Technical Committee on Behavioral Systems and Control Theory

This column focuses on the activities of the IEEE Control Systems Society (CSS) technical committees (TCs). In addition to providing information about the activities of a selected TC, the column is a call for participation and contributions by researchers with related interests. For information about joining a CSS TC, please contact either the chair of the TC or the CSS VP-Technical Activities. A list of TCs and contact information can be found on the Technical Activities portion of the CSS Web site http://www.ieeecss.org/

As IEEE CSS vice president of Technical Activities since January 2009, it has been my privilege to work with many distinguished individuals in the community. Please contact me at samge@nus.edu.sg if you have any thoughts, ideas, or comments to make our TCs more vibrant, exciting, and to better serve you and the community.

The Technical Committee on Behavioral Systems and Control Theory (TCBST) is responsible for promoting, coordinating, and organizing activities sponsored by the CSS in the areas of behavioral systems theory and control. Behavioral systems theory, which was pioneered by Jan Willems as a theoretical framework for the modeling and analysis of systems, encompasses the classical transfer-function and state-space approaches. This theory poses a set of trajectories that satisfy the laws of the system, its properties, and the way in which these properties are reflected, whether in transfer functions, state space, or systems of partial differential equations, as the central object of study. In some situations the transfer-function point of view is not applicable, for example, when viewing a system as a “signal processor” transforming inputs to outputs is untenable on rational grounds. The shortcomings of the state-space approach are no less evident; for example, state-space descriptions are not available for multidimensional systems; moreover, properties such as controllability and observability, which are related to the essential nature of a system, are instead highly nonintrinsic when defined as properties of a particular state-space representation.

The adoption of the behavioral paradigm has fostered a great deal of work in the classical tradition of the mathematical sciences, making possible a precise and logically consistent formulation of general principles of dynamics as well as fundamental properties of dynamical systems. The behavioral approach has been applied to multidimensional systems, coding theory, and the modeling of physical systems. TCBST covers modeling and simulation of physical systems, control, identification, multidimensional systems, coding theory, model reduction and approximation, algebraic methods, and algorithms.

TC ACTIVITIES
TCBST currently has nine core members. The committee comprises several action groups devoted to the organization and promotion of activities and to the gathering and dissemination of information relating to specific research areas. Among these are the action groups on control theory, nD systems, algebraic system theory, coding theory, identification, model reduction, and simulation.

Members of TCBST are involved in the editorial boards of IEEE Transactions on Automatic Control, Automatica, Systems and Control Letters, and Multidimensional Systems and Signal Processing. The main objectives of the CSS TCs are to provide educational opportunities, inform CSS members of advances in control subspecialties, and to provide opportunities for technical discussions. The mission of the CSS Technical Activities Board is to provide technical resources and opportunities for collaboration in the areas of control systems within each TC, across TCs, and beyond our Society, which is achieved mainly through the collective efforts of the 18 CSS technical activities; the contributions from enthusiastic members; and voluntary services of liaison officers, representatives, and members of related committees.

This month’s column, which is based on material provided by Paolo Rapisarda, focuses on the related activities of the IEEE CSS TC on Behavioral Systems and Control Theory (TCBST), which began in 2006.

Shuzhi Sam Ge

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MEET THE NEW IEEE CSM ASSOCIATE EDITORS

Richard D. Braatz

Richard D. Braatz is professor and Millennium Chair at the University of Illinois at Urbana-Champaign, where his research interests are in the robust control of complex, multiscale systems with applications to pharmaceuticals, biomedicine, nanomaterials, and energy systems. He has consulted or collaborated with IBM, Sikorsky Aircraft, Eli Lilly, and Abbott Laboratories and has coauthored more than 200 journal and proceedings papers and three books, including the textbook Fault Detection and Diagnosis in Industrial Systems. Professional service includes the IEEE Control Systems Society (CSS) Board of Governors, chair of the CSS Technical Committee on Industrial Process Control, chair of the Control Systems Technology Outstanding Paper Award Committee, and program chair for the 2010 American Control Conference. He is an associate editor for IEEE Transactions on Automatic Control, Automatica, and the Journal of Process Control, and he is editor-at-large of Optimal Control Applications and Methods. Honors include the Donald P. Eckman Award from the American Automatic Control Council, the Antonio Ruberti Young Researcher Prize, the IEEE Transactions on Control Systems Technology Outstanding Paper Award, and two Journal of Process Control Prize Paper awards. He is Fellow of the IEEE and IFAC.

Daniel E. Davison

Daniel E. Davison received the B.A.Sc. in engineering science from the University of Toronto in 1992 and the M.A.Sc., also from the University of Toronto in 1994. He received the Ph.D. from the University of Michigan, Ann Arbor, in 1997. From 1997 to 2000, he was a research associate at the University of Cambridge in the United Kingdom, where he worked on the control of emissions from internal combustion engines. In 2000 he joined the Department of Electrical and Computer Engineering at the University of Waterloo, Canada, where he is currently an associate professor and the associate chair for undergraduate studies. He is interested in many aspects of control systems, especially dynamics that occur in social, economic, and life sciences. His current research is motivated by dynamics and control problems connected with social-psychological systems.

Mason Peck

Mason Peck is a member of the Mechanical and Aerospace Engineering faculty at Cornell University, where he also teaches in Cornell’s Systems Engineering program. His Ph.D. in aerospace engineering is from the University of California, Los Angeles, and he has a master’s in English from the University of Chicago. His research focuses on spacecraft dynamics and control. He has authored or coauthored 23 refereed journal articles, 46 reviewed conference papers, and 17 patents in the United States and the European Union. He spent 15 years as an aerospace engineer and consultant, working with Boeing, Northrop Grumman, Lockheed, and Goodrich. Recent research projects include the CUSat in-orbit inspection technology demo, a satellite built at Cornell and expected to launch through AFRL’s University Nanosatellite Program; spacecraft dynamics and control at the microscale, a study of microchip-size spacecraft; and gyroscopic robotics, a study of robotic actuation through workless constraint torques, which was demonstrated on NASA microgravity flights.

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Processing, as well as in the program committees of the IEEE Conference on Decision and Control (CDC) and Mathematical Theory of Networks and Systems (MTNS). Invited sessions on behavioral system theory are regularly organized by TCBST members at the IEEE CDC, at the MTNS symposium, and at the International Federation of Automatic Control (IFAC) World Congress. Please see the Web page http://users.ecs.soton.ac.uk/pr3/ieee/index.html for announcements of upcoming events.

CONTACT INFORMATION

CSS members interested in participating in TCBST are encouraged to contact the committee coordinator, Paolo Rapisarda, of the University of Southampton, United Kingdom, at pr3@ecs.soton.ac.uk. More information can be found at http://users.ecs.soton.ac.uk/pr3/ieee/index.html.