

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 July 25, 1986 by 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 fourteen times thereafter. This SIAG had 652 members including 308 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 Advisory Committee

Chair, Francesco Bullo

Vice Chair, Wei Kang

Program Director, Sonia Martinez

Secretary, Eduardo Cerpa

SIAG/CST Conference Steering Committee

Fariba Fahroo (01/01/20 - 12/31/23)

William Levine (01/01/20 - 12/31/23)

Kirsten Morris (01/01/20 - 12/31/23)

Hitay Ozbay (01/01/20 - 12/31/23)

Qing Zhang (01/01/20 - 12/31/21)

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 inter-disciplinary field, with strong connections to both mathematics and engineering. More recently, there has been research in system theory applied in both biology, sociology, and finance. Stochastic control, which has long been an area of interest in the mathematical control community, is of increasing interest in applications due its importance in biological systems, finance and quantum control. A growing area of interest is control and optimization of networked systems. This area often uses graph theory. 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. During the last two years substantial attention has focused on modeling, analysis and control of epidemic models, as motivated and compelled by the COVID-19 pandemic.

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 reached a peak of 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. Relative to other SIAGs, CST is a medium-sized activity group. 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". AACC is the national member 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 nominates a SIAM liaison to the IEEE Conference on Decision and Control organized by CSS and SIAG members are involved with reviewing for IEEE Conference on Decision and Control.

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 2/3 of members are affiliated with US universities.

To keep up with changes in the field, we have organized a special session in our SIAM Journal on Control and Optimization entitled "Mathematical Modeling, Analysis, and Control of Epidemics." This special session was advertised in SIAM News and other venues. The total number of submissions was 57 and 14 papers are undergoing review and under consideration.

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 conference 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 is currently being organized, with 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 (including one by Dr. Giulia Giordano, as described above).

Beginning with CT13, we started publishing conference proceedings. This decision adds to the workload and cost of organizing CT. However, we believe it has contributed to larger participation in CT meetings. This is 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, the following number of sessions were organized by SIAM volunteers: 3 sessions in 2016, 4 sessions in 2017, 5 sessions in 2018, 4 sessions in 2019, and 3 sessions in 2020. This activity brings, on average, about US\$10,000/year to our organization (for example, \$8,438 in 2017, \$11,154 in 2018, \$4,710 in 2019, and \$10,898 in 2020). We would find it appropriate if a fraction of the income generated from our organized sessions at ACC would be

used to support our activities, including our biennial conference and including limited travel funds required to attend administrative AACC meetings.

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?

There were several minisymposia organized by volunteers affiliated with the CST AG at the 2020 SIAM Annual Meeting, including three of on “The Intersection of Optimal Control and Machine Learning” and one on “Control Problems in Natural Resource Management.” Four additional minisymposia were ultimately canceled and did not take place because of the pandemic.

The 2021 CT conference will be held jointly with the SIAM Annual Meeting. Previously, the 2017 CT conference was held concurrently with the SIAM annual meeting. Our tradition has been that every second CT meeting is held concurrently with a SIAM Annual Meeting.

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?
 - The SIAG has distributed an electronic newsletter since 2014. Email seems to be an effective method of communication for our SIAG. Recently, the newsletter was revamped and now includes interviews with distinguished members and numerous updates from the community. The newsletter is distributed on a regular schedule.
 - SIAM is a member of the American Automatics Control Council. Our activity group has a member on the board, organizes sessions at the annual meeting, and serves in an editorial role.
 - SIAM is a sponsoring society for the IEEE CSS Conference on Decision and Control, and we organize sessions at this conference and serve an editorial role.
 - 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 APDE and CST AGs. This award is generally awarded to someone in the control theory field. In recent years, it appears that the AG has had minimal involvement in the execution of this award.
 - 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 2020/21, we energetically advertised our awards, akin to implementing an unofficial nomination committee, with a special emphasis on reaching out to under-represented scientists. This informal outreach effort was completely independent and fully decoupled from the selection committees. We are delighted to share that the 2021 winner of the

SIAG/CST Prize is Dr. Giulia Giordano, the first female recipient of the award since the award's inception in 1998.

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

The CT21 conference will be held online due to COVID-19 travel restrictions; we are engaged in executing it. We plan to complete the review of all submissions and publish the special session in SIAM JCO on epidemics. We plan to redouble our efforts in soliciting articles for SIAM News to improve our visibility in the applied mathematics community. We plan to adopt the SIAM Engage platform to keep in touch with our members.

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 description) 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 there are multiple professional societies with overlapping interests. There is heavy competition for attendance at conferences. The recent effort of SIAM and by the leadership of this SIAG to collect the dates and locations of relevant controls meeting to avoid conflict with other major conferences is important.

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 have an impact in many areas, including computational science, optimization, dynamical systems, stochastic systems, networks... 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 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, 2022.

Signed

Francesco Bullo

May 14th, 2021