

Control Education Technical Committee

The work of the IEEE Control Systems Society (CSS) Technical Committee (TC) on Control Education is focused on

- » promoting control with its cross-boundary nature as a field that spans science, technology, engineering, and mathematics (STEM)
- » providing students at all levels, including precollege, undergraduate, graduate, and post-graduate, the opportunity to explore the world of control engineering
- » organizing workshops and special sessions on education that bring academia and industry together to facilitate learning experiences to attract students to control engineering
- » communicating to the public at large about the control field
- » engaging all TCs in control education issues and activities
- » organizing semiannual meetings of the committee and using them as a platform to promote the control field.

THE LEADERSHIP TEAM

The TC is chaired by Ljubo Vlacic (Australia) with deputy chairs (in alphabetical order) Bonnie H. Ferri (United States) and Bozena Pasik-Duncan (United States).

There are currently 29 academics and students who are actively involved in the activities initiated and organized by the TC. The TC website has recently been moved to its new address (<http://control-education.ieeecss.org/>) thanks to the work of Maria Prandini, Bozena Pasik-Duncan, and Cody E. Clifton. This website points to some control education resources that have been contributed by committee mem-

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Participants listen intently at the 2014 Oregon workshop.

bers. Readers are encouraged to review the site and contact any of the committee's leadership team if they wish to participate with the committee and its activities.

MOST RECENT ACTIVITIES

The following is a list of workshops initiated and organized by the TC's leadership team. The TC's website has some workshop material available. Please contact the TC chair if you wish to participate in future workshops and/or initiate a new workshop on an education topic.

The TC Deputy Chairs Bonnie H. Ferri and Bozena Pasik-Duncan continued their tremendously fruitful work with passion and great enthusiasm. Thanks to them, the committee is proud to be able to report the following highlights.

American Control Conference (ACC) Workshop on Ubiquitous Hands-On Learning: The Future of Engineering Education

June 3, 2014, Portland, Oregon,
Sponsored by NSF, Digilent, and
National Instruments

Authentic hands-on lab activities are very effective in improving student learning and the retention of knowledge. Touch, in particular, may be underappreciated as a component in student learning since it can increase students' long-term memory and recall of the displayed phenomena. Experiential learning, via hands-on experiments, can influence memory and recall. However, experiments are generally relegated to centralized laboratories during three-hour blocks of time.

The development of inexpensive and portable USB-powered oscilloscopes, function generators, micro-controller boards, and other portable electronic equipment, coupled with software running on laptops, has facilitated a new model of engineering education where hands-on experiences can be done ubiquitously, anytime and anywhere. Students can explore the theoretical concepts introduced in lectures with laboratory-type experiences either immediately in the classroom or at home, rather than waiting for a scheduled laboratory time.

This workshop provided attendees with an overview of the pedagogy and

the logistical models for implementing hands-on learning. The theory of experiential learning was exploited to show how and when experiments should be used to enhance the understanding of theory in lecture-based classes.

ACC14 Invited Session on Control Education

June 5, 2014, Portland, Oregon

The papers included in this invited session showed cutting-edge pedagogies applied to courses in systems and control. The pedagogies included experiential education and problem-based learning. Some of these papers arose out of work performed for NSF grants on engineering education. Five of the papers exploited experiential learning, where hands-on activities allowed students to experience a new perspective on the topic being taught. The sixth paper showed how a standard senior-level control course could be taught using a problem-based learning approach.

The session attracted approximately 75 people, showing a large interest in the topic of control education. The TC on Control Education encourages people who are interested in contributing papers to invited sessions on control education to contact the TC leadership team for information on opportunities at future conferences.

The Beauty of Controls Workshop for Middle and High School Students and Teachers

June 3, 2014, in Conjunction
with ACC14

This outreach event was designed to increase the general awareness of the importance of systems and control technology and its cross-disciplinary nature among middle and high school students and teachers. Control is used in many common devices and systems: cell phones, computer hard drives, automobiles, and aircraft, but is usually hidden from view. The control field spans science, technology, engineering, and mathematics (STEM).



Attendees at the 2014 Oregon workshop.

The success of all STEM disciplines depends on attracting the most gifted young people to science and the engineering profession. Early exposure of middle and high school students and their teachers is a key factor. The goal of these outreach efforts was to promote an increased awareness of the importance and cross-disciplinary nature of control and systems technology.

The workshop included presentations by control systems experts, informal discussions, and the opportunity for teachers and students to meet passionate researchers and educators from academia and industry. The talks were educational, inspirational, and entertaining. All participants received certificates of participation.

The Beauty of Controls Workshop for Middle and High School Students and Teachers

June 17, 2013, in Conjunction
with ACC13

The session brought attention to the fact that long before NSF was concerned with K-12 education, our control community had the idea that high school teachers and their students should be made aware of and become involved in the basic ideas of control theory. The idea was that education is, at all levels, an inclusive process. It should integrate scholarship, teaching, and learning both horizontally and vertically. A model was developed that has been followed by other organizations and societies. It has established a sustainable outreach partnership among the control communities and school districts at the places where major conferences are held. (In addition to this workshop, a

special session on the history of workshops was held on June 19, 2013.)

The talks at the workshops for middle and high school students and teachers serve as a model for developing the best presentations by young researchers. The session attracted young researchers who are seeking the opportunity to make their contributions to the CSS and AACC outreach programs as well to their local communities.

During the last 15 years, over 150 speakers have been involved in the series of workshops. The TC website contains a list of all workshops, its programs, and presenters. This history of Workshops for Middle and High School Teachers and Students is a success story and there is so much to be learned from it. A brochure on the history of the workshops and special sessions is in the final stages of preparation, and it will be presented at the Panel and Discussion Session at the upcoming ACC in Chicago. Both events at ACC13 were very well attended and well received.

PARTNERSHIP WITH IFAC TECHNICAL COMMITTEE ON CONTROL EDUCATION

A partnership with the IFAC Technical Committee on Control Education (established at the IFAC World Congress in Barcelona, July 2002) has been strengthened and close collaboration has been developed around the IFAC series of control education symposia.

Ljubo Vlacic, *Chair*
Bonnie H. Ferri, *Deputy Chair*
Bozenna Pasik-Duncan,
Deputy Chair

