Academic Corner
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In this issue, we interview IEEE SMC member Laura Giarrè. She is a Professor of Control Systems. She earned her Laurea degree summa cum laude in Electronic Engineering from the University of Florence in 1986 and a Ph.D. in System Engineering from the University of Bologna in 1992. In 1987, she worked as a researcher at the Research Laboratory of the Motorways Public Company. Between 1988 and 1993, she was with the Department of Systems and Computer Science at the University of Florence, Italy. From 1993 to 1998, she served as an Assistant Professor at the Department of Computer and Control Engineering at Turin Polytechnic. She then joined the University of Palermo, where she was an Associate Professor from 1998 to 2016. Since 2016, she has been a Full Professor at the Department of Engineering 'Enzo Ferrari' at the University of Modena and Reggio Emilia, Italy. From 2020 to 2022, she also served as an Adjunct Professor at the I.I.R. Department of ICT and Natural Science at the Norwegian University of Science and Technology (NTNU) in Ålesund, Norway. She has held several visiting positions, including at the University of California, Santa Barbara (Fall 1996, Fall 1997, Winter/Spring 1999, Winter and Fall 2006), the Laboratory for Information and Decision Systems at MIT (2015), the Computer Science and Artificial Intelligence Laboratory at MIT (Cambridge), and the Johan Kepler University of Linz, Austria (2018). Her research interests span system identification, control of networked systems, and assistive technology, with a focus on localization, navigation, and obstacle avoidance for visually impaired individuals. More recently, she has also explored opinion dynamics modeling and control. She currently serves as the Chair of the IEEE Italian Chapter of the System, Man, and Cybernetics Society and is a member of the scientific board of the Fondazione Ampioraggio.

(1) What inspired you to pursue system identification, robust control, and networked systems?
I started my Ph.D. studying system identification and adaptive control. I have been passionate about System Theory since my undergraduate studies because I enjoy using mathematics and physics in a concise way to describe the world. I love modeling not only physical systems but also relationships, ideas, and economic structures. When I moved to the Polytechnic University of Turin as a research assistant in 1993, my mentor, Prof. Milanese, proposed a problem and allowed me to work on it autonomously. The problem was related to robust identification—in other words, identifying not just a single model from data but a set of models, as required by robust control. I became passionate about this topic. It is crucial to understand the scope of a model before choosing one method over another. The key difference between adaptive control and robust control lies in whether one controls a set of models or a single model with time-varying parameters. The identified model must be determined based on different assumptions about the noise affecting the data and depends on the prior knowledge available. Most of my ideas came from exchanging and discussing research topics with international colleagues. I also spent some time in California, in Santa Barbara at UCSB as a visiting professor before moving to the University of Palermo in 1998. One of my Ph.D. students, Dario Bauso, after a period at UCLA, introduced me to the emerging topic of networked control. Since then, this has been one of my main research areas with applications to telecommunication, robotics, wearable sensors, smart mobility, smart health, and smart cities.

(2) What do you see as the biggest challenges in robust system identification and control today?
I firmly believe that the more we understand a system, the better the model we develop will explain the collected data. A model predictive capability lies in its ability to accurately describe data beyond what was used to determine it. While AI applications are widespread today, I often see them being

overused in control systems. If we have physical knowledge of a system, we should leverage it. As we say in Italian, 'there is no need to shoot an ant with a cannon' – meaning we shouldn't use an excessively complex tool for a simple problem. The real challenge is learning when and how AI can be beneficial for control, or better yet, how control theory can enhance AI. For example, since XAI (Explicable AI) aims to bridge the gap between AI's complex decision-making and human understanding – enhancing accountability and fairness – it would be interesting to integrate it with control theory. This combination could provide more interpretable and reliable autonomous systems, especially in areas like robotics, industrial automation, and adaptive decision-making.

(3) How do you see the future of networked systems, smart grids, and consensus protocols evolving over the next 5-10 years?

Many of the advancements in networked systems have been driven by the various wars and conflicts of our time. As telecommunications have become smarter and more efficient, connectivity now permeates every aspect of our lives. Distributed control, which initially emerged for sensor networks, has become a reality in many everyday applications – from smart vehicles to smart cities to smart agriculture. Applications that focus on people's well-being already exist and will continue to develop, for example, in the fields of health and workplace safety. Yet, I firmly believe that technology should ultimately serve a greater purpose – contributing to the creation of a more sustainable society.

(4) How has your experience across academia and industry shaped your research?

This is a win-win scenario, as both industry and academia can gain from collaboration. In my experience, academics should focus on proposing new methodologies and technologies rather than tailoring research exclusively to industrial demands. At the same time, engaging with industry challenges provides valuable opportunities for innovation and problem-solving. During my career, I founded a startup, and I believe that entrepreneurship plays a crucial role in driving innovation and bringing new ideas into society.

(5) What advice would you give to young researchers aspiring to work in system control and AI-driven networked systems?

Always follow your interests rather than simply chasing what is trendy at the moment. Find a research question that truly intrigues you and pursue it with passion. Moreover, being multidisciplinary is the key to success. If you stay confined to your office or only interact with colleagues who share your background, you limit your perspective. Go abroad, attend conferences, and listen to seminars – even if they seem unrelated to your field. Expanding your horizons will undoubtedly make your mind more creative and productive. I have been exposed to various environments, both abroad (UCSB in California, MIT in Massachusetts, JKU in Austria, NTNU in Norway) and in Italy (Florence, Turin, Palermo, Modena), which has greatly broadened my perspective, both in life and in research.

(6) How important is international collaboration in advancing research, and how can young academics engage in it?

I believe that establishing national and international collaborations has been incredibly important for both my students and me. Being part of global research networks is always a key factor for success. Young researchers also need to learn how to write grant proposals, as this skill will be valuable for their careers, both in academia and industry. I am currently passionate about mentoring young researchers, especially women, to support them in advancing their careers. My advice is always to overcome self-doubt and build confidence, as strong networks and inspiring role models play a crucial role in this journey.