

## The 56th IEEE Conference on Decision and Control (CDC)

The 56th IEEE Conference on Decision and Control (CDC) was held December 12–15, 2017 at the Melbourne Convention and Exhibition Centre, Australia. The conference was preceded by technical workshops on December 10–11, 2017. The workshops were hosted at the Law Building at the University of Melbourne, which also sponsored the event.

The CDC is recognized as the premier scientific and engineering conference dedicated to the advancement of the theory and practice of systems and control. The annual event brings together an international community of researchers and practitioners in the field of automatic control to discuss new research results, perspectives on future developments, and innovative applications relevant to decision making, systems and control, and related areas.

Since its inception in 1962, the conference has been held mostly in the United States, with the exception of four events in Europe, four in Asia-Pacific, and two in the Caribbean. This is the second time that the conference came “Down Under” and the first time it was held in Melbourne; the first CDC in Australia was held in Sydney in 2000. The Melbourne Convention

and Exhibition Centre was chosen as a venue because of its excellent spaces, support, and facilities; central location; and a wide variety of food and accommodation options within walking distance from the venue.

The IEEE CDC is hosted by the IEEE Control Systems Society (CSS) in cooperation with the Society for Industrial and Applied Mathematics (SIAM) and the Japanese Society for Instrument and Control Engineers.

### REGISTRATION

The total number of registrations at CDC 2017 was 1309, which included 492 students. The following statistics exclude exhibitors, sponsors, and volunteers. A total of 84% of the registrations were submitted at the advanced rate. The three countries with the highest number of registrations were the United States (395), Australia (110), and China (97). The number of registrants from Africa was four, 276 from Asia, 111 from Australia and New Zealand, 480 from Europe, 461 from North America, and 23 from South America. Our professional conference organizers, ICMS Australasia, handled all registrations.

### TECHNICAL PROGRAM

There were 2123 submissions received, from which 1097 were selected

for presentation at the conference, which corresponds to 51.7% acceptance rate. The CDC is constantly evolving, and this year, for the first time, a number of papers in the program were submitted and considered for *IEEE Control Systems Letters*. All papers were first handled by the Conference Editorial Board (CEB) (chair Alessandro Astolfi). Final decisions were then made by Mario Sznaier (Program chair), Constantino Lagoa (Program vice-chair), Luca Zaccarian (Program vice-chair), and Senior Editors Franco Blanchini, Patricio Colaneri, Carlo Novara, Ian Petersen, and Sophie Tarbouriech.

There were 17 parallel tracks on each day, but no technical sessions were scheduled for the afternoon of Thursday, December 14, to allow for informal meetings and special interest sessions.

### BODE AND PLENARY LECTURE

Other program highlights included plenary talks and the Bode lecture that covered a wide range of topics:

- » Naomi E. Leonard (Princeton University), Bode lecture, “Learning from Nature: When Models Meet Multitudes”
- » Graham C. Goodwin (University of Newcastle), plenary lecture, “Rolling Horizon Stochastic Policy Optimization with

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A traditional welcome for IEEE Conference on Decision on Control participants by the Wurundjeri People of the Kulin Nation.



Workshop speakers for “Deterministic and Stochastic Hybrid Methods for Robust Learning and Optimization in Dynamical Systems” (from left): Martin Guay, Jorge Poveda, Chris Manzie, Kyriakos Vamvoudakis, and Andrew Teel.



At the Welcome reception (from left): John Doyle, Murat Arcaç, and Nikolai Matri.



Naomi Leonard gives her Bode lecture, “Learning from Nature: When Models Meet Multitudes.”

Application to the Treatment of Type-1 Diabetes Mellitus”

- » Anna G. Stefanopoulou (University of Michigan), plenary lecture, “Control Engineers: The Unsung Heroes of Battery Technology”
- » Pablo Parrilo (Massachusetts Institute of Technology), plenary lecture, “Mathematical Optimization in Systems and Control.”

## TUTORIALS AND SPECIAL SESSIONS

In total, there were four special sessions and six tutorial sessions. The special session, “Scaling Heights: A Journey Through Roberto Tempo’s Research Activity,” was dedicated to our colleague Roberto Tempo, who sadly

passed away last year. Special session topics included the following:

- » “Controls Teaching Made Easier with MATLAB and Simulink Sponsor,” sponsored by The MathWorks Inc.
- » “Systems and Control Research Overview and Career Opportunities at United Technologies Research Center,” sponsored by the United Technologies Research Center, East Hartford, Connecticut, with the following speakers from that organization: Dr. Andrzej Banaszuk (senior director, Systems Department), Dr. Andrew Sparks (principal engineer, Control Systems Group leader), Dr. Amit Surana (princi-

pal engineer, System Dynamics and Optimization Group), Dr. Shaunak D. Bopardikar (staff engineer, Control Systems Group), and Dr. Milos Ilak (staff engineer, Control Systems Group)

- » “Scaling Heights: Our Times Shared with Roberto Tempo,” with the following speakers: Prof. John Baillieul (Boston University, United States), Prof. Bob Barmish (University of Wisconsin-Madison, United States), Prof. Christos Cassandras (Boston University, United States), Prof. Patrizio Colaneri (Politecnico di Milano, Italy), Prof. Alberto Isidori (Università di Roma, Italy), Prof. Rick Middleton (University of



Graham Goodwin presenting his plenary talk, “Rolling Horizon Stochastic Policy Optimization with Application to the Treatment of Type-1 Diabetes Mellitus.”



Pablo Parrilo giving his plenary talk, “The Role of Structure in Optimization and Control: How to Detect It, and How to Exploit It.”



Anna Stefanopoulou presenting her plenary talk, “Control Engineers: The Unsung Heroes of Battery Technology.”



The Student Reception (from left): Adair Lang, Wencelao Shaw Cortez, and Daniel Selaratnam.



The Women in Control luncheon (from left): Anna Stefanopolou, Aparna Dhinakaran, Sylvia Herbert, and Bozenna Pasik-Duncan.

Newcastle, Australia), and Prof. Thomas Parisini (Imperial College, United Kingdom and the University of Trieste, Italy)

- » “Meet the Faculty Candidate Poster Session,” organized by Warren Dixon (University of Florida, United States).

Tutorial sessions were included on the following topics:

- » “Improving Efficiency and Scalability of Sum-of-Squares Optimization: Recent Advances and Limitations,” organized by Amir Ali Ahmadi (Princeton University), Yang Zheng (University of Oxford), Antonis Papachristodoulou (University of Oxford), James Saunderson (University of Washington), and Georgina Hall (Princeton University)
- » “Synthetic Biology: From Design to Applications,” organized by Elisa Franco (University of Cali-

fornia, Riverside) and Yutaka Hori (Keio University)

- » “Hamilton–Jacobi Reachability: A Brief Theory Overview, New Toolboxes, and Recent Advances in Addressing the Dimensionality Challenge,” organized by Somil Bansal (University of California, Berkeley), Mo Chen (Stanford University), Sylvia Herbert (University of California Berkeley), and Claire Tomlin (University of California Berkeley)
- » “A System-Level Approach to Controller Synthesis,” organized by John C. Doyle (Caltech)
- » “Scaling Heights: A Journey Through Roberto Tempo’s Research Activity,” organized by Maria Elena Valcher (University di Padova), Fabrizio Dabbene (CNR-IEIIT), and Hideaki Ishii (Tokyo Institute of Technology)

- » “Mathematics of Deep Learning,” organized by Rene Vidal (Johns Hopkins University), Joan Bruna (New York University), Raja Giryes (Tel Aviv University), and Stefano Soatto (University of California, Los Angeles).

## WORKSHOPS

Workshops were held at the University of Melbourne on the two days preceding the conference. There were three full-day and four half-day workshops with a total of 218 registrations. A great interest of our community in interdisciplinary topics, such as deep learning, was illustrated by a very high number of registrations (72) for the workshop “What’s the Big Deal with Deep Learning?” A detailed list of workshops and their organizers is given below.

Full-day workshops:

- » “30 years of the Ramadge–Wonham Theory of Supervisory Control: A Retrospective and Future Perspectives,” organized by Stephane Lafortune (University of Michigan), Karen Rudie (Queens University), and Stavros Tripakis (University of California, Berkeley)
- » “Deterministic and Stochastic Hybrid Methods for Robust Learning and Optimization in Dynamical Systems,” organized by Jorge I. Poveda (University of California, Santa Barbara), Andrew R. Teel (University of California, Santa Barbara), Mouhacine Benosman (University Pierre et Marie Curie), Kyriakos G. Vamvoudakis (Virginia Tech), Chris Manzie (University of Melbourne), and Martin Guay
- » “What’s the Big Deal with Deep Learning?” organized by Girish Chowdhary (University of Illinois at Urbana-Champaign), Alexander Schwing (University of Illinois at Urbana-Champaign), Hassan Kingravi (Pindrop Labs), and Chinmay Soman (University of Illinois at Urbana-Champaign).

Half-day workshops:

- » “Economic Model Predictive Control: State of the Art and



A group photo of student volunteers with IEEE Control Systems Society President Edward Chong and Conference on Decision and Control General Cochairs Richard Middleton and Dragan Nesic. Top row (from left): Armaghan Zafar, Amir Saberi, Edwin Chong, Dragan Nesic, Richard Middleton, Amin Mahdizadeh, Tianci Yang, Alejandro Maas, Wenceslao S. Cortes, Yankai Lin, and Masoud Khorasani. Bottom row (from left): Luis Cuevas, Zhiyang Ju, Adair Lang, Ricardo Rosas, Daniel Selvaratnam, and Kaixiang Wang.

Open Problems,” organized by Timm Faulwasser (Karlsruhe Institute of Technology), Matthias A. Muller (University of Wuerzburg), and Lars Gruene (University of Bayreuth)

- » “Distributed Parameter Systems: From Theory to Applications,” organized by Michael A. Demetriou (Worcester Polytechnic Institute) and Orest V. Iftime (University of Groningen)
- » “Scenario-Based Optimization for Stochastic Optimal Power Flow Problems,” organized by Ian Hiskens (University of Michigan), John Lygeros (ETH), and Maria Vrakopoulou (ETH)
- » “Detectability for Time-Varying Systems,” organized by Ying Tan (University of Melbourne), Ti-Chung Lee (Minghsin University of Science and Technology), and Iven Mareels (University of Melbourne).

### CSS AWARDS

Li-Chen Fu (vice-president, Member Activities) presented the Outstanding Chapter Award to IEEE CSS Lebanon Joint Chapter (chair Daniel Asmar) and the Distinguished Member Award to Linda Bushnell.

Maria Prandini (vice-president, Conference Activities) presented the CDC

Best Student Paper Award to Santiago Paternain, University of Pennsylvania (advisor: Alejandro Ribeiro), for “Safe Online Navigation of Convex Potentials in Spaces with Convex Obstacles,” by Santiago Paternain and Alejandro Ribeiro. There were three other finalists for this award:

- » Michael W. Fisher, University of Michigan (advisor: Ian A. Hiskens), “Parametric Dependence of Large Disturbance Response and Relationship to Stability Boundary,” by Michael W. Fisher and Ian Hiskens
- » Jorge I. Poveda, University of California, Santa Barbara (advisor: Andrew Teel), “A Class of Distributed Adaptive Pricing Mechanisms for Societal Systems with Limited Information,” by Jorge I. Poveda, Philip N. Brown, Jason Marden, and Andrew Teel

» Vasileios Tzoumas, University of Pennsylvania (advisors: George J. Pappas, University of Pennsylvania, and Ali Jadbabaie, Massachusetts Institute of Technology), “Resilient Monotone Submodular Function Maximization,” by Vasileios Tzoumas, Konstantinos Gatsis, Ali Jadbabaie, and George J. Pappas.

Thomas Parsini (vice-president, Publication Activities) presented four Outstanding Paper Awards:

- » Ali Mesbah was presented the IEEE Control Systems Magazine Outstanding Paper Award for his article, “Stochastic Model Predictive Control: An Overview and Perspectives for Future Research,” *IEEE Control Systems Magazine*, vol. 36, no. 6, pp. 30–44, 2016.
- » The IEEE Transactions in Control Systems Technology Outstanding Paper Award went to Walter Caharija, Kristin Pettersen, Marco Bibuli, Pedro Calado, Enrica Zereik, José Braga, Jan Tommy Gravdahl, Asgeir J. Sørensen, Milan Milovanović, and Gabriele Bruzzone for “Integral Line-of-Sight Guidance and Control of



IEEE Control Systems Society President Edwin Chong (right) congratulates Richard Murray (left) on his IEEE Control Systems Award.



A group photo of IEEE Control Systems Society and IEEE award recipients. Top row (from left): Michael Fisher, Jorge Poveda, Yiguang Hong, Wei Ren, Santiago Paternain, Ali Mesbah, Walter Caharija, and Milan Milovanovic. Middle row (from left): Samuel Coogan, Calin Belta, Ebru Aydin Gol, Paulo Tabuada, Lorenzo Marconi, Graziano Chesi, Kirsten Petersen, Naira Hovakimyan, Naomi Leonard, Brett Ninness, and Edwin Chong. Bottom row (from left): Vasileios Tzoumas, Xiaobo Tan, Linda Bushnell, Alessandro Giua, Roy Daou, Richard Murray, Tryphon Georgiou, Michele Pavon, and Murat Arcaç.

Underactuated Marine Vehicles: Theory, Simulations, and Experiments," *IEEE Transactions on Control Systems Technology*, vol. 24, no. 5, pp. 1623–1642, September 2016

- » The IEEE Transaction on Control of Network Systems Outstanding Paper Award was presented to Samuel Coogan, Ebru Aydin Gol, Murat Arcaç, and Calin Belta for "Traffic Network Control from Temporal Logic Specifications," *IEEE Transactions on Control of Network Systems*, vol. 3, no. 2, pp. 162–72, 2016.
- » The George S. Axelby Outstanding Paper Award was presented to Yongxin Chen, Tryphon T. Georgiou, and Michele Pavon for "Optimal Steering of a Linear Stochastic System to a Final Probability Distribution, Part I," *IEEE Transactions on Automatic Control*, vol. 61, no. 5, pp. 1158–1169, May 2016.

Anuradha Annaswamy (vice-president, Technical Activities) presented the following three awards:

- » the Award for Technical Excellence in Aerospace Control to Naira Hovakimyan for pioneering innovations in adaptive

control and its application to aerospace systems

- » the Control Systems Technology Award to Pierino G. Bonanni, James D. Brooks, David S. Chan, Ramu S. Chandra, Paul K. Houpt, H. Kirk Mathews, Bernardo Adrian Movsihoff, and Manthram Sivasubramania for control systems innovations of the GE Trip Optimizer leading to both commercial success and significant environmental benefits

- » the Transition to Practice Award to Angeliki Pantazi for the development of advanced control technologies for magnetic tape data storage and nanopositioning applications.

CSS President Edwin K.P. Chong gave the Antonio Ruberti Young Researcher Prize to Wei Ren, University of California, Riverside, for pioneering contributions to distributed coordination and control of multiagent systems. He also presented the Hendrik W. Bode Lecture Prize to Naomi Leonard, Princeton University, for contributions to the theory and application of coordinated control of mobile, multiagent systems in engineering and in nature.

## IEEE AWARDS

Chong presented class of 2017 IEEE Fellows (evaluated by the CSS): Calin Belta, Linda Bushnell, Graziano Chesi, Guang Duan, Alessandra Giua, Yiguang, Pablo Iglesias, Lorenzo Marconi, Brett Ninness, Kristin Pettersen, Luca Schenato, Paulo Tabuada, and Xiaobo Tan.

Richard Murray, California Institute of Technology, was awarded IEEE Control Systems Award by Chong, on behalf of IEEE President Karen



IEEE Control Systems Society President Edwin Chong (left) passes the gavel to his successor, 2018 Society President Francesco Bullo (right).



IEEE Control Systems Society past presidents (from left): Jay A. Farrell, Edwin K.P. Chong, Yutaka Yamamoto, Maria Elena Valcher, Richard H. Middleton, Tamer Başar, Christos G. Cassandras, David A. Castanon, and Francis J. Doyle, III.

Bartleson, for contributions to the theory and applications of nonlinear and networked control systems.

The IEEE Transportation Technologies Award was presented to Claire Tomlin, University of California, Berkeley, for contributions to air transportation systems, focusing on collision avoidance protocol design and avionics safety verification. The award was presented by Chong on behalf of IEEE President Bartleson.

### SPONSORSHIPS

The University of Melbourne and the University of Newcastle were the platinum sponsors. The gold sponsor was ANCA Motion. United Technologies Research Centre and The Mathworks were silver sponsors. The University of Western Australia also financially supported the conference. There were six exhibitors: Anca Motion, United Technologies Research Centre, Springer Nature, SIAM, Mathworks, and Cruise.

The CSS provided student support for travel and registrations. In total, 62 students from 15 countries (Australia, Brazil, Canada, China, France, Germany, India, Israel, Italy, South Korea, Mexico, The Netherlands, Russian Fed-

eration, and the United States) received travel support to attend the CDC.

### SOCIAL EVENTS

The welcome reception was preceded by a Australian Indigenous Welcome to Country Performance. A reception on Tuesday evening for students and newcomers was also included. There was a native animal interaction organized just before the conference banquet that was very well received. A free Thursday afternoon provided an opportunity for informal meetings or sightseeing. The farewell reception was well attended.

### ACKNOWLEDGMENTS

The team working on this conference dedicated a lot of their time for a seamless organization and compilation of the technical program: Richard Middleton (General cochair), Dragan Nesic (General cochair), Mario Sznaiar (Program chair), Luca Zaccarian (Program vice-chair), and Constantino Lagoa (Program vice-chair). The work of Alessandro Astolfi (CEB chair) on PaperPlaza support was invaluable in ensuring a seamless review process, and the CEB and IPC were instrumental in preparing a high-quality technical program: Girish

Nair (Finance chair), Chris Manzie (Local Arrangements chair), Wei Xing Zheng (Publications cochair), James Welsh (Publications cochair), Minyue Fu (Workshop chair), Amir Aghdam (Registration chair), Ian Manchester (Student Activities chair), Valery Ougrinovski (Exhibits and Sponsorship chair), and Zhiyong Chen (Sponsorship chair). The team from ICMS Australasia, led by Lili Lin, delivered a great support for the conference.

### NEXT CONFERENCE

The 57th CDC (<https://cdc2018.ieeecss.org/>) will be held Monday through Wednesday, December 17–19, at the Fontainebleau in Miami Beach, Florida, United States. With beautiful beaches, warm weather, and the nearby Miami Beach's Art Deco Historic District, the next CDC offers a great location and will undoubtedly deliver another successful conference.

**Richard Middleton,**  
*General Cochair, CDC 2017*

**Dragan Nesic,**  
*General Cochair, CDC 2017*

