Smart Automation: CASE 2019 in Vancouver, Canada

By Weiming Shen and Jingshan Li

The 2019 IEEE 15th International Conference on Automation Science and Engineering (CASE 2019) was held in Vancouver, British Columbia, Canada, on 22–26 2019. It represents the flagship automation conference of the IEEE Robotics and Automation Society (RAS) and constitutes the primary forum for cross-industry and multidisciplinary research in automation. Its goal is to provide broad coverage and dissemination of foundational research in automation among researchers, academics, and practitioners.

Rapid development and advancements of cloud computing, edge computing, the Internet of Things (IoT), cyberphysical systems, and big data are bringing new life to artificial intelligence (AI), resulting in a new generation of automation, "smart automation," which was the theme of CASE 2019. Topics include automation in smart homes, smart buildings, smart manufacturing, smart health care, and so forth.

The key organizers worked very closely with strong support from the CASE Steering Committee chair (Figure 1) and members to develop conference promotion strategies and the technical program, including regular keynotes and an industry panel as well as social activities.

CASE 2019 attracted a record high number of 616 submissions, including 544 full papers [of which 64 papers were from *IEEE Robotics and Automation Letters* (*RA-L*)] and 72 presentation-only abstracts. These contributions were from 48 countries across all continents. An important success factor of CASE 2019 was the organization of special sessions. Through the tremendous efforts of the program chair, special session chairs, and other organizing committee members, the conference received a record number of 35 special session proposals, among which 31 were approved. Special session paper submissions (212) contributed to a third of the total submissions (616).

The final technical program included 304 papers, and 52 presentation-only contributions were organized across 10 parallel tracks and 62 sessions. The final (full paper) acceptance rate was about 56%. The technical sessions covered multiple emerging areas of automation, such as AI, health care, smart buildings and energy systems, and sustainable production systems. In addition to the contributed papers, the conference featured four keynote talks, an industry panel, four workshops, and two tutorials.

The conference program kicked off with opening remarks from General Chair Weiming Shen, RAS President Wolfram Burgard, CASE Steering Committee Chair Bengt Lennartson, and Program Chair Jingshan Li, welcoming conference participants and introducing conference programs and activities.

The first keynote talk was provided by Prof. Matthew Mason from Carnegie Mellon University (Figure 2). He shared his experience and personal journey from academic research to technology commercialization and discussed his visions for the next commercial robotics revolution. He explained Tom Wagner's vision of a robotic transformation of materials handling, illustrated Berkshire Grey's accomplishments, and discussed the interaction between academia and industry.

The second talk was by Stephan Biller, vice president for Offering Management at IBM Watson IoT. He discussed the challenges in industrial automation settings and showed that AI and advanced analytics can help us better visualize the butterfly effect and better understand how decisions about maintenance of one asset will impact another, as well as help business leaders obtain the agility their companies desperately need.

The third keynote by Prof. Mengchu Zhou from the New Jersey Institute of Technology discussed the transformation and improvement of manufacturing activities using Industry 4.0

Figure 1. (From left): The CASE 2019 Program Committee Chair Jingshan Li, CASE Steering Committee Chair Bengt Lennartson, and CASE 2019 General Chair Weiming Shen. (Photo courtesy of Weiming Shen.)

Figure 2. Prof. Matthew Mason presenting the keynote talk "From Carnegie Mellon to Berkshire Grey." (Photo courtesy of Weiming Shen.)

Figure 3. Members of the CASE 2019 industry panel: (from left) Jingshan Li (chair), Aldo Dagino, Boro Dropulic, Sahika Genc, Quiros Gustavo, and Alain Ouellette. (Photo courtesy of Jingshan Li.)

technologies, such as advanced automation, AI, machine learning, big data analytics, and the IoT. Through real-life applications from the semiconductor manufacturing sector, he illustrated the development of smart manufacturing ecosystems capable of performing real time monitoring and optimization of manufacturing processes in various ways, from high-level strategic resource and production planning to real time, equipment-level smart dispatching and predictive maintenance.

The fourth keynote by Dr. Srinivas Katipamula from Pacific Northwest National Laboratory highlighted the evaluation and current state of building automation, i.e., where and how building automation should allow seamless integration of buildings with the grid. He showed how building automation can be brought into the future by making building systems self-configuring,

self-commissioning, self-learning, self-diagnosing, self-healing, and self-transacting, ultimately leading to a self-aware building state.

An industry panel, organized by the program committee, invited senior managers and technical experts in the automation industry: Dr. Aldo Dagino, ABB, advanced analytics manager, Global Information Systems; Dr. Boro Dropulic, Lentigen, chief science officer and general manager; Dr. Sahika Genc, Amazon, senior applied scientist, AI and Web Services; Dr. Quiros Gustavo, Siemens, senior key expert; and Alain Ouellette, GE Aviation, directeur exécutif, Innovation en Fabrication (Figure 3). The panelists introduced their achievements and their visionary thoughts for smart automation. They discussed state-of-the-art research and applications in the general area of smart automation; shared their experi-

ence and ideas; addressed significant advancements; exposed unsolved challenges; and presented critical needs from different backgrounds and perspectives such as manufacturing, aviation, data science, information technology, and biofabrication.

The conference included four workshops: Data Science for Engineering Automation; Healthcare 4.0: Smart and Interconnected Healthcare Systems; Frontiers in Control and Smart Automation: Robotics, Energy, and Education; and Socio-Technical Automation Systems. Two tutorials were also provided: Theory and Education of Autonomous Control of Driving Agents with Deep Learning; and Additive Manufacturing Data Management, Analytics, and Process Control. A total of about 250 conference attendees participated in these workshops and tutorials.

At CASE 2019, two Best Paper Awards for *IEEE Transactions on Automation Science and Engineering* (*T-ASE*) were announced by *T-ASE* Editor-in-Chief Michael Wang and presented by *T-ASE* Awards Committee Chair Fan-Tien Cheng:

- T-ASE Best Paper Award (Figure 4): "Chiller Plant Operation Optimization: Energy-Efficient Primary-Only

Figure 4. IEEE T-ASE Awards Committee Chair Fan-Tien Cheng (right) presenting the IEEE T-ASE Best Paper Award to Peter Luh. (Photo courtesy of Weiming Shen.)

and Primary-Secondary Systems" by Danxu Zhang, Peter Luh, Junqiang Fan, and Shalabh Gupta (University of Connecticut)

- T-ASE Best New Application Paper Award: "Correctness Guarantees for the Composition of Lane Keeping and Adaptive Cruise Control" by Xiangru Xu, Jessy W. Grizzle, Paulo Tabuada, and Aaron D. Ames (Georgia Institute of Technology).

Four CASE 2019 Best Paper Awards were announced by CASE 2019 Awards Committee Chair Leyuan Shi and presented by CASE Steering Committee Chair Bengt Lennartson:

- Best Student Paper Award (Figure 5): "Real-Time Control for Large-Scale Additive Manufacturing Using Thermal Images" by Feifan Wang, Feng Ju, Kyle Rowe, and Nils Hofmann (Arizona State University and Local Motors)
- Best Healthcare Automation Paper Award (Figure 6): "Evaluation of E-Consults in Healthcare Delivery" by Aditya Mahadev Prakash, Qiaochu He, and Xiang Zhong (University of Florida and Hongkong University of Science and Technology)
- Best Application Award (Figure 7): "Tool-Center-Point Control of a Flexible Link Concrete Pump With Hydraulic Limitations Using Quadratic Programming" by Julian Wanner and Oliver Sawodny (University of Stuttgart)
- Best Paper Award (Figure 8): "Selecting the Optimal System Design Under Covariates" by Siyang Gao, Jianzhong Du, and Chun-Hung Chen (City University of Hong Kong and George Mason University).

The conference attracted over 510 participants from 38 countries. The organizing committee also arranged several interesting social activities and technical tours, including a welcome reception and a junior researcher gathering on 23 August, a Women in Engineering lunch on 24 August, a con-
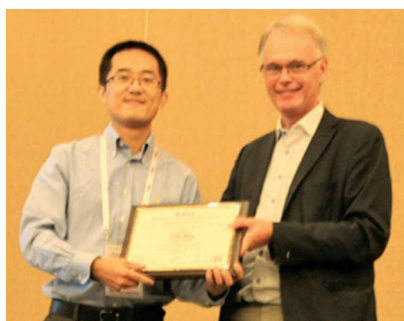

Figure 5. Bengt Lennartson (right) presenting the CASE 2019 Best Student Paper Award to Feifan Wang. (Photo courtesy of Weiming Shen.)

Figure 6. Bengt Lennartson (right) presenting the CASE 2019 Best Healthcare Automation Paper Award to (from left) Mahadev Prakash and Xiang Zhong. (Photo courtesy of Weiming Shen.)

Figure 7. Bengt Lennartson (left) presenting the CASE 2019 Best Application Paper Award to Julian Wanner. (Photo courtesy of Weiming Shen.)

Figure 8. Bengt Lennartson (right) presenting the CASE 2019 Best Paper Award to Siyang Gao. (Photo courtesy of Weiming Shen.)

ference banquet at the Vancouver Convention Center on 24 August, a Lunch with Leaders on 25 August, and a farewell reception on 25 August. Technical tours were arranged on 26 August, including a tour of four UBC research labs related to smart automation and a tour of three facilities related to smart building and smart plant operations.

CASE 2019 received financial support from ABB and the Department of Industrial and Systems Engineering, University of Wisconsin–Madison and in-kind contributions from the University of British Columbia and Huazhong University of Science and Technology.

CASE 2019 also "invented" a new type of sponsorship: "organization sponsor." With five (or more) full registrations or ten (or more) student registrations or an equivalent combination from the same group/department/fac-

ulty/school, the group and its members were recognized as an organization sponsor, including sponsor recognition in the conference program (and on the website) and a free exhibition table. Groups from ten universities were recognized: the University of California, Berkeley; Chalmers University of Technology; Tsinghua University; Huazhong University of Science and Technology; Xi'an Jiaotong University; Peking University; Arizona State University; Eindhoven University of Technology; Tongji University; and National Cheng Kung University.

Special thanks to all CASE 2019 organizing committee chairs and members, Conference Editorial Board editors and associate editors (AEs), *RA-L* editors and AEs, reviewers, and volunteers, as well as authors. We would not have had such a successful conference without their dedication and contributions.