In this issue of *IEEE Control Systems Magazine*, we have interviews with Francesco Bullo, the incoming president of the IEEE Control Systems Society (CSS); Rajesh Rajamani, the program chair of the 2017 American Control Conference (ACC); R. Scott Erwin, who received the 2016 IEEE Judith A. Resnick Space Award; Miroslav Krstic, who received the John R. Ragazzini Education Award at the 2017 ACC; and H. Harry Asada, who presented one of the semiplenaries at the 2017 ACC.

Francesco Bullo is a professor with the Mechanical Engineering Department and the Center for Control, Dynamical Systems, and Computation at the University of California, Santa Barbara. He was previously associated with the University of Padova, the California Institute of Technology, and the University of Illinois. His research interests focus on network systems and distributed control with application to robotic coordination, power grids, and social networks. He is the coauthor of *Geometric Control of Mechanical Systems* (Springer, 2004) and *Distributed Control of Robotic Networks* (Princeton, 2009); his forthcoming *Lectures on Network Systems* is available on his website. He received best paper awards for his work in *IEEE Control Systems Magazine*, *Automatica*, *SIAM Journal on Control and Optimization*, *IEEE Transactions on Circuits and Systems*, and *IEEE Transactions on Control of Network Systems*. He is a Fellow of IEEE and IFAC. He has served on the editorial boards of IEEE, SIAM, and ESAIM journals and will serve as CSS president in 2018.

Rajesh Rajamani is a professor of mechanical engineering at the University of Minnesota. He received the B.Tech. degree from the Indian Institute of Technology at Madras in 1989, and the M.S. and Ph.D. degrees from the University of California, Berkeley, in 1991 and 1993, respectively. He was a research engineer at the United Technologies Research Center in Connecticut and California PATH before joining the University of Minnesota in 1998. His active research interests include sensing, estimation, and observer design for automotive, biomedical, and other interesting applications. He has coauthored over 120 journal papers, is a coinventor on 13 patent applications, and is the author of the popular book, *Vehicle Dynamics and Control* (Springer Verlag). He is a Fellow of ASME and has been a recipient of the CAREER award from the National Science Foundation, the 2001 Outstanding Paper award from *IEEE Transactions on Control Systems Technology*, the Ralph Teetor Award from the Society of Automotive Engineers, and the 2007 O. Hugo Schuck Award from the American Automatic Control Council. Several inventions from his laboratory have been commercialized through start-up ventures cofounded by industry executives. One of these companies, Innotronics, was recently recognized among the 35 Best University Start-Ups of 2016 in a competition conducted by the U.S. National Council of Entrepreneurial Tech Transfer.

R. Scott Erwin is a principal research aerospace engineer at the Air Force Research Laboratory (AFRL) Space Vehicles Directorate, located on Kirtland Air Force Base, New Mexico. Scott received the B.S. degree in aeronautical engineering from Rensselaer Polytechnic Institute in 1991 and the M.S. and Ph.D. degrees in aerospace engineering from the University of Michigan in 1993 and 1997, respectively. He has been with the AFRL since 1997. He was a principal investigator on four space-flight experiments and has managed, led, and contributed to numerous other laboratory and flight programs during his time at AFRL. He has authored or coauthored over 100 technical publications in the areas of spacecraft dynamic, controls, and communications and is an associate fellow of the American Institute of Aeronautics and Astronautics (AIAA) and a Senior Member of the IEEE. He was recently selected as the recipient of the 2016 IEEE Judith A. Resnick Space Award "for outstanding contributions to spacecraft vibration isolation technologies and ultra-precision pointing of large, flexible, space platforms."

Miroslav Krstic is the Alspach endowed chair, the founding director of the Cymer Center for Control Systems and Dynamics, and senior associate vice chancellor for research at the University of California, San Diego (UCSD). He is a Fellow of the IEEE, International Federation of Automatic Control (IFAC), American Society of Mechanical Engineers (ASME), Society for Industrial and Applied Mathematics, and the Institution of Engineering and Technology (United Kingdom); an associate fellow of AIAA; and a foreign member of the Academy of Engineering of Serbia. He has received the ASME Oldenburger Medal, Nyquist Lecture Prize, and Paynter Outstanding Investigator Award; the AACC Ragazzini Education Award; the IFAC Chestnut Control Textbook Prize; the PECASE, NSF Career, and ONR Young Investigator awards; the Axelby and Schuck paper prizes; and the first UCSD research award given to an engineer. He has coauthored 12 books and over 700 refereed papers, including

Digital Object Identifier 10.1109/MCS.2017.2743530
Date of publication: 13 November 2017

280 journal papers, with over 30,000 citations and an h-index of 77 on Google Scholar. He is a senior editor for *Automatica* and *IEEE Transactions on Automatic Control* and editor of the Springer book series *Communications and Control Engineering and Briefs in Control, Automation, and Robotics*. He has served as CSS vice president for Technical Activities and chair of the CSS Fellow Committee.

H. Harry Asada is the Ford Professor at the Massachusetts Institute of Technology (MIT). He received the B.S., M.S., and Ph.D. degrees in mechanical engineering and precision engineering, all from Kyoto University, Japan, in 1973, 1975, and 1979, respectively. He was a visiting research scientist at the Robotics Institute of Carnegie-Mellon University before joining the faculty at MIT in 1982. He was also an associate professor in the Department of Applied Mathematics and Physics at Kyoto University (1985–1988). He is currently director of the Brit and Alex d'Arbeloff Laboratory for Information Systems and Technology in the Department of Mechanical Engineering, MIT. He was the general chair of the 2012 ASME Dynamic Systems and Control Conference and an associate editor of *ASME Journal of Dynamic Systems, Measurement, and Control*. He has been playing key roles in large industrial consortia and multi-investigator projects, including the MIT Home Healthcare Consortium, the NSF Science and Technology Center on Emergent Behavior of Integrated Cellular Systems, and the Advanced Robotics for Manufacturing Institute. He is the author of three books, 150 journal papers, and over 400 refereed conference papers and book chapter articles as well as the inventor of over 40 U.S. patents. His honors include the 2011 Rufus Oldenburger Medal from ASME; the Ruth and Joel Spira Award for Distinguished Teaching from School of Engineering, MIT; the Henry Paynter Outstanding Researcher Award from ASME Dynamic Systems and Control; and Fellow of ASME. He has received 12 best paper awards in the areas of robotics, biomedical engineering, and system dynamics and control.

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FRANCESCO BULLO

Q. Congratulations on your new role in the IEEE Control Systems Society (CSS). You have been extremely active in the CSS over the years. Which of the numerous roles have you found the most rewarding thus far?

Francesco: Thank you for the opportunity to talk about my involvement with CSS. It is an honor and a privilege to serve the Society in this role [of president]. I wish to express my thanks to all people I collaborated with in the past and state what a privilege and honor it is for me to serve the Society going forward.

I have enjoyed all of my roles with CSS over the years. I feel it has been extremely instructive for me to serve as vice president first for Technical Activities and then for Publications. During those years I had a chance to meet regularly with all the volunteers in the CSS Executive Committee and the Board of Governors. On one hand, I have had a chance to learn about every aspect of the Society's activities and how to manage complex processes like our journals and conferences. On the other hand, I have enjoyed contributing to several changes over the years. The one that I remember most vividly is working on the transition from the CSS Multi-Conference on Systems and Control to the newly restarted series of Conference on Control Technology and Applications.

Francesco Bullo, 2018 president of the IEEE Control Systems Society and professor of mechanical engineering at the University of California, Santa Barbara.

I can sincerely say that I received a lot in exchange for my volunteer work and engagement. I encourage everybody to dedicate time to the CSS endeavors they find valuable. At a personal level, it has been a real pleasure to work with many friends and volunteers of the Society.

Q. How did your educational background bring you to the systems and control field?

Francesco: Well, that's a long story! To start with, I have always enjoyed working on mathematically rigorous topics. I remember being really engaged during high school in my mathematics and physics courses. When high school finished, it was very natural for me to choose engineering as a way to focus on subjects that really resonated with me.

I studied electrical engineering at the University of Padova, Italy, at a time when the first degree, called "Laurea" and comparable to a BS+MS, required at least five years. I specialized in the area of systems and control. From the very beginning of my undergraduate studies, I enjoyed mathematically rigorous topics such as linear algebra and calculus. Later on, I was awestruck by the courses on linear control theory (taught by Prof. Giovanni Marchesini) and estimation theory (taught by Prof. Giorgio Picci); these were the courses that led me to the field of systems and control.

During my undergraduate studies, I spent my fifth year as an exchange

student of the University of California, San Diego (UCSD) thanks to the UC Education Abroad Program. That year was uniquely formative for me as I learned about the American academic system and, for the very first time, had a chance to engage in independent research. Prof. Elias Masry in the Electrical and Computer Engineering Department at UCSD shared an open problem with me, and, after several months of work, we published an article on adaptive filtering and signal processing. This first experience led quickly and naturally to a research career. My last year in Padova was spent working with Prof. Giorgio Picci on geometric control theory and satellite control, and I obtained my Laurea degree in electrical engineering in 1994.

I did my graduate studies at Caltech in the Department of Control and Dynamical Systems from 1994 until 1998. That was a great time for me and also, in general, for people working on nonlinear control theory, geometric mechanics, and robotic locomotion. I had a chance to study mechanical control systems under the guidance of Richard Murray, learn geometric mechanics from Jerrold Marsden, and collaborate on motion control algorithms with Naomi Leonard. I completed my Ph.D. studies at Caltech in 1998.

By this time I was firmly in the field of systems and control. Since then, while I have changed the research topic several times, I have always felt that, at heart, my core competencies are in this field.

Francesco Bullo (bottom row, second from right) and his research group and visitors preparing for a soccer match in May 2013.

Francesco Bullo (left) at the 2015 University of California, Santa Barbara Commencement Ceremony with his advisees (from left): Deepti Kannapan, Pushkarini Agharkar, Rush Patel, and John Simpson-Porco.

Q. What are your current research interests?

Francesco: My current research interests are in the area of network systems and distributed control focusing on engineering, social, and physical systems. This is an elegant and impactful field that is at the intersection of dynamical systems, control theory, and graph theory. I am especially interested in the mathematical understanding of dynamic phenomena that occurs over networks of interacting dynamical systems. One key problem is to characterize how the structure of the network affects the transient and asymptotic properties of the interconnected system. Early references in this field include work by mathematical sociologists and graph theoreticians who began to ask these type of questions in the 1940s and 1950s. Of course, this field builds on classical advances in graph theory and linear and nonlinear control theory as we all know and love.

I collaborate with mathematical sociologists and organization scientists to understand dynamic phenomena in social networks, such as the dynamics of opinion and the convergence to consensus or polarization, the dynamics of social power in deliberative groups, collective decision making and learning, as well as collaborative executions of tasks in organizations. Currently we studying a "wisdom of crowd" phenomenon (that is, the higher accuracy

Francesco Bullo attending the Indian Control Conference at IIT Guwahati in January 2017.


Francesco Bullo (right), his wife Lily, and their children (Marcello and Gabriella) visiting the Cabrillo National Monument in 2017.

of crowd averages over individual judgments due the elimination of individual noise) in large populations as a function of the topology of an influence network.

I have also worked up numerous control design problems arising in cooperative robotics. In this setting, one is faced with the creative task of designing robotic behaviors for groups of increasingly intelligent and well-equipped vehicles. Over the years, my collaborators and I have designed algorithms for coverage control, rendezvous, vehicle routing, human supervision, and more lately, stochastic search. Currently, we are using methods from Markov chain theory to design fast and unpredictable search strategies that counteract smart intruders.

Finally, in collaboration with electrical and power electronics engineers, I am working on the modeling, analysis, and design of controls systems for smart power grids and networks of inverters. Over the last few years we have adopted novel graph-theoretical and multi-agent methods to study the classic power flow equations and design distributed control laws with performance guarantees. Currently, we are characterizing the robust stability of smart networks of power inverters.

Q. What do you see as some of the priorities for ensuring the future success and impact of the field of systems and control?

Francesco: Control is known to be a hidden technology. It can also be, at times, a self-referential discipline. On the contrary, I find it critical that we, as a community, bring our concepts, tools, and values to life by applying, re-evaluating, and extending them in new and creative directions, day after day. There are numerous ways in which this can be achieved, for example, by working with practitioners, fellow engineers, or fellow scientists from the physical and social sciences. It is complex, and it takes some courage to abandon the more traditional path, but it can be an exhilarating experience to do multidisciplinary work with engineers and scientists who have completely different backgrounds and general aims.

As a second aim, I also think that we, as a discipline, need to be able to synthesize a large and growing body of knowledge into a small set of concise documents of our most meaningful ideas and achievements. Richard Hamming (1915–1998) wrote the following about books, and I mean it in a broader sense as a suggestion for our educational programs: "Books which try to digest, coordinate, get rid of the duplication, get rid of the less fruitful methods, and present the underlying ideas clearly of what we know now, will be the things the future generations will value."

Finally, in an ever-changing world, we need to find better ways to communicate the relevance and successes of our discipline, in a way that the outer world can relate to our work and understand its impact.

Profile of Francesco Bullo

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- *IEEE Control Systems Society experience highlights:* member, Conference Editorial Board (1999–2005); associate editor, *IEEE Transactions on Automatic Control* (2005–2008); chair, Technical Committee on Manufacturing Automation and Robotic Control (2004–2008); vice-president for Technical Activities (2011–2012); vice-president for Publications (2013–2014); Program chair, IEEE Conference in Decision and Control (2016); elected member, Board of Governors (2007–2009, 2011–2013, 2016–2018); Society president (2018–2019).
- *Notable Awards:* Outstanding Paper Award, *IEEE Transactions on Control of Network Systems* (2016) and *IEEE Control Systems Magazine* (2008); Fellow, IEEE (2010), IFAC (2017); IEEE Control Systems Society Distinguished Member Award (2015).

Q. How do you see your role as president of the Society, and what are your priorities for the next year? Are you planning any new initiatives?

Francesco: First, I should acknowledge the outstanding work done over the years by the multitude of volunteers who made CSS as successful as it currently is. The most important activity of the Society are obviously our conferences and journals. Very recently we discontinued the Multi-Conference in Systems and Control and started the Conference in Control Technology and Applications as a descendant of our Conference in Control Applications. Also, very recently, we started the new *IEEE Control Letters* journal with a novel smart integration with our IEEE Conference on Decision and Control (CDC). On a related note, there are several other initiatives deserving of attention and involvement, for example, the CSS Video Clip Contest, the Meet the Faculty Candidate poster session, and other special sessions at our conferences.

I believe this is a moment in time when it is most appropriate to help these new efforts by supporting and helping our volunteers in charge of them (editors and conference organizers) execute these new exciting initiatives as best as possible.

At a fundamental level, I see my role as a steward of our main products (conferences and journals) and of our recent initiatives. A second important priority will be to continue to interface with the IEEE and continue to provide advice to the IEEE on priorities for our CSS members. Finally, let me say that I am always available to discuss possible ideas on how to improve the service that the Society provides to its members. I would welcome any feedback.

Q. The young members in our field—especially students—are the future of the CSS. How can we expand their participation and role in the CSS?

Francesco: This question is certainly appropriate, challenging, and timely. First of all, we need to continue to attract young talented engineers and scientists to our discipline of systems and control. The challenge in this task is that the technological world is rapidly changing around us and the use of model-based methods is increasingly questioned.

Second, by our very nature of an open society, anybody can participate in our conferences and submit to our journals, without necessarily being a member and playing an active role in CSS. In other words, being willing to be a member and participate in CSS will always continue to be a volunteer activity. As countless others have noted in the past, participating in the activity of a professional society does help develop one's network and has other small practical benefits, but ultimately it is personal choice with a clear immediate cost and possible, sometimes intangible, benefits.

I believe our best course of action is to simply offer our young colleagues the best possible experience with our conference and journals. Add value to their participation with initiatives that are appropriate for them, for example, special sessions on career advising, industrial job fairs, and Meet the Faculty Candidate poster session at the CDC.

Q. What are some of your interests and activities outside of your professional career? Please also tell us about your family.

Francesco: Some of my other interests include listening to music, gardening, reading, swimming, biking, hiking, soccer, and keeping in touch with family and friends.

My wife Lily is Argentinian, we met at UCSD in 1993 and got married in 2000. We have two young children, Marcello (seven) and Gabriella (three). As a family, we like to make and eat pizza together, play lots of soccer, sing and dance, draw dinosaurs, watch movies, and enjoy everything Santa Barbara has to offer including the amazing weather. My parents are still in Italy, and we can be found there every summer spending time with the whole family.

Q. Thank you for your comments. We wish you success as the 2018 CSS president, and we look forward to reading your "President's Message" columns in the magazine.