

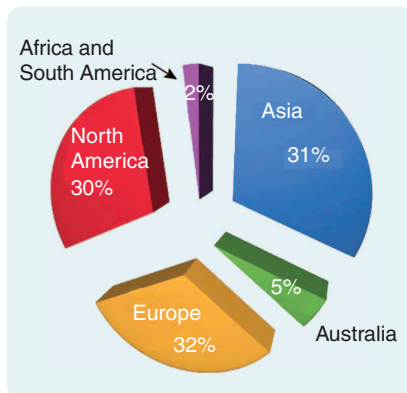
CDC/CCC 2009

The largest Conference on Decision and Control (CDC) of the past 48 years took place in Shanghai, China, in December 2009. The 48th IEEE CDC was held in conjunction with the 28th Chinese Control Conference (CCC) at the Shanghai International Convention Center over the three-day period December 16–18. From the record number of 3105 submitted papers, 1480 were selected for presentation and publication in the conference proceedings. I want to acknowledge the extraordinary work that was done by the 110-member Program Committee in obtaining more than 8000 reviews, on the basis of which an excellent technical program was finalized.

HOW CDC IN CHINA WENT FROM CONCEPT TO REALITY

As I write these words, I notice that *The New York Times* is reporting that China has surpassed Japan as the world's second largest economy. With its growing importance as a political and economic power, China was to many of us a clear choice of venue for the CDC. What was unclear, however, was who could organize it and how complicated it might be to navigate China's rapidly changing political and economic landscape. Because it was unusual in some ways, it is perhaps worth recording something of the early conversations among a number of people whose ideas and efforts would culminate in the 2009 combined CDC/CCC.

At the 2003 CDC in Maui, colleagues from mainland China, a few



The geographic diversity of the attendees of CDC/CCC 2009 in Shanghai was striking. The organizers had hoped that the 2009 conference would provide a showcase of China's emerging influence. We were not disappointed.

Chinese-born colleagues living outside China, and a group of people interested in China's reemergence met at the Hyatt Regency Resort & Spa. A CDC in China gradually became the main topic of this informal exchange, and it was decided to explore possible routes along which this could become a reality. In 2004, at the 43rd CDC, a proposal for CDC in China was circulated to the IEEE Control Systems Society (CSS) Board of Governors (BoG). Based on the feedback from the BoG, several China-CDC enthusiasts began discussions regarding possible choices of people in prominent positions in the Chinese research community who could serve as CDC general chair. We all owe a debt of gratitude to our colleagues Y.C. Ho, T.J. Tarn, H.F. Chen, and Daizhan Cheng (among others) for their strong support in inviting Lei Guo of the Chinese Academy of Sciences to serve as general cochair of the conference. Lei agreed to take

on this responsibility and proposed that the Institute of Systems Science in the Chinese Academy of Sciences be the national organization to support CDC in China. With Lei's support and endorsement, the proposal for a CDC in China was formally approved by the CSS BoG at its meeting at the 44th CDC & European Control Conference in Seville, Spain, December, 2005. Lei Guo and I were appointed general cochairs, and the project of CDC in China was officially launched.



Xiaofan Wang introduces Pengfei Yao's semi-plenary lecture, "Differential Geometric Approach in Modeling of Vibrational Mechanics."



The first plenary lecture of the conference, "Poisson Processes and the Design of Finite State Controllers," was delivered by Roger W. Brockett.



CSS Past President David Castañón (left) presents the 2009 Bode Prize to Peter E. Caines.

THE COMBINED 48th CDC AND 28th CCC

Following the precedent set by an agreement with the European Union Control Association (EUCA) in 2005, the 2009 CDC was held as a joint conference. By a formal agreement between the CSS and the Technical Committee on Control Theory (TCCT) of the Chinese Association on Automation, the conference official title became the Combined 48th IEEE CDC and 28th CCC. Thanks are due to Ted Djaferis and Daizhan Cheng who made this happen by signing a formal agreement on behalf of their respective organizations (CSS and TCCT) at the CCC in 2008.

THE COMPLEXITIES OF DEALING WITH THE WORLD'S OLDEST BUREAUCRACY

After visits to a number of possible venues for the CDC in China, the Organizing Committee settled on Shanghai, and Shanghai Jiao Tong University offered to serve as the local sponsor. Large international meetings such as the CDC require permission of the Chinese government, and in late 2007, Xiaofan Wang and Shaoyuan Li from SJTU made a formal application to the Chinese Ministry of Education for this permission. To my dismay, the application was declined on the basis of what appeared to be technicalities. General Cochair Lei Guo, Program Cochair

Daizhan Cheng, Xiaofan Wang, and Shaoyuan Li counseled patience and that we should reapply. In due course, the application was resubmitted, and then began a lengthy process of obtaining approval from a succession of ministries and councils. As a hedge, Jie Huang contacted the Hong Kong International Convention Center as a possible alternative site.

People who traveled to China during the summer of 2008 are well aware of the travel challenges associated with the Chinese government's efforts to manage the success of the



IEEE Division X Director-Elect Vincenzo Piuri (left) presents the 2009 IEEE Control Systems Award to David Quinn Mayne.

Olympic Games. Lei Guo's calm reassurance that the CDC would receive the necessary governmental approval after the conclusion of the games had a stabilizing effect that was crucial.

ORGANIZATION

More than ever, the success of this largest of CDCs depended on the dedication and skill of the international Organizing Committee. Prior experience with IEEE/CSS activities needed to be complemented by similar expertise in the management of professional undertakings in China. Looking at the planning and organization in retrospect, it is an honest assessment that the 2009 CDC could not have taken place in China without Lei Guo's commitment to make it happen. It is equally important to recognize the dedication of Program Cochairs Daizhan Cheng of the Institute of Systems Science of the Chinese Academy of Sciences and Faryar Jabbari of the University of California, Irvine. They were ably assisted by Program Vice Chairs Jie Huang and Hua Wang, Interactive Sessions Cochairs Xiaoming Hu and Er-Wei Bai, and Tutorial Session Cochairs Gary Gang Feng and Tielong Shen. At this writing, the final audits of the conference remain to be done, but thanks to the able efforts of Finance Cochairs Ji-Feng Zhang and Edwin Chong, everything appears to be



CSS Vice President for Conference Activities M.E. Valcher presents the Best Student Paper Award to Kun Deng of the University of Illinois, Urbana-Champaign. His paper, "A Simulation-Based Method for Aggregating Markov Chains," was coauthored with his coauthors Prashant G. Mehta and Sean Meyn.



M. Vidyasagar receives the CSM Outstanding Paper Award from CSS President Tariq Samad. Sagar accepted the award on behalf of recipient James M. Hilkert, who was unable to attend the conference.

in excellent shape. I should also acknowledge the efforts of MaryAnn Stroub who assisted Ed Chong and who filled in for him when he was unable to travel to Shanghai to attend the conference.

Thanks are due also to our Sponsorship Cochair Guangren Duan and Frank Lewis. I add a special word of thanks to Frank for his willingness to undertake this demanding job even though he could have legitimately asked for a pass in light of his own service as general chair of the 2003 CDC in Maui. I depended in many instances on the advice of Local Arrangements Cochair Zongli Lin and Xiaohong Guan. The conference benefitted from a rich set of exhibits by publishers and technology companies, many of which were seen at the CDC for the first time. Accordingly, acknowledgement is gratefully expressed to Exhibits Cochair Jie Chen and Frank Allgower. Publicity Cochair Jing Sun and Shuzhi Sam Ge did a great deal to bring the conference to the attention of people within and outside our community. Registration is one of the more technically complex functions of a large meeting like the CDC, and we were fortunate to have the services of Lihua Xie and Bahram Shafai. Bahram is a veteran registration chair of many CDCs, and his dedication in keeping the process running both before the conference and for very long days during the conference is greatly appreciated.

The Web site was proficiently maintained by webmasters Hongsheng Qi and Calin Belta. Student Activities Cochair Wei Kang and Bugong Xu received able assis-



Some members of the Organizing Committee. From left: Program Vice-Chair Hua O. Wang, Program Cochair Daizhan Cheng, Program Cochair Faryar Jabbari, 2010 CSS President Roberto Tempo, General Cochair John Baillieul, General Cochair Lei Guo, and Local Organization Chair Xiaofan Wang.



Approximately 1500 attendees enjoyed the conference banquet.

tance from Sandra Hirche, chair of the CSS Student Activities Committee, and Hong Chen, chair of CSS Developing Countries Conference Support Program.

Some jobs associated with running our large conferences require substantial expertise and experience along with a willingness to put in many hours of labor. In particular, I must



(From left) Xiaofan Wang, Roger Brockett, and Jie Huang enjoy the welcoming reception.

acknowledge the work of outgoing Conference Editorial Board Chair Thomas Parisini, incoming Conference Editorial Board Chair Alessandro Astolfi, and of course, the PaperPlaza gurus Pradeep Misra and Huibert Kwakernaak. I did not realize until late in the summer of 2009 how much work and fine detail was hidden below the surface in the job description of the publications chair. I want to extend a special note of thanks to both Ben M. Chen and Dawn Tilbury. Ben was very capable in organizing printing and production on the Chinese side, and Dawn brought a great sense of humor, considerable past experience, and no small amount of creativity to producing the final conference publications.

Finally, it is important to acknowledge the monumental effort of the local

control community in Shanghai. I am sure there were challenges that I never heard about that were efficiently and quietly met by Xiaofan Wang and Shaoyuan Li. Ning Li also must be mentioned. Ning spent the spring of 2009 visiting Boston, and upon returning to Shanghai in mid-summer, she organized a small army of student volunteers who handled an incredible number of details both before and during the conference. Junyan Li's energetic support is recognized as well. The extraordinary team from Shanghai looked after every detail from conference setup to the superb banquet entertainment.

In looking back to the months leading up to the Combined 48th CDC and 28th CCC, it was truly a 24-hour-a-day effort as dedicated volunteers on many continents worked to bring the conference to life.

SPECIAL SESSIONS AND PRECONFERENCE WORKSHOPS

The Combined CDC/CCC included several special sessions that nicely complemented the main technical program. We thank R. Kishan Baheti, Michael Branicky, and Garie Fordyce for organizing a lunchtime open house of the U.S. National Science Foundation. Other special sessions that we gratefully acknowledge include the following:

- » The MathWorks Session. Organizers: Pieter Mosterman, senior research scientist, The MathWorks; Arkadiy Turevskiy, technical marketing manager, The MathWorks; Moderator: T. John Koo, professor, Chinese Academy of Sciences.
- » Quanser Session: Bridging the Gap Between Engineering Education, Research, and Innovation. Presenter: Nianqing Li, manager, Asian Distribution, Quanser.
- » Design and Prototype Real-Time Control Systems with NI LabVIEW. Organizer: Jeannie Falcon, National Instruments.
- » Honeywell Session: Applications and Research in Industrial Wireless. Organizers: Tariq Samad and Paul McLaughlin, Honeywell, including presentations by George Pappas, University of Pennsylvania and David Zhang, Honeywell Technology Solutions Laboratory, Shanghai.



Ceremonial drums are traditional in many parts of Asia.

Preconference workshops were solicited and scheduled by Workshops Cochairs George Yin and Zhong-Ping Jiang. All workshops were well attended and gave attendees the opportunity to explore selected topics in depth. The topics and organizers were:

- » 20 Years of Passivity-Based Control: Theory and Applications. Organizers: Alessandro Astolfi (University of Roma, Italy), Fernando Castaos (SUPELEC-L2S, Gif-sur-Yvette, France), David Hill (The Australian National University, Australia), Romeo Ortega (SUPELEC, France), and Mark Spong (University of Dallas, Texas, United States).
- » Five Decades of Control and Optimization. Organizers: Christos G. Cassandras (Boston University, United States), and Weibo Gong (University of Massachusetts, Amherst, United States). Additional participants:

Dah Ming Chiu (Chinese University of Hong Kong, China), Xi-Ren Cao (Hong Kong University of Science and Technology, China), Pirooz Vakil (Boston University, United States), Leyuan Shi (University of Wisconsin-Madison, United States), Qing-Shan Jia (Tsinghua University, United States), Peter B. Luh (University of Connecticut, United States), J.Q. Hu, Yifan Xu, BaiMei Yang (Fudan University, China), and Xiaohong Guan (Tsinghua University, China).

- » Network Science: New Directions in Control Systems. Organizers: Nader Motee (California Institute of Technology, United States). Additional participants: Fan Chung Graham (University of California, San Diego, United States), Ali Jadbabaie (University of Pennsylvania, United States), Sanjoy Mitter (Massachusetts Institute of Technology, United States),



The erhu is a traditional Chinese instrument that has two strings and is played with a bow.



Everywhere in China you can hear music played by ensembles of erhu (the bowed string instrument) and gu zheng (the plucked string instrument).



Wing Shing Wong gives a semiplenary lecture.



The audience at a plenary lecture.



Peter C. Caines presents the Bode Lecture.

Jeff Shamma (Georgia Institute of Technology, United States).

- » Biomolecular Circuit Analysis and Design. Organizers: Antonis Papachristodoulou (University of Oxford, United Kingdom) and Domitilla Del Vecchio (University of Michigan, Ann Arbor, United States). Additional participants: Mustafa Khammash (University of California at Santa Barbara, United States), Richard Murray (California Institute of Technology, United States), Frank Allgöwer (University of Stuttgart, Germany), and Pablo A. Iglesias (Johns Hopkins University, United States).
- » Model Predictive Control: Design and Implementation Using Matlab. Organizers: Liuping Wang (RMIT University, Australia).

PLENARY AND BODE LECTURES

Complementing the technical program, many special lectures were featured at the combined CDC/CCC. There were three plenary lectures, four semiplenary lectures, and the Bode Lecture. The 2009 Bode Lecture was presented by Peter C. Caines of McGill University. On the final day of the conference, Caines delivered his 2009 Bode Lecture, "Mean Field Stochastic Control."



P.R. Kumar answers a question after his plenary lecture.

The plenary speakers and lectures are as follows:

- » "Poisson Processes and the Design of Finite State Controllers," Roger W. Brockett, Harvard University.
- » "Towards a System-Theoretic Foundation for Control over Networks," P.R. Kumar, University of Illinois.
- » "New Opportunities for Control: Quantum Internal Model Principle and Decoherence Control," Tzyh Jong Tarn, Washington University.

The semiplenary speakers and lectures are as follows:

- » "Information Aggregation in Complex Dynamic Networks," Ali Jadbabaie, University of Pennsylvania.
- » "What Are Moment Problems and Why Are They



Anders Lindquist delivers a semiplenary lecture.



Ali Jadbabaie during his semiplenary lecture.



Peng Fei Yao presents a semiplenary lecture.



T.-J. Tarn presents a plenary lecture.



Conference registration.

Useful in Systems and Control?" Anders Lindquist, KTH Sweden.

- » "Target Choice, Control Energy, and Communication Complexity: Facets of an Information-Based Distributed Control System," Wong Wing Shing, Chinese University of Hong Kong.
- » "Differential Geometric Approach in Control and Modeling of Vibrational Mechanics," Pengfei Yao, Chinese Academy of Sciences.

AWARDS CEREMONY AND CONFERENCE BANQUET

The CSS recognizes technical achievements and outstanding service through various awards. The Awards Ceremony preceded the conference banquet. In addition to the usual CSS awards, this year the ceremony featured the TCCT Guan



Registration Cochair Bahram Shafai.

Zhao-Zhi Award and the IEEE Leon K. Kirchmayer Graduate Teaching Award.

The Awards Ceremony

This year's technical award winners were as follows:

- » CDC Best Student-Paper Award Finalists:
 - Ravi Teja Sukhavasi, California Institute of Technology, (Advisor: B. Hassibi) for "The

Kalman Like Particle Filter: Optimal Estimation with Quantized Innovations/Measurements," by R. Sukhavasi and B. Hassibi.

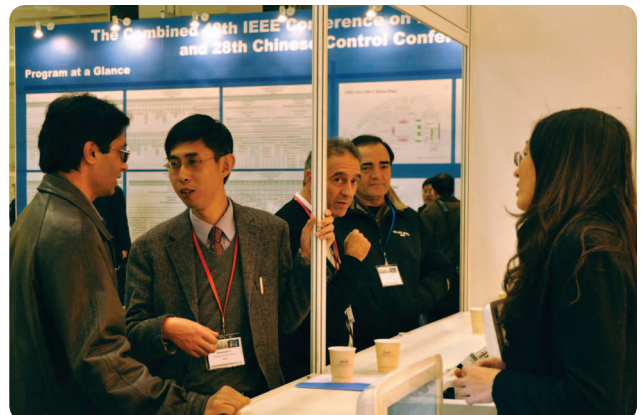
- Sergio Daniel Pequito, Technical University of Lisbon, Portugal, (Advisor: P. Aguiar) for "The Entropy Penalized Minimum Energy Estimator," by S. Pequito, A. Aguiar, and D. Gomes.
- Kun Deng, University of Illinois at Urbana-Champaign, (Coadvisors: P. Mehta and S. Meyn) for "A Simulation-Based Method for Aggregating Markov Chains," by K. Deng, P. Mehta, and S. Meyn.
- Alireza Tahbaz-Salehi, University of Pennsylvania, (Advisor: A. Jadbabaie) for "Learning Under Social Influence," by A. Tahbaz-Salehi, A. Sandroni and A. Jadbabaie.

The winner was Kun Deng.

- » The IEEE Control System Magazine Outstanding Paper Award was won by James M. Hilkert for his article "Inertially Stabilized Platform Technology, Concepts and Principles," *IEEE Control Magazine*, vol. 28, no. 1, pp. 26–46, February 2008.
- » The IEEE Transactions on Control System Technology Outstanding Paper Award was won by Angeliki Pantazi, Abu Sebastian, Giovanni Cherubini, Mark Lantz, Haralampos Pozidis,



Lihua Xie, Ning Li, and Bahram Shafai with registration desk volunteers.



Shaoyuan Li at the registration desk.

Hugo Rothuizen, and Evangelos Eleftheriou, for the paper "Control of MEMS-Based Scanning-Probe Data-Storage Devices," *IEEE Transactions on Control Systems Technology*, vol. 15, no. 5, pp. 824–841, September 2007.

- » The George S. Axelby Outstanding Paper Award was given to Antoine Girard and George Pappas for the paper "Approximation Metrics for Discrete and Continuous Systems," *IEEE Transactions on Automatic Control*, vol. 52, no. 5, pp. 782–798, May 2007.
- » The Control Systems Technology Award was presented to Giovanni Cherubini, Evangelos Eleftheriou, Mark Lantz, Angeliki Pantazi, Haralampos Pozidis, Hugo Rothuizen, and Abu Sebastian, IBM Zurich Research Laboratory, Switzerland, and Reza Moheimani, University of Newcastle, Australia, for nanopositioning "for MEMS-based storage and other applications."
- » The Antonio Ruberti Young Researcher Prize was awarded to Joao Hespanha of the University of California, Santa Barbara,



The Oriental Pearl Radio Tower.

"for fundamental contributions to adaptive control and to the theory of switched and hybrid systems."

- » The 2009 Hendrik W. Bode Lecture Prize was awarded to Peter E. Caines of McGill University, Montreal, for fundamental contributions in the areas of stochastic, adaptive, large scale, and hybrid systems. His prize lecture was titled "Mean Field Stochastic Control."

Other awards presented at the 2009 CDC/CCC included the Outstanding Chapter Award, which was presented to the IEEE CSS Bulgaria Control Systems Chapter, Vladimir S. Jotsov, chair. Three members of our community, Francis J. Doyle III of the University of California, Santa Barbara, Jay Farrell of the University of California, Riverside, and Yutaka Yamamoto of the Graduate School of Informatics of Kyoto University, received the CSS Distinguished Member Award.

Three awards deserve special mention. The Guan Zhao-Zhi Award is the major award of the Chinese Technical Committee on Control Theory, named in honor of Zhao-Zhi Guan, a pioneer of modern control theory in China. It is given annually at the CCC. At this combined CDC-CCC it became an international award. Papers submitted to the conference could request consideration for the award. A total of 43 application papers were submitted from ten countries. After review by the Conference Editorial Board, the 28 accepted papers were sent to three to five additional reviewers. Five papers were then selected from a final short list, and these papers were presented in a special session one evening during the conference. According to a vote of the GZZ Awarding Committee, the paper "Geometric Control of Particle Manipulation in a Two-Dimensional Fluid" by Y. Or, J. Vankerschaver, S. Kelly, R.M. Murray, and J.E. Marsden won the award.

The highest award usually conferred at the CDC Awards Ceremony is the IEEE Control Systems Award, sometimes referred to as the "Field Award." This major IEEE award was established by the IEEE Board of Directors in 1980, and recipient selection is administered through the Technical Field Awards Council of the IEEE Awards Board. An IEEE evaluation committee considers nominations, and the basis for selection includes the seminal nature of the contribution, whether it is a singular achievement, and whether it has practical impact.



Acrobats (left) and face-change artists (right) were part of the banquet entertainment.

Other considerations are breadth of contributions, depth of contributions, historical precedence, and quality of the nomination.

This year, the 2009 IEEE Control Systems Award was given to David Q. Mayne in recognition of his "contributions to the application of optimization to modern control theory." The award consists of a bronze medal, certificate, and honorarium.

Another major IEEE level award was given this year. The Leon K. Kirchmayer Graduate Teaching Award honors teachers of electrical and electronics engineering and related disciplines, and it is meant to recognize inspirational teaching of graduate students in the IEEE fields of interest. The award is administered through the Technical Field Awards Council of the IEEE Awards Board. This year the award was given to Roger W. Brockett for "inspirational mentoring of generations of graduate students who have



To become a Shaolin master, one must begin martial arts training at an early age.

gone on to define the field of control engineering."

Conference Banquet

A highlight of the social program, the conference banquet, featured traditional Chinese food and entertainment. The banquet had the highest attendance at any CDC to date as 1500 people enjoyed the warm Chinese hospitality. The program consisted of tra-

ditional Chinese music, acrobatics, a display of martial arts, and, of course, a display of face-change artistry that is a signature art form of China.

CLOSING THOUGHTS

It was one of the greatest privileges of my life to serve as general cochair of CDC/CCC 2009. The many experiences and friendships that were gained in China are precious. The best part, however, was being able to show people what life looks like in emergent China. It is my great hope that everyone who attended enjoyed the experience as much as I did. Thanks again to my distinguished cochair, Lei Guo, to our 2009 CSS President and supporter Tariq Samad, and to my wonderful colleagues at all points of the compass who joined and supported this most excellent adventure.

John Baillieul
General Cochair

Five Decades of Ho-ntrol and Ho-ptimization

The professional career of Yu-Chi (Larry) Ho in the systems and control community spans the past five decades during which he has been a leading influential figure in several areas of control and optimization. His book *Applied Optimal Control* (coauthored with A.E. Bryson, Jr.) is in the list of Citation Classics, and his work on differential games and team theory played a key role in shaping this area in the 1970s. He is one of the founders of the field of discrete-event systems that emerged in the 1980s, while in the 1990s and through the past few years he has been developing ordinal optimization as a novel approach to complex optimization problems.

Larry Ho turned 75 in 2009. To celebrate this occasion and his long-term contributions, a one-day workshop was held on December 15 as part of the 48th CDC in Shanghai, his birthplace. The workshop consisted of nine talks by former students Dah Ming Chiu, Weibo Gong, Christos Cassandras, Xi-Ren Cao, Pirooz Vakili, Leyuan Shi, Qing-Shan Jia, Peter Luh, and J.Q. Hu in areas where Larry Ho has made fundamental long-lasting contributions. The topics discussed Internet traffic control, perturbation analysis of discrete-event and hybrid systems, learning and optimization, efficient simulation, game theory, and related application areas such as electricity auctions and stock index futures. The workshop attendees included several of Larry's longtime friends and colleagues, providing many opportunities for stimulating discussions on the past, present, and future of our field.

The workshop was preceded on the evening of December 14 by a banquet celebrating Larry Ho's 75th birthday, organized by Xiaohong Guan, Cheung Kong Professor of Systems Engineering and Dean of the School of Electronic and Information, Xian Jiaotong University. Excerpts of tributes paid to him by colleagues and past students were read, and several gifts were presented to Larry and his wife Sophia.



Yu-Chi (Larry) Ho and his wife Sophia at the banquet in his honor on Monday, December 14, 2009 in the Shanghai International Convention Center.