The 62nd IEEE Conference on Decision and Control

The 62nd IEEE Conference on Decision and Control (CDC) took place on 13–15 December 2023 at the Marina Bay Sands, Singapore. Technical workshops were held on Tuesday, 12 December. This is the first time that CDC was held in Singapore and Southeast Asia.

CDC is recognized as the premier scientific and engineering conference dedicated to the advancement of the theory and practice of systems and control. The conference annually 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, automatic control, and related areas.

CDC 2023 was hosted by the IEEE Control Systems Society (CSS) in cooperation with the Society for Industrial and Applied Mathematics (SIAM), the Technical Committee on Control Theory of the Chinese Automation Association (TCCT), the European Control Association (EUCA), the Korea Institute of Control, Robotics and Systems (ICROS), and the Japanese Society for Instrument and Control Engineers (SICE).

REGISTRATION

CDC 2023 received a total of 1,953 registrations for the conference and 651 registrations for workshops. Out of all registrations, 795 (41%) were students. There were also 31 registrations for live-streaming.

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The conference hotel, Marina Bay Sands.

TECHNICAL PROGRAM

CDC 2023 received 2,342 submitted papers, out of which 1,368 were accepted (including 338 papers concurrently published in *IEEE Control Systems Letters*). The acceptance rate was 58%. The program offered a diverse and rich agenda, spread over three days with 26 parallel sessions, including four tutorial sessions, one poster session, five special sessions, four plenary lectures, and the annual distinguished Bode Lecture. Fifteen preconference workshops were conducted on 12 December.

BODE AND PLENARY LECTURES

The highlights of the program included the Bode lecture and four plenary talks.

- Miroslav Krstic (University of California at San Diego, USA), Bode lecture: "Machine Learning: Bane or Boon for Control?"
- Jie Huang (the Chinese University of Hong Kong, China), "The Evolution of the Distributed Observer and Its Applications"
- Naomi E. Leonard (Princeton University, USA), "Fast and Flexible Multi-Agent Decision-Makings"
- Dorsa Sadigh (Stanford University, USA), "Learning Representation for Interactive Robots: Why We Need to Place Humans at the Center of the Equation"
- Anders Rantzer (Lund University, Sweden), "Dual Control Revisited."

SPECIAL SESSIONS

The special sessions included the following:

- "Control for Climate Change: Empower a Billion Lives," chaired by Hideaki Ishii; speakers: Anuradha Annaswamy and members of two winning teams
- "Sanjoy Mitter Memorial Session," chaired by Munther Dahleh and Ali Jadbabaie
- "Can GPT Design Your Controller?," chaired by George Pappas; panelists: Magnus Egerstedt, Jonathan How, and Dorsa Sadigh.

Bode and Plenary Lectures. (a) Miroslav Krstic delivering the 2023 Bode Lecture. (b) Jie Huang delivering his plenary lecture. (c) Naomi E. Leonard delivering her plenary lecture. (d) Dorsa Sadigh delivering her plenary lecture. (e) Anders Rantzer delivering his plenary lecture.

- "MathWorks Special Session: Combining Learning and Control in Cyber-Physical Systems"; speaker: Andreas Malikopoulos.
- "Future of Work and Workers: Potential Roles for Automation and Control," chaired by Anuradha Annaswamy; speaker: Pramod Khargonekar.

TUTORIALS

There were four tutorial sessions. The topics were

- "Nonstandard Linear-Quadratic Decision Making," organized by Tamer Basar and Huanshui Zhang
- "Statistical Learning Theory for Identification and Control," organized by Yassir Jedra, Nikolai Matni, George J. Pappas, Anastasios Tsiamis, and Ingvar Ziemann
- "Analysis and Design of Optimization Algorithms Using Tools From Control Theory," organized by Laurent Lessard and Bryan Van Scoy
- "Control and Optimization for Autonomous Energy Systems," organized by Bernstein Andrey and Cavraro Guido.

BENCHMARK COMPETITIONS

Benchmark competitions were organized at CDC for the first time. There were 61 teams from all over the world participating in the two competitions.

- "Autonomous Driving Control Benchmark Challenge," organized by Yutaka Hirano, HIRANO Research Lab, Japan; Rui Gao, Modelon K.K., Japan; Junichi Kako, Toyota Motor Corporation, Japan; Fuguo Xu, Chiba University, Japan; and Tielong Shen, Sophia University, Japan
- "Cooperative Aerial Robots Inspection Challenge," organized by Thien-Minh Nguyen, Muqing Cao, Shenghai Yuan, and Lihua Xie from Nanyang Technological University, Singapore, and Ben M. Chen from the Chinese University of Hong Kong, China.

The winner of the Autonomous Driving Control Challenge was "Predictive Motion Control Considering Body Attitude Constraints for Four In-Wheel Motor Vehicles," by Hongqing

Rui Gao announcing the benchmark competition awards.

Magnus Egerstedt granted the Hendrik W. Bode Lecture Prize to Miroslav Krstic, University of California, San Diego.

Chu, Zongxuan Li, Qiao Kang, Zhenghao Li, Bingzhao Gao, and Hong Chen from Tongji University, China.

The winner of the Cooperative Aerial Robots Inspection Challenge was Team KIOS COE: Angelos Zacharia, Andreas Anastasiou, Savvas Papaioannou, Panayiotis Kolios, Christos G. Panayiotou, and Marios M. Polycarpou from the University of Cyprus.

WORKSHOPS

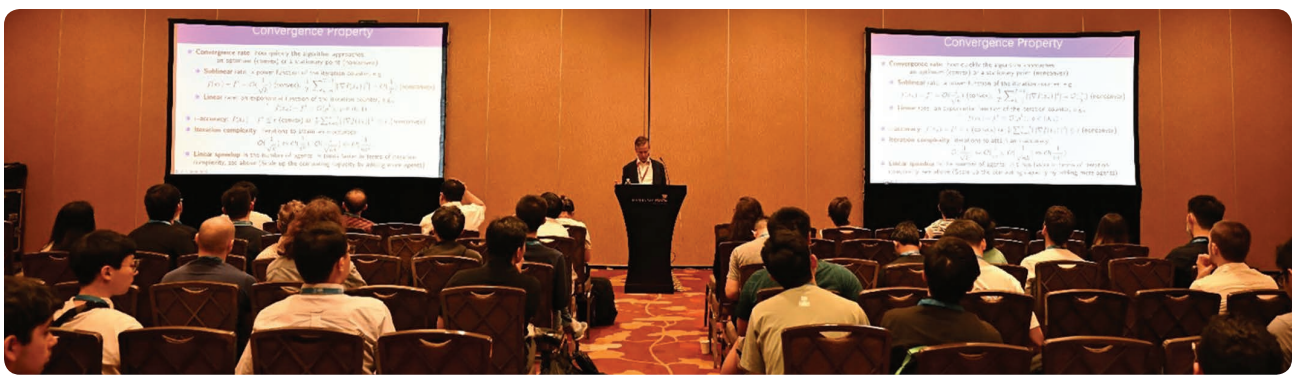
The preconference workshops were managed by workshop co-chairs Andreas A. Malikopoulos and Ben M. Chen, and the program comprised the following 15 full-day workshops:

- "Semi-Tensor Product of Matrices and Its Applications," organized by Daizhan Cheng, Maria Elena Valcher, and Kuize Zhang
- "Control, Game, and Learning Theory for Security and Privacy," organized by Tamer Basar and Quanyan Zhu
- "Distributed Control, Optimization, and Learning for Multi-Agent Systems," organized by Tao Yang, Cesar A. Uribe, Yiguang Hong, and Angelia Nedich
- "Population Games: Strategic Multi-Agent Interactions at Scale," organized by Shinkyu Park, Murat Arcak, and Nuno C. Martins
- "Modern Adaptive Control and Estimation: From Theory to Applications," organized by Yongping Pan, Bowen Yi, Sayan Basu Roy, Alexey Bobtsov, and Romeo Ortega
- "Counter-Adversarial Inference, Control, and Learning: New Frontiers, Newer Challenges," organized by Arpan Chattopadhyay, Kumar Vijay Mishra, John S. Baras, P. R. Kumar, and Vivek S. Borkar
- "Physics-Informed Learning for Control and Optimization," organized by Thomas Beckers, Sandra Hirche, and Rolf Findeisen
- "Formal Methods and Decision Making in the Age of AI," organized by Lars Lindemann and Cristian Ioan Vasile.
- "Benchmarking, Reproducibility, and Open-Source Code in Controls," organized by Angela P. Schoellig, Jonathan P. How, Peter Corke, George J. Pappas, Sandra Hirche, Lukas Brunke, Siqi Zhou, Adam W. Hall, Federico Pizarro Bejarano, and Jacopo Panerati
- "Learning Enabled Control and Coordination for Societally-Aware Transportation Systems," organized by Alexandre Bayen, Karthik Gopalakrishnan, Devansh Jalota, Jessica Lazarus, and Marco Pavone
- "Systems Theory of Ensembles: Fundamentals, Learning, and Applications," organized by Jr-Shin Li, Shen Zeng, and Hiroya Nakao
- "Learning and Control for Decarbonized Energy and Transportation Systems," organized by Sivaranjani Seetharaman and Apurv Shukla
- "Autonomous Unmanned Systems Technologies and Applications," organized by Lihua Xie and Ben M. Chen.
- "Control Barrier Functions: Recent Developments and Future Directions," organized by Gennaro Notomista and Yorai Wardi
- "Formal Methods in System Resilience: From Analysis to Control," organized by Rong Su and Xiang Yin.

CSS AWARDS

The CSS Awards Ceremony was held on Thursday evening before the banquet, introduced by Awards Chair John Baillieul. Jorge Cortes, Jing Sun, and Andrea Serrani were recognized with Distinguished Member Awards, and the Outstanding Chapter Award went to the CSS Italy Chapter, chaired by Fabrizio Dabbene.

Carolyn Beck (CSS vice president, Conference Activities) presented the CDC Best Student Paper Award to Feras Al Taha, Cornell University (advisor: Eilyan Bitar) for the paper



Karl H. Johansson delivering a talk at a workshop.

"A Distributionally Robust Approach to Regret Optimal Control using the Wasserstein Distance," coauthored with Shuhao Yan and Eilyan Bitar.

Carolyn Beck also presented the CDC Outstanding Student Paper Awards to

- Max Emerick, University of California, Santa Barbara (advisor: Bassam Bamieh), "Continuum Swarm Tracking Control: A Geometric Perspective in Wasserstein Space," by Max Emerick and Bassam Bamieh
- Thomas Lew, Stanford University (advisor: Joel Burdick), "Exact Characterization of the Convex Hulls of Reachable Sets," by Thomas Lew, Riccardo Bonalli, and Marco Pavone
- Xiangyuan Zhang, University of Illinois (advisor: Tamer Basar), "Revisiting LQR Control From the Perspective of Receding-Horizon Policy Gradient," by Xiangyuan Zhang and Tamer Basar.

The Roberto Tempo Best CDC Paper Award was conferred by Carolyn Beck to

- Yixuan Lin, Ji Liu, "Subgradient-Push Is of the Optimal Convergence Rate," *Proceedings of the IEEE Conference on Decision and Control*, Cancun, Mexico, 2022, pp. 1307–1312.

Yannis Paschalidis (CSS vice president, Publication Activities) conferred five Outstanding Paper Awards.

- The 2023 IEEE Control System Magazine Outstanding Paper Award was given to Danylo Malyuta, Taylor P. Reynolds, Michael Szmuk, Thomas Lew, Riccardo Bonalli, Marco Pavone, and Behçet Açıkmeşe for the paper "Convex Optimization for Trajectory Generation: A Tutorial on Generating Dynamically Feasible Trajectories Reliably and Efficiently," *IEEE Control Systems Magazine*, vol. 42, Issue: 5, October 2022.
- The 2023 IEEE Control Systems Letters Outstanding Paper Award was given to Balázs Gerencsér for the paper "Computable Convergence Rate Bound for Ratio Consensus Algorithms," *IEEE Control Systems Letters*, vol. 6, pp. 3307–3312, 2022.

CSS Awards. (a) Honoring the new IEEE Fellows at the award ceremony. (b) IEEE Past President Ray Liu presenting the 2023 IEEE Control Systems Award to Naomi E. Leonard. (c) The 2023 awardees together with CSS President Magnus Egerstedt.

Naomi E. Leonard, Princeton University, was presented the IEEE Control Systems Award by IEEE Past President Ray Liu.

- The 2023 IEEE Transactions on Control of Network Systems Outstanding Paper Award was given to Gianluca Bianchin, Jorge Cortés, Jorge I. Poveda, and Emiliano Dall'Anese for the paper "Time-Varying Optimization of LTI Systems Via Projected Primal-Dual Gradient Flows," *IEEE Transactions on Control of Network Systems*, vol. 9, no. 1, pp. 474–486, 2022.
- The 2023 IEEE Transactions on Control Systems Technology Outstanding Paper Award was given to Nicolás Faedo, Giordano Scarciotti, Alessandro Astolfi, and John V. Ringwood for the paper "Nonlinear Energy-Maximizing Optimal Control of Wave Energy Systems: A Moment-Based Approach," *IEEE Transactions on Control Systems Technology*, vol. 29, no. 6, pp. 2533–2547, 2021.
- The 2023 George S. Axelby Outstanding Paper Award was given to Christoph Kawan, Andrii Mironchenko, Abdalla Swikir, Navid Noroozi, and Majid Zamani for the paper "A Lyapunov-Based Small-Gain Theorem for Infinite Networks," *IEEE Transactions on Automatic Control*, vol. 66, no. 12, pp. 5830–5844, 2021.

Ian Petersen (CSS vice president, Technical Activities) presented the 2023 IEEE CSS Award for Technical Excellence in Aerospace Control to Marco Pavone for outstanding contributions to optimal control and decision making and their application to aerospace robotics. The 2023 Control Systems Technology Award was conferred to Francis J. Doyle III for pioneering the design of control algorithms to enable the commercial development of an artificial pancreas as a therapeutic intervention to improve the quality of life for individuals with diabetes.

The winner of the 2023 IEEE CSS Transition to Practice Award was Alexandre Bayen, University of California, Berkeley, for sustained contributions to transforming fundamental transportation and control technology research into industrially relevant innovation. This award carries an invitation to deliver a plenary lecture at the 2024 IEEE Conference on Control Technology and Applications (CCTA).

Magnus Egerstedt (CSS president) awarded the 2023 Antonio Ruberti Young Researcher Prize to Fabio Pasqualetti, University of California, Riverside, for foundational contributions to the theories of cyberphysical security, complex networks, and data-driven control. Finally, Magnus Egerstedt granted the Hendrik W. Bode Lecture Prize to Miroslav Krstic, University of California, San Diego, for pioneering partial differential equations, backstepping, and extremum seeking control and for fostering their technology commercialization.

IEEE AWARDS

Magnus Egerstedt recognized the class of 2023 IEEE Fellows evaluated by the CSS: Hong Chen, Dimos Dimarogonas, Kingsley Fregene, Javad Lavaei, Henrik Sandberg, Ling Shi, Ying Tan, and Abdelhamid Tayebi. The class of 2023 IEEE Fellows evaluated by other IEEE Societies consists of Amir Aghdam, Alejandro Dominguez-Garcia, Lei Guo, Chenghui Zhang, Alexandre Bayen, Daoyi Dong, Birgit Vogel-Heuser, Youmin Zhang, Hassan Bevrani, Antonio Franchi, Hong Wang, Paul C.-P. Chao, Zhiwei Gao, and Jun Yang.

Hideaki Ishii (vice president, Diversity, Outreach, and Development) presented the 2023 IEEE Control Systems Graduate Collaboration Fellowship to

- Jorge Luis Anderson Azzano, Universidad Nacional de La Plata
- Miguel Felipe Castiblanco, Universidad Nacional de Colombia
- Hao Li, Institute of Automation, Chinese Academy of Sciences
- Ashish Kumar Shakya, Indian Institute of Technology (IIT)
- Shuixin Xiao, Shanghai Jiao Tong University.

Naomi E. Leonard, Princeton University, was presented the IEEE Control Systems Award by IEEE Past President Ray Liu for contributions to applications and theory for control of nonlinear and multiagent systems.

Participants enjoying the welcome reception.

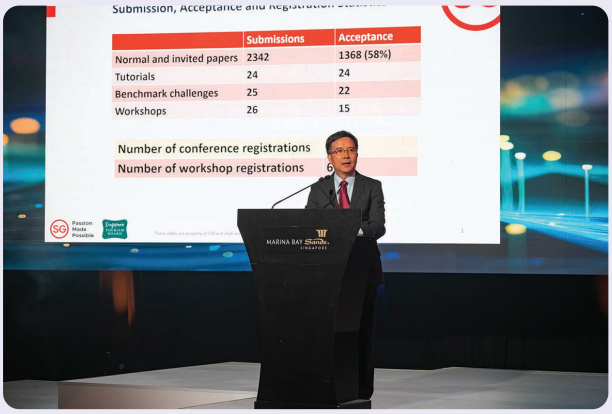
SPONSORSHIPS AND EXHIBITIONS

Shanghai Jiaotong University and the Shandong University of Science and Technology were the conference's platinum sponsors. MathWorks and Harbin Engineering University were the conference's gold sponsors. The Nanjing University of Information Science and Technology and Acelink were the conference's silver sponsors. Tongji University was the conference's bronze sponsor. *IEEE/CAA Journal of Automatica Sinica*, AiTEN, Franklin Open, and the Huazhong University of Science and Technology sponsored the conference at the copper level. There were 30 exhibitions, including 20 talent recruitment exhibitions, during the conference.

SOCIAL EVENTS

The conference's Welcome Reception was held in the Lotus & Melati

(a)



(b)

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Images from the conference banquet. (a) The conference banquet. (b) Lihua Xie delivering the welcome speech at the conference banquet. (c) OpCom members at the banquet dinner. (d) The Lion Dance at the conference banquet. (e) Lihua Xie, Magnus Egerstedt, Karl H. Johansson, and Guoqiang Hu proposing a toast at the conference banquet.

Present and past CSS presidents. (From left to right): Francesco Bullo (2018), John Baillieul (2006), Elena Valcher (2015), Christos Cassandras (2012), Tamer Basar (2000), Yutaka Yamamoto (2013), Thomas Parisini (2021–2022), Magnus Egerstedt (2023–2024), and Francis J. Doyle (2016).

Bayview Foyer on Tuesday evening. Lunches were provided for all registered participants during the conference. Coffee breaks were held in the Bayview Foyer and Exhibition Hall. The CSS Breakfast for Underrepresented Students took place on Wednesday morning, followed by the traditional—and well-attended—Women in Control Luncheon. The Meet the Faculty Candidates session held on Wednesday had 48 participants. The banquet, attended by about 1,030 people, was held in the Roselle-Simpor Main Ballroom on Thursday right after the CSS Award Reception. The farewell reception took place on Friday in the Lotus & Melati Bayview Foyer. There were also soccer games and table tennis competitions at the conference.

NEXT CONFERENCE

The 63rd IEEE CDC (https://cdc2024.ieeecss.org) will be held from Monday through Thursday, 16–19 December 2024, at the Milano Congressi (MiCo) Conference Center, Milan, Italy. The conference will be preceded by technical workshops on Sunday, 15 December 2024. The 63rd CDC will feature contributed and invited papers as well as workshops and tutorial sessions. Milan, the capital of Lombardy in the north of Italy, is one of the largest metropolitan areas in the European Union. Milan is known as Italy's fashion, food, architecture, and art capital, whose history dates back thousands of years. Get the chance to visit museums and art galleries that include some of the most important collections in the world, including major works by Leonardo da Vinci. We look forward to seeing you in Milan!

ACKNOWLEDGMENT

We wish to thank the members of the Operating Committee of the 62nd IEEE CDC for their outstanding service. Karl H. Johansson and Guoqiang Hu had the opportunity to work with an excellent team of program vice chairs and invited session chair: Zongli Lin looked after the invited sessions, Melanie Zeilinger solicited and coordinated the tutorial sessions, Na Li and Changyun Wen helped with the technical program, and Yiguang Hong solicited invited session proposals. Rong Su and Hyo-Sung Ahn were vitally important as finance chairs. Amir Aghdam's relentless and competent efforts as the conference editorial board chair were crucial in ensuring the smooth review process and high-quality technical program. The publicity subcommittee comprised of Lin Zhao, Hideaki Ishii, and Bayu Jayawardhana did a great job. In particular, Lin worked tirelessly in outreaching, designing the conference website and logo, serving as the website master, and editing/remaking the recorded videos of Bode lecture and plenary talks. The workshops attracted high numbers of proposals and participants due to the great efforts of Andreas A. Malikopoulos and Ben M. Chen. The Sponsorship and Exhibition team was composed of Jie Chen, Jun Xu, Alberto Speranzon, and Tielong Shen secured a high number of sponsors and exhibitors, and Jie Chen was instrumental in getting sponsors and Jun Xu's effort in coordinating the workshops by the sponsors and exhibitions was greatly appreciated. Hai Lin's tireless effort and dedication to the publications will always be remembered. Thanks also goes to Cheng Xiang for his contributions to the publications. Patricia Wong and Chien Chern Cheah did an excellent job in local arrangement. Philip E. Paré was an amazing student activities chair, securing sponsorships from the NRF and facilitating and coordinating student awards and travel support. Christos Cassandras served as chair for diversity and inclusion and Emma Tegling served as Chair for social media with passion and personality. The support from Pradeep Misra in the submission, review, and registration system was crucial for the smooth operation of the conference. Thanks also go to the registration cochairs Kezhi Mao and Yan Xu, and the support and advice from Faryar Jabbari were invaluable. A special shoutout to Jasmine and Joy, our professional conference organizers, for their unwavering support and diligent and extraordinary contributions. We wish to acknowledge the precious assistance of the hotel event manager, Benson Chan, and the group operations managers You Dian Lim and Jamadil Layel for continued support and problem-solving during the conference week. Finally, we would like to express our gratitude for the support given by the Singapore Exhibition and Convention Bureau, Singapore Airlines, and all our sponsors and exhibitors.

Lihua Xie
General chair, CDC 2023
Karl H. Johansson and Guoqiang Hu
Program co-chairs, CDC 2023