

developments in the nonlinear control area but also helped promote the field in Japan.

The vitality of the research area of TCNSC is evident from the number of papers and sessions devoted to nonlinear systems and control at the CDC and ACC. Challenging and interesting problems with practical motivations always emerge in various topics of nonlinear systems and control. The TCNSC

will continue to support the exchange of ideas and help its members discover solutions. In addition to organizing sessions on state-of-the-art development at conferences, TCNSC will also help its members realize ideas of providing educational opportunities such as tutorial sessions and workshops. TCNSC will also work on further cooperation with the IFAC Technical Committee on Nonlinear Control Systems to share ideas to

promote the area of nonlinear systems and control more effectively. For more information, please visit the TCNSC website at <http://nonlinear-systems-and-control.ieeeccs.org/nonlinear-home>. CSS members interested in participating in TCNSC are encouraged to contact the committee chair at hiroshi@ces.kyutech.ac.jp.

Hiroshi Ito

Technical Committee on Variable Structure and Sliding-Mode Control

The pioneering work on variable structure and sliding-mode control (VS&SMC) was started in the Soviet Union in the 1950s. In the late 1970s, after the publication of the books [1], [2] and the tutorial [3], the robustness properties of variable-structure control attracted the attention of the international control community.

The first step in the consolidation of an international VS&SMC community was the Variable-Structure Systems (VSS) Workshop, which was held in 1990 in Sarajevo, Yugoslavia. Prof. Asif Sabanovic played a key role in organizing the workshop. This workshop established, within the VS&SMC community, the tradition of holding a meeting every even year. Another tradition started in Sarajevo: the publication of a book with selected chapters devoted to current problems and topics in VS&SMC systems. The second workshop, held in 1992 in Sheffield, was organized by Prof. Alan Zinober together with some of the nonlinear control community. The next workshop on VSS and Lyapunov design

The other TC tradition is the publication of a book with selected chapters reflecting the principal directions in the development of VS&SMC theory.

was organized by Prof. Luigi Glielmo and Prof. Franco Garafalo in Benevento, Italy. This was another key point in the “life” of the VS&SMC community. During this workshop, a decision was made to organize VSS workshops separately. The VSS96 workshop was subsequently held in Tokyo and organized by Prof. Hideki Hashimoto.

The creation of the Technical Committee (TC) on VS&SMC was approved during the IEEE Conference on Decision and Control (CDC) in 1997 with cochairs Prof. U. Ozguner and Dr. K.K. David Young. From 2000 until 2006, the TC was chaired by Prof. V. Utkin, in 2006–2008 by Prof. A. Sabanovic, and from 2009–2014 by Prof. Sarah Spurgeon.

OBJECTIVES OF THE TC ON VS&SMC

The main goal of the TC is the coordination of scientific groups working

in the field. The principal decision of the TC is the place, dates, and the organizers for biannual VSS workshop. The 13th IEEE VSS Workshop, held in Nantes, France in June 2014, was chaired by Prof. A. Glumineau and Prof. F. Plestan, and the 14th VSS Workshop will be in June 2016 in Nanjing, China, chaired by Prof. X. Yu and Prof. L. Fridman.

TC ACTIVITIES

The other TC tradition is the publication of a book with selected chapters reflecting the principal directions in the development of VS&SMC theory. Since 1999, a total of nine books have been published. Another way to organize cooperation between the groups is the publication of special issues devoted to general or specific features. At least 14 special issues have been published based on VSS workshop material.



The closing ceremony of VSS 2014.

Another activity is the organization of special sessions during the CDC. The TC coordinates special sessions during the CDC each odd year. The last two sessions were “Lyapunov methods for Second-Order Sliding Modes” at CDC 2013 and “Continuous Higher-Order Sliding-Mode Controllers” at CDC 2015. These were organized by Prof. J. Moreno and Prof. L. Fridman.

EDUCATION

One of the most important goals is the education of Ph.D. students and young researchers. Courses on VS&SMC have been given by Prof. V. Utkin and Prof. C. Edwards within the framework of the European Embedded Control Institute. In 2015, we organized a series of schools on VS&SMC in Aussois, France, June 7–12, and in Nanjing, China, August, 24–29. We have also obtained CSS support for the organization of a VS&SMC school 2016, in Mumbai, India. Extended editions of the textbook [4] and the new textbook [5] covering recent results in the field have been published.

CHALLENGES

The TC guidelines mention that the committee should design (if they do not exist) and track the existing Wikipedia articles. How is the TC VS&SMC working with *Wikipedia*? There are two problems with this goal. The first

is that at least six articles devoted to VS&SMC already exist on *Wikipedia*. The most difficult problem is to correct already existing web pages or at least to make revisions/comments on already existing pages. The second problem is the need to write new articles devoted to recent advances in VS&SMC. We have already discussed the list of articles, and I have in principal discussed this with potential authors. I think this should be one of the most crucial targets for the TC over the next 2–3 years.

INFORMATION AND EDUCATIONAL MATERIAL

The TC guidelines mention that TC web page should include information helpful for people wishing to learn about the field. How is this reflected on TC VS&SMC web site? Due to copyright restrictions, it is only possible to

put links to relevant papers on the website, which is done in the section ‘useful links’ <http://variable-structure.ieeecss.org/tc-variable-structure/useful-links>. Beginners will find links to *Wikipedia* articles with descriptions of the basic notions and initial references. There is also information about recently published books, textbooks, and tutorials in the field on the TC website. The events section (<http://variable-structure.ieeecss.org/tc-variable-structure/events>) has links to the schools organized by the TC and the web sites of the schools contain presentations by the invited speakers.

NEW IDEAS

There have been discussions about how to make a Matlab toolbox for VS&SMC design. There have been numerous attempts to design such a toolbox but the TC as a professional



Prof. V. Utkin (center) with VSS16 cochairs Prof. Xinghua Yu (left) and Prof. Leonid Fridman.

community should have a common platform. To make such a toolbox, significant intellectual and organizational work must be done and consensus between principal experts in the field should be found. Moreover, a project should be found to pay the programming engineers. The other interesting idea we are discussing in the VS&SMC TC is the design of a laboratory with experimental benchmarks on which any researcher can test their algorithms and compare it with other designs by just submitting Matlab code.

A special situation will occur in the foreseeable future, in that some members of the VS&SMC community, such as Prof. G. Bartolini, Prof. B. Drazenovic, Prof. K. Furuta, Prof. A. Glumineau, Prof. L. Hsu, Prof. O. Kaynak, Prof. A. Sabanovic, Prof. U. Ozguner, Prof. A. Zinober (and others), will have retired or are about to retire. It is important to remark that the workshop Recent Advances in Sliding Modes (RASM 2015) was organized in Istanbul, Bogazici University, April 9–11, 2015 to celebrate Prof. Okyay Kaynak.



An announcement of VSS 2016 at the end of VSS 2014 (from left): Prof. F. Plestan, Prof. S. Li, Prof. L. Fridman, and Prof. A.A. Glumineau.

COLLABORATIONS

The VS&SMC-like scientific fields were born when frequency-switching devices started to be available, and power electronics was one of the first and most important application fields. That is why a large number of the TC members are also members of the IEEE Industrial Electronics Society (IES). Moreover, Prof. Xinghua Yu (a member of the TC on VS&SMC) is actually president elect of the IES and cochair of VSS16 workshop. Some TC members are also members of different International Federation of Automatic Control (IFAC) Committees: 1.2 Adaptive and Learning Systems, 1.3 Discrete-Event and Hybrid Systems, 2.1 Control Design,

2.3 Nonlinear Control Systems, 2.5 Robust Control, and others. There have been special sessions at the last four IFAC World Congresses and at the IFAC meetings NOLCOS, SAFEPROCESS, and ADHS. That is why the VSS workshops are usually sponsored by IEEE CSS, IEEE IES, and cosponsored by IFAC.

JOINING THE TC ON VS&SMC

To join the TC, send an e-mail with your affiliation to Prof. Levant (levant@post.tau.ac.il) asking to be included in the

TC VS&SMC database, which means that you will receive all of the information about the community and are sent proposals, suggestions, and information about new publications. The TC on VS&SMC operates with an Executive Committee that organizes events on behalf of the TC members. Current members of the Executive Committee are listed at <http://variable-structure.ieeeccs.org/sites-member-roster>, and any of them can be contacted with ideas for events or feedback on the existing program. An extensive mailing list of TC members is also maintained and used to promote the committee's activities. Information about the TC on VS&SMC can be found on the TC website: <http://variable-structure.ieeeccs.org/tc-variable-structure/home>.

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Leonid Fridman



Participants in the summer school on sliding-mode control and observation, held in Nanjing, China, August 28, 2015.