SIAG Control and Systems Theory (CST)
Charter Renewal Application

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Control and Systems Theory. The SIAM Council and on July 25, 1986 the SIAM Board of Trustees originally formed the SIAG/CST under the aegis of SIAM on July 20, 1986. Its initial operating period began January 1, 1987 and ended December 31, 1989. Its charter has been renewed by the council and board sixteen times thereafter. This SIAG had 501 members including 195 students as of December 31, 2022.

According to its Rules of Procedure, the objective of the SIAG is to foster activity and interaction between mathematicians, engineers and other scientists interested in control and systems theory. The SIAG plans to encourage further development of theory and methods for the estimation and control of systems.

Within the framework of SIAM, the SIAG will conduct activities that implement its purposes.

Its purposed functions are to organize activities, including conferences, sessions at SIAM meetings, sessions at meetings of other organizations cooperating with SIAM, and publications, to (1) promote interaction between mathematicians, engineers and other scientists interested in control and systems theory, (2) keep SIAM membership up to date on developments in this area, (3) facilitate the development of control and system theory and (4) encourage its application.

The activity group awards two prizes: (1) the SIAM Activity Group on Control and Systems Theory (SIAG/CST) Prize, established in 1997, is awarded every two years to a junior researcher for outstanding research contributions, as determined by the prize committee, to mathematical control or systems theory and (2) the SIAG/CST Best SICON Paper Prize established in 2007. The prize is awarded every two years to the author(s) of the two most outstanding papers, as determined by the prize committee, published in SICON in the two calendar years before the year of the award

The SIAG has complemented SIAM's activities and supported its proposed functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

List all current officers of the activity group (including advisory board, if relevant).

SIAG/CST Executive Board
Chair, Jacquelien Scherpen
Vice Chair, Eduardo Casas
Program Director, Christophe Prieur
Secretary, Weiwei Hu

SIAG/CST Conference Steering Committee
Fariba Fahroo (01/01/20 - 12/31/23)
Wei Kang (01/01/22 - 12/31/26)
William Levine (01/01/20 - 12/31/23)
Kirsten Morris (01/01/20 - 12/31/23)
Hitay Ozbay (01/01/20 - 12/31/23)

1. How is the field covered by the activity group doing? Is it growing, is the focus shifting? What have been the significant advances over the last two years?

   Control and systems theory is an inherently interdisciplinary field with strong connections to both mathematics and engineering. More recently, there has been research in system theory applied in biology, sociology, finance, and quantum, amongst other application areas. Data-based and learning control has entered the field, and stochastic control, which has long been an area of interest in the mathematical control community, plays a more and more important role. A still growing area of interest is control and optimization of networked systems. This area often uses graph theory. In the pandemic, this was a topic of high interest as well and has resulted in a special section in the SIAM Journal of Control and Optimization in 2022. The importance of large networks means that computational issues are important. Computation for large-scale systems is also important in control of systems governed by partial differential equations. The latter developments have been of increased importance in the past decade.

2. How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG stable or increasing? How is the SIAG keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG?

   The activity group membership peaked with 832 total members in 2011, then declined to a minimum of 537 in 2014, and since then, it has steadily rebounded to the 2020 membership of 652. The 2022 membership shows a decline, again to a new minimum of 501 members in December 2022. We can only guess that the decline is due to the COVID-19 pandemic and the corresponding declining visibility. This activity group is one of the smaller SIAGs. While control and systems theory is an important and extremely active area, many researchers in the field are more engaged in other organizations such as the IEEE Control Systems Society (CSS), the International Federation on Automatic Control (IFAC), and the numerous local organizations,

including the European Control Association (EUCA) and the Chinese Association of Automation (CAA).

We maintain fruitful connections with other control-focused organizations. First, SIAM is a (voting) member of the American Automatic Control Council (AACC), “an association of the control systems divisions of nine member societies to represent the United States to the world control community’’. Francesco Bullo is our representative, with Weiwei Wu as a vice-representative from the board. AACC is the national membership organization for the USA inside IFAC. The SIAG CST represents SIAM inside AACC and nominates a member of the AACC Board of Directors; the board meets twice yearly, and numerous subcommittees meet as needed. Second, the SIAG CST chair recommends and then supervises the work of editors for the reviewing of papers submitted to the American Control Conference (ACC). Third, the SIAG CST used to nominate a SIAM liaison to the IEEE Conference on Decision and Control organized by CSS. The tasks of such liaison are currently under debate, and we aim to renew and update the Memorandum of Understanding with the CSS.

Encouraging researchers active in the mathematics of control and systems theory to be SIAG members is a continuing issue. Also, unlike IFAC and (to a lesser extent IEEE), SIAM is viewed as an American organization, and about 3/5 of its members are affiliated with the USA. Some SIAM programs are only open to US universities, such as the new postdoc program, even though the percentage of non-US membership is rising.

To keep up with changes in the field, we have organized a special section in our SIAM Journal on Control and Optimization entitled “Mathematical Perspectives on Control of Quantum Mechanical Systems.” Submissions are accepted from April 1, 2023, to June 30, 2023. We aimed at another special section on a very timely topic entitled “PDE control and machine learning,” and we had high-profile invited guest editors who prepared a proposal. However, SIAM stopped further processing, because it has the idea that too many special sections were organised. It is encouraged, though, to keep a close eye on the topic and consider it for a future special section.

3. Please list conferences/workshops the activity group has sponsored or co-sponsored over the past three years, and give a brief (one sentence or phrase) indication of the success or problems with each.

   The major conference organization of the CST AG is the biennial SIAM Conference on Control and its Applications. Our most successful conference was the 2015 conference held in Paris, with 464 participants and 437 submissions.

   The 2021 meeting was organized online in conjunction with the SIAM Annual meeting. There were 4 invited plenary speakers (Carolyn Beck, Maryam Fazel, Lars Grune, and Asu Ozdaglar), a joint plenary speaker (Rodolphe Sepulchre), and 3 lectures connected to our prizes.

   The 2023 meeting is currently being organized and will take place in July in Philadelphia. There will be 43 MiniSymposia (MS) organized by volunteers affiliated with the CST AG, members of

the Organizing Committee, and volunteers not directly connected to the activity group. Most of the MS will be composed of four 25-minute in-person presentations; additionally, 57 contributed lectures are accepted for a 15-minute presentation at the conference and, after a proper review process by the Program Committee, under the responsibility of the Program Committee Chair, 19 papers were accepted for publication in the proceedings of the conference.

The 2023 CT conference program includes 4 invited presentations from Eduardo Cerpa, Hélène Frankowska, Sonia Martinez, and Benedetto Piccoli, who will deliver plenary presentations. The program is completed by several special sessions, including three prize lectures and four Panel Discussions entitled "AFOSR Mathematics Research – Past, Present, and Future », "Panel on the Future of Applied Math and Control Systems » and "45 Years Later – Control, Diversity, and Inclusion ».

Starting with CT13, we publish conference proceedings. This decision adds to the workload and cost. However, we believe it has contributed to larger participation in CT meetings because many university departments (especially in Engineering) and performance indicators regard proceedings as critical to the significance of a conference. Publication of a paper in the proceedings is optional, and we plan that this practice will continue. For reference, web pages of past CT meetings can be found at, letting “xx” indicates the year of the conference, https://archive.siam.org/meetings/ctxx/

Our activity group regularly organizes sessions at the American Control Conference (sponsored by the AACC). At ACC, papers were submitted under SIAM membership. For the ACC2023 (submission in 2022), 16 papers were submitted, of which 8 were accepted. Because of this effort, we are discussing with the AACC to get registration fee waivers for future ACC attendance of SIAG CST members.

4. Please indicate the number of minisymposia directly organized by the activity group at the last two SIAM annual meetings. When did the SIAG last organize a track at an annual meeting or meet jointly with the SIAM Annual Meeting?

   The SIAM annual meeting 2021 was held jointly with the CT meeting, naturally, the minisymposia organized by our SIAG were scheduled in the CT meeting. The SIAM annual meeting in 2022 was hybrid. The W.T. and Idalia Reid Prize lecture was delivered by Enrique Zuazua about Control and Machine Learning. Furthermore, a few sessions on optimal control were organized.

5. Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?

- SIAM is a member of the American Automatic Control Council. SIAG/CST has members (Francesco Bullo and Weiwei Hu) on the board and organizes the submissions of papers at the annual meeting, as well as serves in an editorial role.
- SIAM i s a sponsoring society for the IEEE CSS Conference on Decision and Control, and we are currently considering a renewal of the Memorandum of Understanding.

- SIAM Activity Group on Control and Systems Theory (SIAG/CST) Prize has been instrumental in promoting rising young researchers. Recipients of the awards can be found at https://www.siam.org/prizes/sponsored/siagcst.php.
- SIAG/CST Best SICON Paper Prize honors the work of mathematical researchers in controls. Recipients of the awards can be found at https://www.siam.org/prizes/sponsored/bestsicon.php.
- W. T. and Idalia Reid Prize. This major career prize is jointly administered by Differential equations and CST AGs. This award is generally awarded to someone in the control theory field.
- The impact of all these awards: CST Prize, best SICON paper and Reid prize is enhanced by plenary prize lectures at the CT conference.
- During 2022, we started to stimulate special sections on highly relevant topics by highly respected researchers in the field for SICON. One was approved, and the next one we aimed for was not brought further despite the topic being very timely and a very high-profile guest editor (winner of the W.T. and Idalia Reid Prize).

6. What activities are planned and proposed for the next period of the charter? Please describe scheduled and suggested future activities in detail.

   We aim to increase the visibility of our SIAG and send out more news letters to our members. We plan to redouble our efforts in soliciting articles for SIAM News to improve our visibility in the applied mathematics community. In 2022, our proposed novel news liaison (Giulia Giordano) was not yet contacted.

7. How can SIAM help the activity group achieve its goals?

   Establish nominating committee for awards and include a comprehensive roster of all volunteers (with role descriptions) on the SIAM website. Continue to allow us to use the limited income from our involvement with AACC to support our SIAM CT conference.

   The CST community is multidisciplinary, and multiple professional societies have overlapping interests. There is heavy competition for attendance at conferences, e.g., in 2023, the triannual IFAC World Congress will take place in July in Japan, as will the ICIAM in August.

   We hope to be able to schedule our CT conference in the future on a schedule that is suitable for many people and has no conflict with major other conferences. Note that the end of July is not ideal for parts of the world where the end of July is in the middle of vacation, such as in Europe. Stimulating and continuing to involve the non-US members to get involved could be a way to increase attendance at the conference.

8. How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?

   Control and systems theory is sometimes called the “hidden science.” Its methodology and results impact many areas, including computational science, optimization, dynamical systems, stochastic systems, networks, data-based control, PDE systems, and machine learning. Similarly, other fields have an impact on control and systems theory.

   Our strong links outside of mathematics, particularly in engineering, present a challenge in terms of membership and conference attendance. However, it is also a resource in terms of the promotion of applied mathematics and computational science.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning Jan. 1, 2024.

Signed
Jacquelien Scherpen
19 May 2023