HYSCOM and HYCON

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This column is the third of a new department that focuses on the activities of the IEEE Control Systems Society (CSS) technical committees (TCs). In addition to providing information about TC activities, the column is intended to serve as a call for participation by readers with related interests. Please contact me at farrell@ee.ucr.edu for information about joining a CSS technical committee.

The objectives of the IEEE Control System Society (CSS) technical committees (TCs) are to provide educational opportunities, inform CSS members of advances in control subspecialties, and facilitate technical discussions. This issue's column focuses on the activities of the IEEE CSS Hybrid Systems TC (HYSCOM). The activities of HYSCOM are strongly connected with the activities of the European Network of Excellence on Hybrid Systems HYCON. The activities of HYCON started officially in September 2004. Their Web site is http://www.dii.unisi.it/~hybrid/ieee.
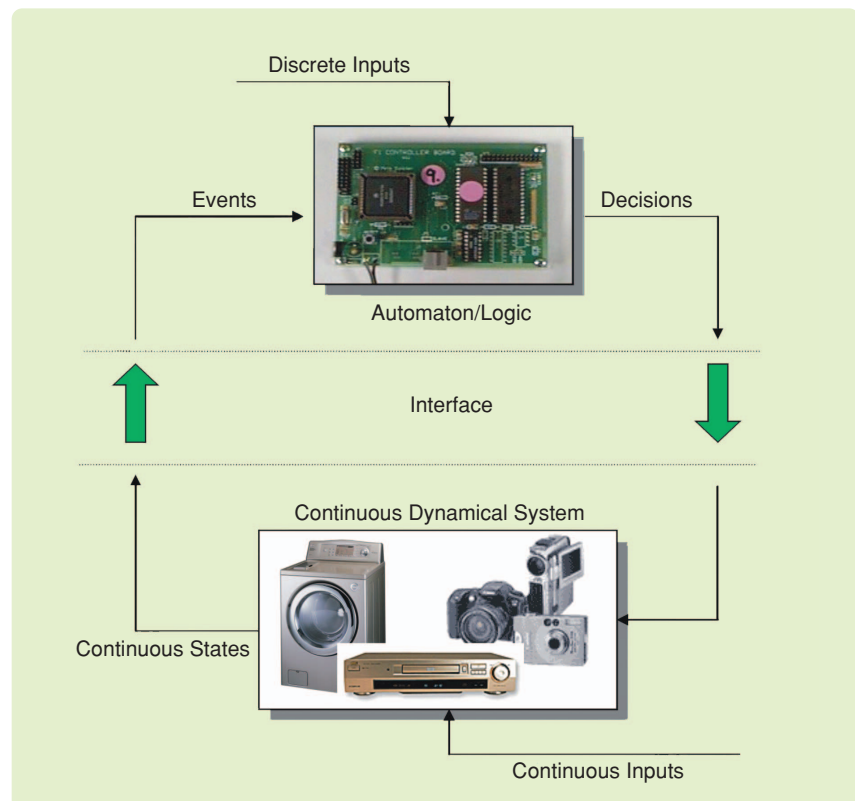
HYBRID SYSTEMS FOCUS

Recent technological innovations have stimulated considerable interest in the study of dynamic systems having a combined continuous and discrete nature. Such *hybrid systems* are characterized by the interaction of continuous parts, governed by differential or difference equations, and by discrete parts, described by finite state machines, if-then-else rules, and propositional and tempo-

ral logic. Hybrid systems switch between various operating modes where each mode is governed by its own dynamical laws. Mode transitions are triggered by variables crossing specific thresholds (state events), by the elapse of certain time periods (time events), or by external inputs (input events). Typical hybrid systems are embedded systems, constituted by dynamical components governed by logical/discrete decision components. Application areas of hybrid systems include automotive, manufacturing, communication networks, aerospace, robotics, systems biology, traffic control, and chemical processes.

Hybrid systems require interdisciplinary approaches exploiting formal methods in computer science, control theory, and operations research. The development of a theory and general tools for controller synthesis, verification, stability, and performance analysis, are yet far from being mature.

TC ACTIVITIES

Each year HYSCOM organizes various educational events. Recently, the Second HYCON Ph.D. School on Hybrid Systems was held in Siena (Italy) on July 16–19, 2007. The school was targeted at researchers wanting to learn the main concepts of hybrid systems as well as those already

working in the field of hybrid systems. The topics that were discussed included modeling, mathematical properties, stability and stabilization, simulation, reachability analysis and verification of safety properties, observability and state estimation, networked and embedded control systems, model predictive control, identification, diagnosis, stochastic models, and the use of hybrid tools in industrial applications. The school, coordinated by A. Bemporad and M. Heemels, was attended by about 90 students from around the world. It was supported by the European Network of Excellence HYCON, by the University of Siena, and by the IEEE CSS. The speakers' lecture notes are publicly available on the Web site of http:// www.dii.unisi.it/hybrid/school07.

The 10th Conference on Hybrid Systems: Computation and Control, organized by A. Bemporad, A. Bicchi, and G. Buttazzo, was held in Pisa, Italy, on April 3–5, 2007. The conference was attended by 130 registrants from 16 countries. The proceedings were published by Springer-Verlag.

The International Curriculum Option of Doctoral Studies in Hybrid

Second HYCON Ph.D. School on Hybrid Systems.

Control for Complex, Distributed, and Heterogeneous Embedded Systems (ICO), cofunded by the Italian Ministry of Education, University, and Research and HYCON, is a convention of international interuniversity cooperation between several European and U.S. universities aimed at creating a joint curriculum on hybrid systems.

Ph.D. candidates are monitored by the ICO board. A Ph.D. dissertation award was given in 2007 to M. Lazar and A. Chaillet. Thirty-three Ph.D. students are currently enrolled in ICO. For more information see the Web site http://www.piaggio.ccii.unipi.it/ICO/ICO.htm.

The HYCON-EECI Graduate School on Control, which was held in Paris at the European Embedded Control Institute from February 12, 2007 to April 27, 2007, consisted of ten independent modules, one module per week (21 hours). Each module was attended by 15 students on average. For more information see http://www.ist-hycon.org/EECI-docs/EECI-Modules9.pdf.

CONTACT INFORMATION

HYSCOM is chaired by A. Bemporad. For more information about academic and industrial research groups working on hybrid systems as well as additional technical resources, please visit the TC Web page http://www. dii.unisi.it/~hybrid/ieee. CSS Members interested in participating in HYSCOM are welcome to contact the committee chair at bemporad@dii.unisi.it.

Attendants of the Second HYCON Ph.D. School on Hybrid Systems.