White Rose Research Online

eprints@whiterose.ac.uk
https://eprints.whiterose.ac.uk
Universities of Leeds, Sheffield and York

Deposited via The University of Sheffield.

White Rose Research Online URL for this paper:
https://eprints.whiterose.ac.uk/id/eprint/147245/

Version: Accepted Version

Article:
Rossiter, J., Pasik-Duncan, B., Visioli, A. et al. (2019) Technical committee on control education. IEEE Control Systems Magazine, 39 (4). pp. 20-22. ISSN: 0272-1708

https://doi.org/10.1109/MCS.2019.2913489

© 2019 IEEE. Personal use of this material is permitted. Permission from IEEE must be obtained for all other users, including reprinting/ republishing this material for advertising or promotional purposes, creating new collective works for resale or redistribution to servers or lists, or reuse of any copyrighted components of this work in other works. Reproduced in accordance with the publisher's self-archiving policy.

Reuse
Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

Takedown
If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

UNIVERSITY OF LEEDS
University of Sheffield
UNIVERSITY of York

IEEE Technical Committee on Control Education

J. A. Rossiter, B. Pasik-Duncan, A. Visioli, A. Serbezov, K. Zakova, M. Huba, S. Dormido

The IEEE technical committee on control education (http://control-education.ieeecss.org/control-home) works very much in partnership with the corresponding IFAC TC 9.4 (https://tc.ifac-control.org/9/4/wellcome), and indeed much of the membership is shared. The main focus is unsurprisingly, the development and dissemination of best practice in higher education engineering teaching, with a specific focus on topics strongly linked to control (e.g. signal processing, feedback, modelling, systems analysis, identification, laboratory design and delivery and so forth). A secondary but equally important focus, which is more evident within the IEEE TC, is outreach, that is, activities which communicate the importance and excitement of our topics to the youth and their school teachers. The committees are always keen to welcome new members who have an enthusiasm for control and effective communication/teaching.

In terms of the core activities, the members of the two committees have an enthusiasm to ensure that control education retains a high profile in the control community, as it impacts on nearly all of us. The obvious mechanism is dedicated education sessions at the major conferences such as the annual American Control Conference, the Conference on Decision and Control, European Control Conference and the triennial IFAC world congress, as well as of course at a number of smaller conferences as the opportunities arise. Moreover, the committees have prime responsibility for the organisation of the triennial IFAC Symposium on Advances in Control Education (https://ifac-ace2019.org/); this year in parallel with ACC in Philadelphia.

Figure 1: Delegates in Bratislava at IFAC ACE in 2016.

Of course, in addition to the routine paper submissions, education is often best disseminated using other means and thus the members are active in proposing and delivery alternative contributions such as:

- Panel sessions e.g.: Preparing Tomorrow's Scientists and Engineers for the Challenges of the 21st Century (IFAC world congress 2017), Your Research Sharing through Outreach (IFAC world congress 2017), What is an ideal undergraduate control curriculum (PID 2018), A First Course in Feedback, Dynamics and Control: A Survey for the Global Control Community (ACC 2019).
- Demonstrator sessions of teaching concepts, tools and laboratories, e.g.: IFAC world congress 2008 &2017, UKACC Control 2018, ACE 2016 & 2019.

Figure 2: Delegates from the panel session at the PID event in Ghent, May 2018.

Current discussions include the planning of a demonstrator session at the world congress in Berlin 2020 (https://www.ifac2020.org/) and we encourage all readers to consider what they could showcase to their colleagues to help us all improve our practice.

The IEEE TC in particular has been enormously active in arranging outreach events on a regular basis in order to inspire and educated everyone about control and enthuse the youth enough to consider engineering as a career option. Some recent examples include:

- An IEEE Young Professionals/ WIE Workshop is planned to be held at ACE 2019.
- Workshop for Middle & High School Students and Teachers at ACC 2018: The Power, Beauty and Excitement of Cross-Boundaries Nature of Control, a Field that Spans Science, Technology, Engineering & Mathematics (STEM).
- HS Special Session organized jointly with AACC TC on Education at ACC in Seattle (2017): http://a2c2.org/news/2017/2017-acc-stem-workshop-middle-high-school-students-teachers
- 15th Anniversary Workshop for High School Students and Teachers: The Power, Beauty and Excitement of the Cross-Boundaries Nature of Control, a Field that Spans Science, Technology, Engineering & Mathematics (STEM), ACC, Chicago, IL, July 1, 2015.
- Workshop for High School Students and Teachers: The Power, Beauty and Excitement of the Cross-Boundaries Nature of Control, a Field that Spans Science, Technology, Engineering & Mathematics (STEM), CDC, Los Angeles, CA, December 15, 2014.
- Workshop for Middle and High School Students and Teachers: The Beauty of Controls, ACC, Portland, OR, June 3, 2014 .
- Special Session: History of Workshops for Middle and High School Students And Teachers: Ideas and Technology of Control Systems, ACC, Washington, D.C., June 19, 2013.

There are also current plans to deliver an event at the world congress in 2020: **Control Engineering Workshop for Girls – Solving Today's Problems,** The benefits of the workshop are expected to be as follows:

- Focusing on women in control engineering through example;
- Bringing girls to the university and showing them they can solve problems;
- Promoting control engineering education in a diverse and inclusive environment.

One lesser known focus of the two TCs is the collation and management of control resources for the community. This has been an agenda item for over a decade and indeed some early work produced a template website (no longer supported) as long ago as 2008 for demonstration at the IFAC 50 year celebration and later on, a more organised repository (https://tc.ifac-control.org/9/4/repository) has been kindly hosted by Francisco Candelas (Spain) on behalf of the global community. Going forward, committee members have canvassed senior members of the IEEE and IFAC and there is now a provisional commitment to develop a more sustainable repository of resources; this project is being led by Jacquelien Scherpen. Clearly, the two TCs will then

play a core role in adding high quality education and dissemination resources to this repository.

Figure 3: Delegates in Brescia at IFAC IBCE in 2015.

Both committees meet in person whenever it is practical to do so to discuss major decisions and strategy. At the more recent meetings, it was determined that a core and potentially deliverable focus was linked to the curriculum. There are two main aspects to this project.

- Most engineers will do one, or perhaps two control courses during their undergraduate studies, but there is a lack of clarity over which topics should be prioritised in such courses and thus decisions may be taken at a local level. It was felt that we could support this decision making by collating the thoughts of the global community, both academics and industrialists. Thus, a current project has been developing a questionnaire to extract this information. The intention is to release the questionnaire in the summer of 2019 and report the results at the world congress in 2020. It is noteworthy that this project is also a priority for the 'Industrial Liaison TC members of IFAC' (Establish the core competencies and key skills that industry expects for entry-level control positions at BS, MS and PhD levels.).
- A secondary aspect depends partially on the first. That is, once we have identified the priority topics, can we identify, collate and deliver high quality resources which staff can use to support their students? Clearly, this aspect goes hand in hand with the repository project.

As a final point, it may be interesting for readers to have some quick insight to the world leading work of the members on virtual and remote laboratories (VRLs) development. The increasing power of the web and software tools allows us to deliver educational solutions that were almost unimaginable just 20 years ago. Access to laboratory activities is a core bottleneck for engineering students, and thus any expansion of this which removes timetabling, space and equipment restrictions is to be welcomed. Teaching automatic control is challenging since it

is a discipline with a very dynamic evolution and whose nature is cross-disciplinary. VRLs fit particularly well into this scenario, since they enable opportunities without precedents for large-scale sharing of experimentation resources, and thus they can provide students with access to a wide variety of labs. Several TC members have made this area their priority [1,2] and have produced tools now used far beyond their own institutions.

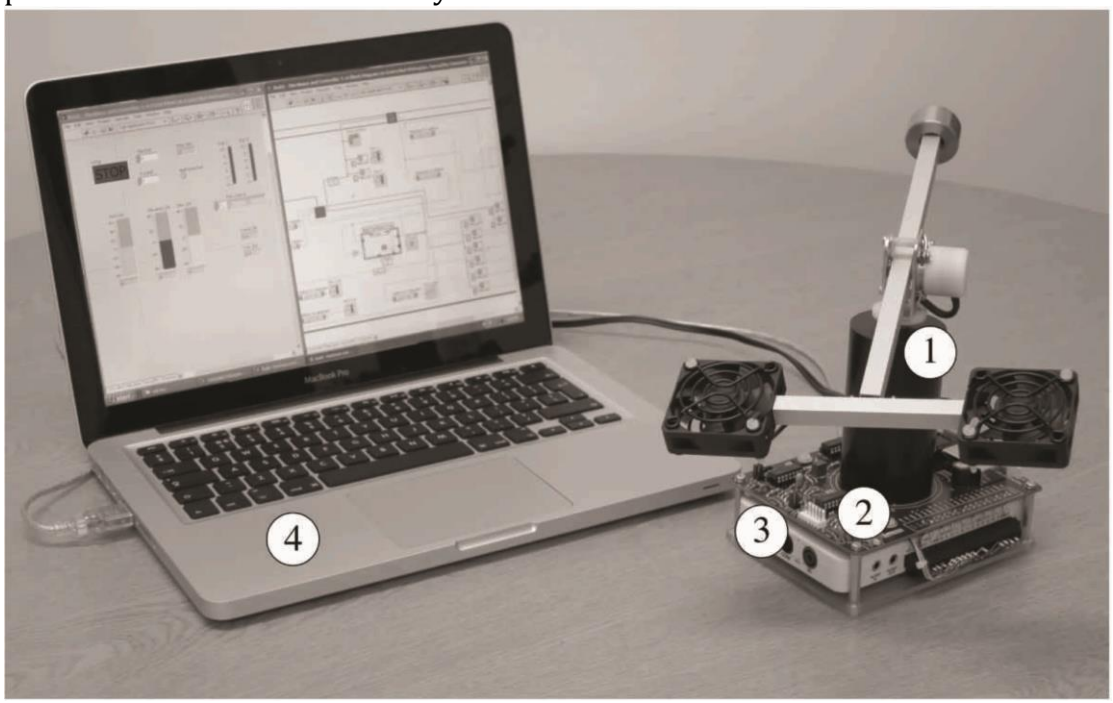

Figure 4: Example of a take home helicopter kit [1] which students can connect to their laptops via a USB

To summarise, the work of these two TCs is dependent primarily on the energy of the members. There are a variety of positive contributions that we can make to the global community and these are primarily limited only by the time of the members. We welcome new members who feel they can contribute and support the work or indeed, feel we can usefully add to the current list of priority activities.

[1] Good Practice in Control Education, J.A. Rossiter, B. Pasik-Duncan, S. Dormido, L. Vlacic, B. Jones, and R. Murray, 2018, European Journal of Engineering Education, http://dx.doi.org/10.1080/03043797.2018.1428530
[2] R. Heradio, L. de la Torre, S. Dormido. "Virtual and Remote Labs in Control Education: A Survey", *Annual Reviews in Control*, 42, 2016, 1-10, doi: 10.1016/j.arcontrol.2016.08.001