In this issue, *IEEE Control Systems Magazine* interviews seven IEEE Fellows elected in 2016 who are doing research in control systems: Thor I. Fossen (Norwegian University of Science and Technology), Sarangapani Jagannathan (Missouri University of Science and Technology), Wei Ren (University of California, Riverside), B. Wayne Bequette (Rensselaer Polytechnic Institute), Maurice Heemels (Eindhoven University of Technology), Francesco Borrelli (University of California at Berkeley), and Carlos Canudas-de-Wit [French National Centre for Scientific Research (CNRS)].

Thor I. Fossen is a professor of guidance, navigation, and control at the Norwegian University of Science and Technology (NTNU), Trondheim, Norway. He received the M.Sc. degree in marine technology in 1987 and the Ph.D. degree in engineering cybernetics in 1991, both from NTNU. He pursued postgraduate studies as a Fulbright scholar in flight control at the Department of Aeronautics and Astronautics, University of Washington, Seattle. He has been a visiting professor at the University of California, San Diego, the University of California, Santa Barbara (UCSB), and the Technical University of Denmark. He was elected to the Norwegian Academy of Technological Sciences in 1998. He is a cofounder of the DNV-GL company Marine Cybernetics AS, where he was vice president of R&D from 2002 to 2008. He is currently codirector of the Centre for Autonomous Marine Operations and Systems at NTNU. He has served as an associate editor of *Automatica*, vice chair of the IFAC Technical Committee on Marine Systems, and chair of the IEEE Oceanic Engineering/Control System Joint Society Chapter, Norway Section. He is the author of the Wiley books *Guidance and Control of Ocean Vehicles* (1994), *Handbook of Marine Craft Hydrodynamics and Motion Control* (2011), and *Marine Control Systems* (2002). He is the editor of *Nonlinear Observer Design* (1999) and *Parametric Resonance in Dynamical Systems* (2012), both from Springer. He has authored more than 300 journal and proceedings papers. His honors include the Automatica Prize Paper Award in 2002, the Arch T. Colwell Merit Award at the SAE 2008 World Congress, and IEEE Fellow. His research interests are in nonlinear control theory, autonomous and intelligent systems, vehicle dynamics, hydrodynamics, vehicle simulators, control systems and nonlinear observers for marine craft and unmanned vehicles, guidance systems, and strapdown inertial navigation systems.

Sarangapani Jagannathan is the Rutledge-Emersion Distinguished Professor and director for the NSF Industry/University Cooperative Research Center on Intelligent Maintenance Systems, Missouri University of Science and Technology. He received the B.S. degree from the Anna University at Madras, India (1986), the M.S. degree from the University of Saskatchewan at Saskatoon, Canada (1989), and the Ph.D. degree from the University of Texas (1994). He was a consultant with Caterpillar, Peoria, Illinois, from 1994 to 1998 before joining academics in 1999. He has served as an associate editor of many journals, including *IEEE Transactions on Control Systems Technology* (2004–2009), *IEEE Transactions on Neural Networks and Learning Systems* (2005–2009), *IEEE Systems Engineering Journal* (2007–2010), and *Transactions of the Institute on Measurement and Control* (2010–2015). He served as the IEEE Control Systems Society (CSS) Technical Committee Chair on Intelligent Control (2011–2015) and as program chair for many CSS-supported IEEE conferences, including registration chair for the 2012 IEEE Conference on Decision and Control (CDC). He has consulted or collaborated with more than 60 companies, including Boeing, Caterpillar, Honeywell, Chevron, and Festo. He is the coauthor of four books, two edited books, and more than 380 journal and proceedings papers and holds 20 U.S. patents. Honors include the Caterpillar Research Excellence Award; Boeing Pride Achievement Award; NSF Career Award; and Fellow of the IEEE, IET, and Institute of Measurement and Control, United Kingdom. His research interests are in control theory using neural networks and its application to manufacturing, sensor-networked control, robotics/autonomous systems, diagnostics/prognostics, and cyber-physical systems.

Wei Ren is a professor in the Department of Electrical and Computer Engineering, University of California, Riverside. He received the B.S. degree from Hohai University in 1997, the M.S. degree from Tongji University in 2000, and the Ph.D. degree from Brigham Young University in 2004. From 2004 to 2005, he was a postdoctoral research associate with the Department of Aerospace Engineering, University of Maryland. Before moving to the University of California, Riverside in 2011, he was with the Department of Electrical and Computer Engineering, Utah State University, from 2005 to 2011. He is an associate editor for *Automatica*, *Systems and Control Letters*, and *IEEE Transactions on Control of Network Systems*. He is

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the author of *Distributed Coordination of Multi-Agent Networks* (2011) and *Distributed Consensus in Multi-Vehicle Cooperative Control* (2008), both with Springer-Verlag. His research interests are distributed control of multiagent systems and autonomous control of unmanned vehicles.

B. Wayne Bequette is a professor of chemical and biological engineering at Rensselaer Polytechnic Institute (RPI), where he is also associate director of the Center for Automation Technologies and Systems. He received B.S. and Ph.D. degrees from the University of Arkansas and the University of Texas at Austin, respectively. He was a process engineer at American Petrofina, Port Arthur, Texas, between his undergraduate and graduate studies. He was a visiting lecturer at the University of California, Davis, before becoming a faculty member at RPI in 1988. He is on the editorial boards of *Industrial and Engineering Chemistry Research* and *Journal of Diabetes Science and Technology*, is a trustee of the Computing Aides in Chemical Engineering Corporation, and is a member of the Smart Manufacturing Leadership Coalition. He was the program chair for the 2001 American Control Conference (ACC), general chair of the 2003 ACC, president of the American Automatic Control Council (AACC) in 2008–2009, and is currently the AACC secretary. He is the author of two textbooks and over 180 journal articles, book chapters, and proceedings papers. In addition to IEEE Fellow, honors include fellow of the American Institute of Medical and Biological Engineering, fellow of the American Institute of Chemical Engineers, and induction into the Arkansas Academy of Chemical Engineers. His research interests are in the modeling and control of chemical and biomedical systems.

Maurice (W.P.M.H) Heemels is a professor at the Eindhoven University of Technology (TU/e), The Netherlands. He received the M.Sc. degree in mathematics and the Ph.D. degree in control theory (both summa cum laude) from TU/e in 1995 and 1999, respectively. From 2000 to 2004, he was with the Electrical Engineering Department, TU/e, as an assistant professor and from 2004 to 2006 with the Embedded Systems Institute as a research fellow. Since 2006, he has been with the Department of Mechanical Engineering, TU/e, where he is a full professor in the Control Systems Technology Group. He held visiting research positions at the Swiss Federal Institute of Technology (ETH), Zurich, Switzerland (2001), and UCSB (2008). In 2004, he was also at the Research and Development Laboratory, Océ, Venlo, The Netherlands. He was an associate editor of *Automatica, Nonlinear Analysis: Hybrid Systems, Annual Reviews in Control,* and *IEEE Transactions on Automatic Control*. He served, among others, as general chair for the 2012 IFAC Conference on Analysis and Design of Hybrid Systems and program chair of the 2013 IFAC Workshop on Distributed Estimation and Control in Networked Systems. He is the author of more than 300 journal and proceedings papers. Honors include a personal VICI grant awarded by NWO (The Netherlands Organization for Scientific Research) and STW (Dutch Technology Foundation), Automatica Outstanding Service Award, and the Simon Stevin best teacher award (elected by students). His research interests include hybrid and cyberphysical systems, networked and event-triggered control systems, and constrained systems including model predictive control.

Francesco Borrelli is the Howard-Penn-Brown Professor at the Department of Mechanical Engineering of the University of California, Berkeley. He received the "Laurea" degree in computer science engineering in 1998 from the University of Naples "Federico II," Italy. In 2002 he received the Ph.D. degree from the Automatic Control Laboratory, ETH-Zurich, Switzerland. He spent five years of postdoctoral studies between the Honeywell Research Labs in Minneapolis and the Aerospace Engineering and Mechanics Department of the University of Minnesota. He consults with major corporations in the area of control design and optimization. He is the author of more than 100 publications in the field of predictive control. He is author of *Constrained Optimal Control of Linear and Hybrid Systems* (Springer Verlag), the winner of the 2009 NSF CAREER Award, and the winner of the 2012 IEEE Control System Technology Award. In 2008 he was chair of the IEEE Technical Committee on Automotive Control, and in 2016 he was nominated as IEEE Fellow. He is the cofounder and CTO of BrightBox Technologies Inc., a startup focused on cloud computing for autonomous systems, and the founder and codirector of the Hyundai-UC Berkeley Center of Excellence on Active Safety. His research interests include constrained optimal control, model predictive control and its application to robotics, automotive control, and energy-efficient building operation.

Carlos Canudas-de-Wit is director of Research at the CNRS, at GIPSA-Lab, Grenoble, France. He received the B.Sc. degree in electronics and communications from the Technological Institute of Monterrey, Mexico, in 1980 and the M.Sc. degree in the Department of Automatic Control, Grenoble, in 1984. He was visitor researcher in 1985 at Lund Institute of Technology, Sweden, and in 1987 he received the Ph.D. degree in automatic control from the Polytechnic of Grenoble. He is the current leader of the NeCS GIPSA-Lab (CNRS)-INRIA team on networked controlled systems. He was an associate editor of *IEEE Transactions on Automatic Control* and *Automatica* and currently is the associate editor of *IEEE Transactions on Control System Technology*, *IEEE Transactions on Control of System Networks*, and *Asian Journal of Control*. He is an IEEE Fellow. He has established several industrial collaboration projects with major French companies including Framatome, EDF, CEA, Ifremer, Renault, Schneider, ILL, IFP, and Alstom. He was president of the European Control Association in 2013–2015 and served on the CSS Board of Governors in 2011–2014. He is the general chair of the 2019 IEEE CDC, Nice, France. His research publications include more than 250 journal and proceedings papers, several books, and a dozen patents. His main field of research was control of robotics, mechanical, and electrical systems. His current research focuses on control of large-scale and complex physical systems and its application to road transportation networks.

Jonathan P. How

THOR I. FOSSEN

Q. How did your education and early career lead to your initial and continuing interest in the control field?

Thor: My original plan was to become a naval architect, so I started to pursue a degree in marine technology. Then by accident I attended a lecture on automatic control. This changed my career. After discovering the frequency-domain techniques, Bode diagrams, and the "magic of feedback control," I knew that I had to do my Ph.D. degree in automatic control. I have not regretted this decision a single day because automatic control or cybernetics is a "life style" or "the science and art of the understanding of understanding" as Rodney E. Donaldson, the first president of the American Society for Cybernetics, so elegantly phrased it.

Thor I. Fossen.

Q. What are some of your research interests?

Thor: My research is focused on robust autonomous vehicles operating underwater, on the surface, and in the air. Important fields of research in this context are autonomy, guidance systems, nonlinear strapdown inertial navigation systems aided by machine vision/GNSS, and motion-control systems.

Q. What courses do you teach relating to control? Do you have a favorite course? How would you describe your teaching style?

Thor: I teach guidance and control of vehicles for master's students and

Profile of Thor I. Fossen

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- *IEEE Control Systems Society experience highlights:* chair, IEEE Oceanic Engineering/Control System Joint Society Chapter, Norway Section 1995–2000.
- *Notable awards:* Fellow, IEEE, 2016; Automatica Prize Paper Award, 2002; The Arch T. Colwell Merit Award at the SAE World Congress, 2008; Fulbright Scholar, 1990.

Thor climbing the Besseggen mountain in Norway.

The UAV Lab at the Norwegian University of Science and Technology (used with permission from Automatisering/Joachim Seehusen).

a Ph.D. course in advanced guidance and navigation systems. My teaching style is informal, and I use PowerPoint presentations and the blackboard to derive equations in more detail.

Q. What are some of the most promising opportunities you see in the control field?

Thor: The transition from automatic control to fully or semiautonomous systems. I believe that future systems will be more intelligent and reduce the need for human intervention. Hence, this will be a major field of research with great impact.

Q. You are the author of five books in the control field. What topics do these books cover?

Thor: I have written three textbooks on guidance, navigation, and control of marine craft. The books focus on control systems for ships, underwater vehicles, and floating structures. The books also include advanced hydrodynamic models that can be used for verification of control systems, design of decision support systems, and computer simulations. In addition to the textbooks, I have been the coeditor, with Prof. Henk Nijmeijer, for two Springer books on the topics of parametric resonance and nonlinear observer design.

Q. What are some of your interests and activities outside of your professional career?

Thor: I love hiking, mountain climbing, downhill skiing, and freeriding. As a Norwegian, these activities are in your genes. We are born with skis attached to our feet. In addition to this, I play soccer, chess, and read books. I also enjoy cooking and wine tasting.

Q. Thank you for your comments.

Thor: You are welcome.