE TECHNICAL PROGRAM AND REGISTRATION

One of the key attributes of the CDC is the rigorous peer-review process for all contributed and invited papers. A two-stage review process was undertaken to improve the quality of the reviews and the accuracy of the final decisions. A program committee of 81 members covered the main areas of research in decision and control. Thanks to the tireless efforts by the editorial board and the program committee, a total of 5629 reviews were obtained for the 1937 regular and invited paper submissions, resulting in an average of 2.9 reviews per paper. Ultimately, 981 papers were accepted for presentation at the conference, with an acceptance rate of about 50%. The process culminated in 926 final submissions.

The CDC continues its strong international reach, as Figure 1 illustrates. The percentage of papers with authors from the United States was around 33%, as compared to 37% in 2007 when the CDC was held in New Orleans. The percentage of papers from the Asia-Pacific region was about 13% (down from 20% in 2007), while papers from Europe, the Middle East, and Africa increased from 36% to 49%. The United States had the most authors at the conference, and there was a surge of papers and presence from Latin America. Italy, France, Sweden, and Australia each had more than 100 coauthors of CDC 2008 papers, as shown in Figure 2.

ORGANIZATION

To manage the 2008 CDC, I was fortunately assisted by an outstanding operating committee of dedicated volunteers. Thomas Parisini expertly led the Technical Program Committee with support from Vice Chairs Mario Sznaier, Marios Polycarpou, and Franco Blanchini. Thomas also managed the over 100 strong Conference Editorial Board and the 81 members of the Technical Program Committee. Credit for the outstanding quality of the technical program therefore goes to Thomas and his vice chairs, who managed a myriad of volunteers to review, edit, recommend, and construct the technical program. Behind the scene were the guiding hands of Huibert Kwakernaak and Pradeep Misra, who continued to enhance PaperPlaza and answered numerous questions by the organizers and authors. Credit for the success
of the 47th CDC must be shared by the following individuals: Magnus Egerstedt managed the conference publications with his characteristic professionalism; Bahram Shafai was smiling throughout the conference while handling countless questions and requests pertaining to registration; Yorai Wardi solicited, cajoled, threatened, and managed the pre-conference workshops; Rogelio Soto led a successful drive for new and traditional CDC exhibitors; Luis Alvarez-Icaza acted as a tireless advocate for the student attendees and their interests; and Faryar Jabbari was a fountain of knowledge and inspiration in dealing with student applicants. By choosing Edwin Chong as our finance chair, I knew that the conference finances would be well managed. The local arrangements chair Rafael Sandoval and his student volunteers worked tirelessly to help answer any questions about the conference and Cancun. Finally, the CDC publicity cochairs, Laura Menini and Luca Zaccarian, brought class and cool efficiency to the conference as well as to all publicity material.

THE PRECONFERENCE AND EDUCATION WORKSHOPS
Several workshops took place on December 8, 2008. While ten educational workshops were originally proposed, seven were ultimately delivered, including the following:
> “Stochastic Hybrid Systems: Theory and Applications”
> “Distributed Control of Robotic Networks”
> “Homogeneous Higher-Order Sliding Mode Control”
> “Modeling, Estimation, and Control in Neuroscience”
> “Nonlinear Power Flow Control Design: Utilizing Exergy, Entropy, Static and Dynamic Stability, and Lyapunov Analysis.”

In addition, special workshops were organized to honor Roger Brockett and Bill Wolovich (see “The Continuing Legacy of Roger W. Brockett” and “Symposium to Honor Bill Wolovich”), two of our most prolific and influential researchers.

THE SPECIAL SESSIONS AND TUTORIAL SESSIONS
The CDC 2008 featured two NSF special sessions, “Celebrating Pontryagin’s Contributions to Control Theory,” and “NSF Initiative on Cyber-Physical Systems: Opportunity for Computer Science and Control Engineering.” The conference also included the following five tutorial sessions:
> “Game Theory and Networks”
> “Systems and Synthetic Biology—A Tutorial Introduction”
> “Trends in Nonlinear Control”
> “Control Theory and Finance”
> “Computer Vision and Control.”
Prior to the CDC, a symposium was held to honor Bill Wolovich on his 70th birthday. Bill has contributed to many research areas, including multi-variable control, robotics, and computer vision. In the control field, he is well known for his seminal contributions to the decoupling problem and his results on polynomial matrix representations of linear systems. He retired from Brown University in 2001, although he continues to teach Brown’s freshman engineering course. With a total of 18 presentations, the symposium ended with a session “In Bill’s Honor,” where photos and early movies were shown and commented on. The evening featured a dinner accompanied by a mariachi band at the El Mortero restaurant.

Bill Wolovich was one of the central players in the early development of linear multivariable control. To put Bill’s work in perspective, it is useful to think back to the 1960s. At that time, principally due to the early work of Rudy Kalman, the field of linear multivariable control emerged with explosive force. For the first half of the decade, linear systems theory focused almost exclusively on linear-quadratic optimal control, Kalman filtering, and the separation principle. Toward the end of the decade, interest began to shift with the publication of two influential papers. The first, by Murray Wonham, was on pole placement. The second, by Bill Wolovich and Peter Falb, was on decoupling with state feedback. These two papers made it clear that there was more to multivariable control than linear quadratic control.

Around this time researchers were beginning to realize that there were exciting questions concerning the representation of linear systems. While this line of research certainly can be traced to the work of Kalman on controllability, observability, and the realization of transfer matrices, a broader understanding of controllability and observability was needed to solve certain state-space problems, which began to emerge at the end of the 1960s. Meanwhile, a different type of linear system model was being pioneered by Howard Rosenbrock, who originated the notion of polynomial matrix representations. Armed with his understanding of state-space feedback control syntheses such as pole placement and decoupling, Bill set out to cast these problems in a polynomial matrix setting. To do this, it soon became clear that new concepts such as relatively prime factorizations of transfer matrices as well as column properness were needed. These key ideas about polynomial matrix representations and control in a polynomial matrix setting were published in Bill’s widely read and influential 1974 monograph *Linear Multivariable Systems*. Much of the material in this monograph continues to be taught today in standard courses on multivariable feedback control, where the polynomial matrix representation enhances the state-space description of systems, provides greater insight into the relation between internal and external descriptions, and describes in a natural way the characterization of all stabilizing feedback controllers. The field will always be indebted to Bill Wolovich for these contributions.

Panos Antsaklis and Steve Morse
THE PLENARY PRESENTATIONS AND BODE LECTURE

The CDC 2008 conference continued the three-day format of its recent history. The Bode Lecture took place on Thursday, while two plenary speakers, four semiplenary presentations, and the five invited tutorial sessions were scheduled throughout the program.

Christopher I. Byrnes of Washington University presented the CSS Bode Lecture, “Analysis and Design of Steady-state Behavior for Nonlinear Feedback Systems.” The lecture focused on periodic steady-state behavior, a phenomenon that is pervasive in nature and in man-made systems.

The CDC 2008 featured two plenary talks:
- “Hybrid Dynamical Systems and Robust Feedback Control” by Andrew R. Teel of the University of California, Santa Barbara
- “Network Control: Modeling the Internet,” by Frank Kelly, of the University of Cambridge.

The CDC 2008 also featured four semiplenary lectures:
- “Robust Adaptive Control: The Search for the Holy Grail” by Petros A. Ioannou of the University of Southern California
- “Distributed Control using Decompositions and Games” by Anders Rantzer of Lund University
- “On Stock Market Modeling and Trading: New Problems for the Control Field” by B. Ross Barmish of the University of Wisconsin
- “Optimal Adaptive Neuro-control” by Frank L. Lewis of the University of Texas at Arlington.

THE AWARDS CEREMONY AND CONFERENCE BANQUET

The conference banquet took place by the hotel pool on a beautiful Cancun evening, Wednesday, December 10, and featured an incredible array of international food. The banquet was notable for its lack of speeches since the CSS awards ceremony took place earlier that evening.

FINAL THOUGHTS AND THANKS

Organizing the conference was a labor of love and a personal journey for me that started long ago as a graduate student trying to publish my first paper. This journey introduced me to the many leaders and volunteers of our CSS community. Throughout the years, I have marveled at the intensity of some and the intellect of others. I have felt the frustration of many as they have tried to improve our processes for reviewing and organizing, and I shared in the joy of many innovations. I have been on the outside looking in, and on the inside trying to channel the energies and creativity of so many of you. So the next time you see one of the CSS volunteers, put yourself in their shoes, or better yet, volunteer to help organize a conference or to serve the CSS. I promise you will be as satisfied as I have been! On behalf of your CDC 2008 Organizing Committee, thank you all for the opportunity to serve. I look forward to seeing you at future CDCs.

Chaouki T. Abdallah
Chair, 47th IEEE CDC
The Beauty of Cancun
The Closing Reception
The 2008 IEEE Awards Ceremony was held in the Grand Coral Ballroom of the Fiesta Americana Grand Coral Beach Hotel, Cancun, Mexico, on Tuesday, December 9. CSS President David Castañón welcomed the attendees and introduced Panos Antsaklis, chair of the Awards Standing Committee, who described the CSS and IEEE awards and thanked the CSS awards subcommittee chairs for their service.

The 2008 subcommittee chairs were:

- Steve Morse: George S. Axelby Outstanding Paper Award
- Mrdjan Jankovic: IEEE Transactions on Control Systems Technology Outstanding Paper Award
- Bonnie H. Ferri: IEEE Control Systems Magazine Outstanding Paper Award
- Siva Banda: Control Systems Technology Award
- Jan Willems: Antonio Ruberti Young Researcher Prize
- Faryar Jabbari: CDC Best Student-Paper Award
- L.K. Mestha: MSC Best Student-Paper Award.

Claire Tomlin, vice-president of Member Activities, presented the Outstanding Chapter Award, which recognizes a chapter for demonstrating a high level of activity, innovation, or growth. The 2008 award went to the Singapore Control Systems Chapter, chaired by Jianliang Wang, in recognition of its efforts for promoting high-quality technical meetings and for disseminating information to a large audience. The award was accepted on behalf of the chapter by Sam Ge.

The Distinguished Member Award was given to Rick Middleton of The Hamilton Institute, National University of Ireland Maynooth, who was recognized for his significant contributions to control theory and applications and his extensive service to the control community. Rick received his B.Sc. (1983), B.Eng. (Hons-I, 1984), and Ph.D. (1987) degrees from the University of Newcastle, Australia, and was on the faculty there for a number of years. He has had visiting appointments at the University of Illinois at Urbana-Champaign and the University of Michigan. He was awarded the Australian Telecommunications and Electronics Research Board Outstanding Young Investigator Award (1991), the Royal Society of New South Wales Edgeworth-David Medal (1994), and the M.A. Sargent Award from the Electrical College of Engineers Australia (2004). He is an IEEE Fellow and a CSS Distinguished Lecturer. His service activities include associate editor and associate editor at large of IEEE Transactions on Automatic Control; associate editor of IEEE Transactions on Control System Technology; associate editor of Automatica; member of the CSS Board of Governors; vice president Member Activities, and vice president Conference Activities of CSS.

Maria Elena Valcher, vice-president of Conference Activities, presented the CDC Best Student-Paper Award, which recognizes excellence in a paper whose primary author is a student member of the IEEE. There were four papers and four student finalists:

- Finalist: Amir Ali Ahmadi, MIT
  Advisor: Pablo Parrilo

- Finalist: Adolfo Anta, UCLA
  Advisor: Paulo Tabuada
  “Space-time Scaling Laws for Self-triggered Control,” by Adolfo Anta and Paulo Tabuada

- Finalist: Johan Karlsson, Royal Institute of Technology, KTH
  Advisor: Anders Lindquist
  “Weight Selection for Gap Robustness with Degree-Constrained Controllers,” by Johan Karlsson, Tryphon Georgiou, and Anders Lindquist
Finalist and Awardee: Necmiye Ozay, Northeastern University
Advisor: Mario Sznaier

Yutaka Yamamoto, vice-president of Publication Activities, presented three paper awards. The first award was the IEEE Control Systems Magazine Outstanding Paper Award for an article or column published during the two calendar years prior to the year of the award, based on impact and benefit to CSS members. This award was presented to Sonia Martinez, Jorge Cortes, and Francesco Bullo for their article “Motion Coordination with Distributed Information,” IEEE Control Systems Magazine, vol. 27, no. 4, pp. 75–88, August 2007.

The IEEE Transactions on Control Systems Technology Outstanding Paper Award was presented to Masayuki Fujita, Hiroyuki Kawai, and Mark Spong, for their paper “Passivity-Based Dynamic Visual Feedback Control for Three Dimensional Target Tracking: Stability and L2-gain Performance Analysis,” IEEE Transactions on Control Systems Technology, vol. 15, no. 1, pp. 40–52, January 2007. This award was presented for a paper published during the two calendar years prior to the year of the award based on originality, relevance of the application, clarity of exposition, and demonstrated impact on control systems technology.

The George S. Axelby Outstanding Paper Award is presented for papers published in IEEE Transactions on Automatic Control during the two calendar years prior to the year of the award based on originality, clarity, potential impact on the theoretical foundations of control, and practical significance in applications. The award was given to Giuseppe C. Calafiore and Marco C. Campi for their paper “The Scenario Approach to Robust Control Design,” IEEE Transactions on Automatic Control, vol. 51, no. 5, pp. 742–753, May 2006.

Jay Farrell, vice-president of Technical Activities, presented the Control Systems Technology Award, which recognizes outstanding contributions to control systems technology either in design and implementation, or in project management. This award can be conferred on an individual or a team. The recipient of this year’s award was Tariq Samad, who was recognized “for technology development, demonstration, and commercialization that spans multiple application domains: process industries, aerospace vehicles, building automation, and automotive power trains.” Tariq Samad is a corporate fellow in Honeywell Automation and Control Solutions. He has been with various R&D organizations in Honeywell for 21 years, contributing to and leading automation and control technology developments for applications in unmanned aircraft, electric power systems, the process industries, building management, and automotive engines. His research interests relate broadly to automation, intelligence, and autonomy for complex engineering systems. He is a Fellow of the IEEE, a recipient of an IEEE Third Millennium Medal, and a Distinguished Member of the CSS. Tariq received the B.S. degree...
in engineering and applied science from Yale University and the M.S. and Ph.D. degrees in electrical and computer engineering from Carnegie Mellon University.

David Castañón presented the 2008 Antonio Ruberti Young Researcher Prize, which recognizes distinguished cutting-edge contributions by a young researcher to the theory or application of systems and control, to Rodolphe Sepulchre, Université de Liège, “for contributions to the theory and applications of nonlinear dynamical systems, in particular, coordination, synchronization, and control.” Rodolphe Sepulchre received his Ph.D. degree from the Université Catholique de Louvain, Belgium, in 1994. He was a research fellow at the University of California, Santa Barbara, and a visiting fellow at Princeton University. His research interests include control and coordination (on manifolds), optimization algorithms on matrix manifolds, optimization-based matrix algorithms for large-scale problems, system theory for oscillators, and sensorless control of induction motors. He served or is currently serving as an associate editor for journals including SIAM Journal for Control and Optimization, Journal of Nonlinear Science, Systems and Control Letters, Automatica, and Mathematics of Control, Signals, and Systems.

Past-President Ted Djaferis and President David Castañón presented the 2008 Hendrik W. Bode Lecture Prize, which recognizes distinguished contributions to control systems, science, or engineering. The recipient delivers a plenary lecture at the CDC, evaluating a significant contribution to control systems science or engineering. The 2008 award went to Christopher Byrnes, Washington University, St. Louis, who was recognized “for fundamental contributions to algebraic and geometric approaches to systems and control.” As the 20th recipient of this prize, he joins a distinguished group of scientists and engineers. He is currently the Edward and Florence Skinner Professor of Systems Science and Mathematics at Washington University in St. Louis, where he also served as dean of engineering for 15 years. He began his professional career at the University of Utah as an instructor of mathematics and has held appointments at Harvard, Arizona State, and the Royal Institute of Technology in Sweden. His research has focused on topics that include the analysis and design of feedback systems, the estimation and filtering of signals and systems, and the application of nonlinear dynamics and geometry to problems in engineering and science. He and his collaborators have won several best paper awards from the CSS and IFAC. In 1998, he received an honorary doctorate from the Royal Institute of Technology and in 2002 was named a foreign member of the Royal Swedish Academy of Engineering Sciences. In 2005, he was awarded the Reid Prize from SIAM. He is a Fellow of the IEEE and the Japan Society for the Promotion of Science. He has served on many civic, corporate, and professional boards and has been active in economic development. He presented the lecture “Analysis and Design of Steady-State Behavior for Nonlinear Feedback Systems,” on Thursday, December 11, 2008. He was selected for this award in 2007 by Past-President Ted Djaferis. David Castañón announced Peter Caines, McGill University, Montreal, Canada as the 2009 Bode Lecture Prize winner.

David Castañón announced the CSS IEEE Fellows for 2008, while John Vig, 2009 IEEE president, congratulated the recipients. The grade of Fellow recognizes unusual distinction in the profession and is conferred only by invitation of the IEEE Board of Directors on a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The accomplishments honored by the grade of Fellow contribute significantly to the advancement of engineering science and technology. The following individuals were elected fellows: Bassam Bamieh, Frank Doyle, Geir Dullerud, Michael Fu, Fred Hadaegh, Joao Hespanha, Zhong-Ping Jiang, Wei Kang, Ilya Kolmanovsky, Dragan Nesic, Andrew Packard, Paul Van den Hof, and Kevin Andrew Wise. The following CSS members were elected Fellows by other IEEE Societies, with the evaluation society indicated in parentheses: John Bay (AES), Tianyou Chai (RA),
Paul Ebert (AES), Jay Farrell (CIS), Hisao Kameda (COMP), Zexiang Li (RA), Steven Low (COMP), Max Meng (RA), Jennie Si (CIS), Roland Siegwart (RA), Chi Wang (SMC), Wen-June Wang (SMC), and Xinghuo Yu (IE).

John Vig presented the IEEE Control Systems Field Award. This award is given for meritorious achievement in contributions to theory, design, practice, or technique, as evidenced by publications or patents in the areas of control systems science, engineering, or technology. The 2008 recipient was Mathukumalli Vidyasagar, Tata Consultancy Services, Madhapur, Hyderabad, India, who was recognized “for promulgation of control science and engineering, from the University of Wisconsin, in 1965, 1967, and 1969, respectively. Between 1969 and 1989 he worked as a professor of electrical engineering at universities in the United States and Canada. His last overseas job was with the University of Waterloo, Canada between 1980–1989. He has held visiting positions at MIT, University of California (Berkeley and Los Angeles), CNRS Toulouse, France, Indian Institute of Science, University of Minnesota, and Tokyo Institute of Technology. In 1989 he returned to India as the director of the newly created Centre for Artificial Intelligence and Robotics, under the auspices of the Defense Research and Development Organization, Ministry of Defense, Government of India. In 2000, he joined Tata Consultancy Services, India’s largest IT firm, as an executive vice president in charge of advanced technology. In addition to
In his academic positions, he has received several honors in recognition of his research activities including the distinguished service citation from his alma mater, the University of Wisconsin at Madison. He is a Fellow of IEEE as well as the Indian Academy of Sciences, the Indian National Science Academy, the Indian National Academy of Engineering, and the Third World Academy of Sciences.

The 2008 CSS Awards Ceremony ended with David Castañón announcing that the 2009 winner of the IEEE Control Systems Field Award is David Mayne, Imperial College, London, United Kingdom.

Taking advantage of the setting, David Castañón presented a certificate of appreciation to Pradeep Misra for his service to the Society. He then asked CSS President-Elect Tariq Samad to join him at the podium and passed the CSS presidential gavel to him. Tariq Samad thanked him for his service and presented him with a plaque, which states:

David Castañón, in appreciation for contributions to the IEEE Control Systems Society as
- Past President, 2009
- President, 2008
- President-Elect, 2007
- General Chair, 46th IEEE Conference on Decision and Control, 2007
- IEEE Control Systems Society Distinguished Member Award, 2006
- Vice President Finance, 2002–2004
- Program Vice Chair 35th IEEE Conference on Decision and Control

Tariq Samad thanked the audience for attending the awards ceremony and encouraged them to nominate deserving individuals for future awards.
Remarks on Receiving the 2008 IEEE Control Systems Field Award

Good evening, ladies and gentlemen. By now it has become a tradition for the recipient of the CSS Field Award to share with the community his past experiences, views on where the subject is going, and future prospects. Over the next several minutes, I too would like to continue this tradition by making a few remarks that are partly autobiographical and partly philosophical.

About 40 years ago Andy Warhol said that “In the future everybody will be famous for 15 minutes.” This is my 15 minutes of fame, but what with inflation and all that, my 15 minutes have shrunk to eight minutes.

My first comment is: It is essential to have role models. While I have been influenced by several distinguished researchers during my adult life, undoubtedly my first role model was my father, who was a professor of mathematics. I was about eight years old when I first began to notice that our house in the South Indian city of Tirupati was always full of my father’s college students, who were constantly discussing what my father called “the subject.” I asked him what they were doing and he said “Oh, we are trying to find results.” I asked him what a “result” was and he said “Well, it is something new.” Within a few days I got my own first “result,” namely: If you square a number, and multiply the two numbers on either side, the difference is always one. Or in modern algebraic notation, 

\[(n+1)(n-1) = n^2 - 1.\]

When I showed this to my father, he said “Well, a result is not something that you did not know before, it is something nobody knew before.” My first reaction was to be amazed that any human being could possibly find out something that nobody knew before, but my next reaction was that if he could do it, then I was also going to do the same thing—I was going to become a researcher and find lots of “results.” It was exactly the kind of thing a silly little kid would think, but it definitely set me on the path to being a researcher.

At a time when many young people seem to be so confused about what they want to do, it was really a blessing for me to know so early in life exactly what I wanted to be, even if I had no idea how to go about it. My father was a most remarkable researcher. He published his first paper at the age of 21, and when he passed away at the age of 84, he had five or six papers under review. Mathematics is supposed to be a young person’s game, and I can’t think of anyone else who published steadily for more than 60 years. I would like to take this opportunity to acknowledge my debt to my father.

My second comment is: Don’t rule out the role of chance in life. Modern man suffers from the hubris that he can control nature, and therefore life is deterministic. But random events and arbitrary choices have unpredictable consequences. In my case, when I was finishing up my bachelor’s degree in electrical engineering at the University of Wisconsin, it was pretty clear in my mind what I was going to do for my master’s and Ph.D. degrees. I was simply fascinated by passive network synthesis, the relationship between positive real functions and energy dissipation, and such topics. So I had decided to study circuit theory for my graduate degrees. Now by the time I reached the final semester of my undergraduate degree at the University of Wisconsin, to graduate all I had to do was to take six elective courses in anything at all. So I chose six electrical engineering courses, which, as you can imagine, all met on Monday, Wednesday, and Friday. The result was that I had classes solidly from 9:30 a.m. until 3:30 p.m. and no time for lunch. After doing this for one week, I realized that I wasn’t going to survive the semester with this kind of schedule. So I dropped my lunchtime course and looked for a course that met on Tuesday and Thursday. The only course I could find was an introductory control systems course. Believe me, that was the only reason I signed up for that course, not any interest in control theory. But somehow this chance deviation into the controls course had quite unforeseen consequences, as you can all see.

My third point is: If you aspire to success, you must work on entire areas, not just individual research problems. I got this advice from the late George Zames, back in 1975, and it really changed the way I do research. Until then I was like a gunslinger, working on whatever problems caught my fancy, with no particular theme or coherence to my work. But after I got this advice from George, I consciously tried to work on entire areas, and it has definitely paid off in terms of the impact I have had on the field.

My fourth point is: Don’t be afraid to change research areas often. Changing areas requires a lot of courage, because you get pushed out of your comfort zone. But it has its own rewards. A related point is: When you do move into a new area, work out everything for yourself from scratch, and don’t always believe everything you read. This is the reason why I like to write a lot of books. It’s only when you start writing a book that you realize just how poorly you understand the subject. Writing a book forces you to develop a holistic view of the subject. The benefit is that if you do even a halfway decent job of explaining a particular subject, then pretty soon everyone begins to look at things your way.
In this connection I would like to acknowledge my debt to Charlie Desoer. When he invited me to join him and finish up our book on feedback systems, I was just 25 years old. It was his generosity that made him reach out to a kid on such an important project. Working on that book made me realize the importance of making it easy for the reader to dip in and out of a book. Even 30 years ago, most people did not have the time to read a book in its entirety. They just want to look up something very specific, and the author has to facilitate that. I have consciously tried to make my books highly “modular” and I think this has caused them to be pretty popular.

Now here is the last and final point: The family comes first and foremost. Shakuntala and I have been married now for 36 years, and without doubt I could not have achieved what little I did without her support over the years. Everyone who knows her is extremely fond of her, and indeed some of our relatives who come to Hyderabad stay with us, even if they have their own houses in the city. That’s how affectionate and universally well loved she is. While our daughter Aparna was growing up, I always tried to be there when she needed me. In fact I would wait until she went off to sleep at 9 p.m. or so, and then start my “second shift” as I used to call it. Now she’s not “my little baby” anymore and is going to get her own Ph.D. degree very shortly.

Let me conclude with a little attempt at crystal-ball gazing. What is the future of control theory and its applications? I believe the strength of control theory derives from two aspects: First, as engineers we are problem driven, and not technique driven. Second, we know bits and pieces of lots of branches of mathematics, which is the queen of all science to quote Gauss. Because of these two factors, we are able to look at each problem on its own merits, instead of forcing it to fit into a pre-conceived formalism. To illustrate just how widely applicable control theory really is, note that controls people are branching out into all sorts of areas such as communications, mathematical finance, and even biology, but we don’t see people from those areas moving into control! In short, control theory is a “great place to be from” and I don’t see that changing in future. Fads may come and fads may go, but control theory will go on forever, because of its ability to adapt itself constantly.

When I was doing my Ph.D., the whole new vista of mathematical control theory was just opening up. Now, with all the doom and gloom of the financial meltdown all around us, paradoxically I think the current generation of young control theorists has at least two exciting opportunities, namely in mathematical finance, and in “in silico” drug discovery. I would like to describe, extremely briefly, these two opportunities.

I think that we control theorists can play an important role in mathematical finance; indeed, we have already been doing it for the past decade and a half. Again to over-simplify grossly, I view option pricing as computing an expected value and hedging as stochastic control. But the spectacular failure of all the pricing and hedging models, which is at the core of the financial meltdown, shows that it is necessary to incorporate human behavior into the models. The volatility of an asset, which is a key parameter in mathematical finance, is not a natural constant like the Young’s modulus of steel; rather, the volatility is what everyone thinks it is at a given point in time! Suppose everyone in the market place uses the same “incorrect” formula to compute the price of an asset-based derivative. Will the formula gradually become “correct” over time, as a kind of self-fulfilling prophecy? What we really need is a new approach that may be called “flocking theory meets Black-Scholes!”

The current situation in drug discovery reminds me of VLSI synthesis about 30 years ago. Back then, “yields” in chip fabrication were about 3–5%, and every single fabrication facility had its own in-house design team. Over the past three decades, we have moved toward “virtual foundries” that can design a VLSI system purely using CAD tools, and design is now decoupled from fabrication. Interestingly, the “yield” on drug molecules is now between 1.5–2%, or about the same as for VLSI 30 years ago. But I see the emergence of “virtual” drug discovery companies, and indeed one of my research groups is working on precisely this area. Of course, the human body is a lot more complex than an inanimate silicon wafer, but I really do believe that by bringing the rigor of the “systems approach” to problems of drug discovery, we can make substantial contributions.

In conclusion, I feel privileged to join the ranks of the previous winners, many of whom are all-time greats of control theory. I wish everyone in the room the same success I have had if not very much more. Thank you and good night!

Mathukumalli Vidyasagar
The Isidori Fest, held in London May 13–16, 2008, celebrated the prolific and high-impact career of Alberto Isidori for the occasion of his 65th birthday.

Alberto Isidori, University of Rome, in collaboration with Chris Byrnes, Washington University St. Louis; Eduardo Sontag, Rutgers University; and Jessy Grizzle; University of Michigan.

The first tutorial dealt with the modeling and mathematical description of hybrid dynamical systems. Andy Teel presented a new framework to describe a unified formalism of several classes of hybrid systems, including networked systems, switched systems, supervisory systems, and systems with impacts. He showed that the notions of hybrid time domain, jump map, and flow map are natural tools for providing a unified perspective. This talk also illustrated and highlighted the role of these concepts in the analysis and design of hybrid control systems.

The second tutorial dealt with the classical problem of nonlinear output regulation. Alberto Isidori illustrated the theory, introducing the notions of steady-state response for nonlinear systems, controlled invariant manifolds, and zero manifolds. These notions yield a geometric interpretation of the problem of output regulation. In addition, the notion of the limit set of a sequence of sets, a delicate generalization of the classical notion of limit set of a trajectory, was introduced to provide necessary and sufficient conditions for solving the output regulation problem. The tutorial was complemented by a discussion on semiglobal output feedback stabilization tools and an introduction by Chris Byrnes to the geometric theory of dynamical systems.

The third tutorial presented an introduction to systems biology. Eduardo Sontag’s presentation discussed the mathematical foundation of systems biology, including the notions of interconnection, positive system, monotone system, and small gain theorems. These elements were used to interpret the mechanism of operation...
of a class of biological systems and to provide the foundations for their control. The tutorial was complemented by case studies and a system-theoretic interpretation of experimental data.

The last tutorial offered an introduction to the analysis and design of walking robots. Jessy Grizzle began by discussing modeling issues, which included the concept of hybrid zero dynamics, a generalization of the classical notion of zero dynamics. He showed that this concept is at the basis of the construction of control algorithms for stable walking. The theoretical results were illustrated by experiments on a prototypical walking robot. The problems encountered in the construction of the system, both at the mechanical level and at the electronic level, were illustrated.

The last two days of the event, held at the Royal Society, London, were organized in the format of a technical workshop. Presentations were given by F. Allgower, K. Astrom, T. Basar, R. Brockett, F. Delli Priscoli, C. De Persis, W. Kang, P. Kokotovic, A. Krener, I. Landau, W. Lin, R. Marino, S. Morse, K. Schlacher, A. Serrani, E. Sontag, H. Sussmann, T.-J. Tarn, A. Teel, and J. Willems. The workshop was complemented with a poster session by Ph.D. students. The contributions presented at the workshop are included in *Analysis and Design of Nonlinear Control Systems—In Honor of Alberto Isidori*, edited by A. Astolfi and L. Marconi and published by Springer. This volume was presented to all participants.

The audience during a presentation at the Royal Society. From left in the first row: David Mayne, Alberto Isidori, Arthur Krener, Karl Astrom, Jessy Grizzle, and Tamer Basar.

Forty years ago, on July 20, 1969, the whole world watched as America took a giant leap forward in the exploration of space. Members of the Institute of Electrical and Electronics Engineers, working for NASA and its industry contractors, helped make those historical first steps with Apollo 11 a reality. And 40 years later, engineers, computer scientists and allied professionals are still helping to push back the frontiers of space, while developing new technologies that fuel our economy and create jobs here on earth. We’re glad engineers have left their mark, and we’re convinced they’ll keep on making an indelible impression for years to come.