SIAM Activity Group Applied and Computational Discrete Algorithms

Charter Renewal Application

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Applied and Computational Discrete Algorithms. The SIAM Activity Group (or SIAG) to which this renewal applies was originally formed under the aegis of SIAM in December 2018 by the SIAM Council and December 8, 2018, by the SIAM Board of Trustees with its initial operating period beginning January 1, 2019 and ending December 31, 2020. Its charter has been renewed by the Council and Board one time thereafter.

This SIAG has 437 members, including 284 student members, as of December 31, 2021.

According to its Rules of Procedure, the objective(s) of the SIAG are to foster activity and collaboration on the computational solution of combinatorial problems arising in many application areas. It seeks to promote the formulation of computational problems from application areas in terms of combinatorial models, the development of theory and algorithms to solve these problems, the implementation of the algorithms in software, and the deployment of the software in the application domains. The SIAG will bring together mathematicians, computer scientists, statisticians, scientists, and engineers from academia, the national and other research labs, and industry to promote research in applied and computational combinatorics. The SIAG will organize a biennial conference on Applied and Computational Discrete Algorithms, sponsor minisymposia at the SIAM Annual Meeting, and maintain an electronic discussion group.

Its proposed functions were:

1. Organize minisymposia at the SIAM Annual Meeting and ICIAM in years where there is no SIAG conference.
2. At least once every seven years either organize a track of at least six minisymposia at the SIAM Annual Meeting or have an activity group meeting held jointly with the annual meeting. The VP for Programs and the VP at Large will coordinate the scheduling with the SIAG chair.
3. Organize a biennial SIAM Conference on Applied and Computational Discrete Algorithms. The SIAG will consider dovetailing specialized workshops and conferences with the SIAM Annual meeting or other SIAG conferences. The chair of the conference organizing committee shall be either the program director or the chairperson of the SIAG or their designee. The organizing committee must be approved by the VP for Programs at least 16 months before the conference.
4. With the approval of the SIAM Program Committee, the SIAG may organize special sessions at SIAM meetings. Other SIAG meetings may be organized only with the approval of the SIAM president and vice president for programs.

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
Chair: Cynthia Phillips
Vice Chair: Henning Meyerhenke
Program Director: Uwe Naumann
Secretary: Bora Uçar

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?

   The areas covered by the SIAG (combinatorial scientific computing, applied discrete mathematics, algorithm engineering, combinatorial optimization, theoretical computer science (and others), including applications thereof) are growing in importance as graph and other discrete/combinatorial algorithms become a significant component of many emerging applications. These applications include, among many others, data analytics, scientific machine learning, computational biology, and cyber-security. Due to the young age and application area diversity of the SIAG, it is too soon to provide tangible comments on shifts in focus. It could be mentioned, however, that the ubiquitous interest of science and industry in deep (machine) learning has also reached the SIAG's community. To call this a shift in focus would be premature, though.

   Noteworthy advances besides successes in computational aspects of graph neural networks are improvements in the scalability of graph algorithms and their implementations by algorithmic means (e.g. approximation) and/or with massive parallelism of various kinds (clusters, multicore, and manycore parallelism). In particular, the advancement of the GraphBLAS standard and related activities are noteworthy: these works originated in the ACDA community, foster cross-fertilization between fields, and provide portable graph algorithms with several recent success stories in academia and industry.

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 SIAG has grown steadily in its first 3.5 years, particularly in the current period. A key driver in the increase of member numbers was the First ACDA Conference in July 2021. Not only but particularly by this conference, the SIAG was able to attract new members to the SIAM community. An important contributing factor was events organized by the ACDA21 engagement committee (Christian Schulz (Heidelberg U, chair), Rich Vuduc (Georgia Tech), Austin Benson (Cornell), and Cynthia Phillips (Sandia National Laboratories)). A major outcome of this committee was the Introduction Blitz. Each participant presented a single slide describing themselves, their research, and the answer to an icebreaker question. This activity allowed members from disparate communities to learn a bit about others. The committee also previewed the user experience on the virtual platform and made suggestions. Also, to attract computer scientists and applied mathematicians from industry, the ACDA organizing committee led by Bruce Hendrickson (LLNL) and Blair Sullivan (U of Utah) organized a session on industrial problems. We hope that ACDA will be the home for computer scientists who want their work to be used in practice. Thus, having such sessions at the ACDA meeting that introduce industrial combinatorial problems is an attractive service. We don't know how sustainable that will be yet, but we hope it will become a regular part of the ACDA meeting.

   We have a healthy fraction of students (65%), which we see as a good sign for the sustainable growth of the SIAG. 24% of the students are female, and 13% of the non-students are female. 63% of the members are from academia, 18% from Labs, and 13% from industry. The ACDA Conference, the recently established Lecture Series, and the SIAM Engage Portal will be good venues for growing a sense of community as well as the membership of the SIAG. We will pay close attention to increasing the percentage of women and under-represented groups' participation.

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 undoubtedly most important event of this kind for the SIAG was the First ACDA Conference in July 2021. It was held virtually due to the restrictions imposed by the Covid-19 pandemic. The conference was organized by Bruce Hendrickson (LLNL) and Blair Sullivan (U of Utah). The PC chairs were Michael Bender (Stony Brook U) and John Gilbert (UC Santa Barbara). 80 papers were submitted to the conference; 21 were accepted as talks with archival papers, and 12 as talks only. It was co-located with the Annual Meeting and three other conferences; 416 attendees explicitly expressed their interest in ACDA when registering for the joint event. When looking at the topics of the submitted papers and their authors, it is clear that the goal of cross-fertilizing more applied and more theoretical ACDA areas was achieved. Moreover, both the number of papers and the number of participants showed a healthy increase over CSC20, held in Seattle, WA, in 2020. Numerous invited talks and mini-tutorials highlighted connections between combinatorial problems in computer science and core SIAM topics in applied mathematics, e.g., scientific computing.

   We also sponsored the second and third SIAM Symposium on Algorithmic Principles of Computer Systems (APOCS21 and APOCS22), both associated and co-located with SODA. In 2021 and 2022, eleven and five papers were published in the Proceedings, respectively. We attribute the decline in submitted papers to the pandemic. We expect these numbers to rise when SODA and its co-located symposia are in-person events again.

   For completeness, we also mention the SIAM Workshop on Combinatorial Scientific Computing (CSC20) and APOCS20. Both were already contained in the previous charter renewal application, so we forego the details.

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 SIAG's main conference ACDA was co-located with the Annual Meeting in July 2021. SIAG ACDA organized at least 2 minisymposia for AN20.

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?

   In 2021, we formed a committee (headed by ACDA officer Uwe Naumann) to organize the ACDA Online Seminar Series. The inaugural lecture was given by Katherine Yelick (UC Berkeley) in December 2021. The series continued in May 2022 with a lecture presented by Monika Henzinger (U Vienna). We plan to continue with 2-3 seminars per year and are confident in our ability to recruit high-profile speakers such as the first two. This effort creates both visibility for ACDA and a sense of community joined by joint interests.

   Several ACDA-related minisymposia and minitutorials were organized at the SIAM Conferences on CSE in 2021 and on PP in 2022, some by ACDA officers.

In September 2022, a one-week seminar on ACDA will be held in Aussois (France), similar in spirit to the well-known Dagstuhl seminars. For these seminars, a relatively small group of invited participants (perhaps 60) meets for a week of talks and informal research in a remote conference setting. Because everyone stays at the conference center and has meals together, it is an ideal way to make connections. This seminar is organized by Aydin Buluç, Michael A. Bender, and Bora Uçar. This event shall continue our community-building efforts now that the restrictions due to the Covid-19 pandemic have relaxed. We will request that this event be held in cooperation with SIAM.

In 2023, the ACDA Early Career Prize is to be awarded for the first time. The award committee will be finalized soon.

A noteworthy SIAM News article from ACDA appeared in November 2021, recapping the Inaugural 2021 SIAM Conference on Applied and Computational Discrete Algorithms.

The Twitter account for the SIAG, @siam_acda, is handled by SIAG officer Bora Uçar. Like our Engage channel and previous mailing lists, it announces conferences, lecture series, job opportunities, etc.

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

   The major activity will be organizing the 2nd SIAM Conference on ACDA. The organizing committee chairs are Uwe Naumann (RWTH Aachen) and Lenore Cowen (Tufts U); the program committee chairs are Jon Berry (Sandia) and David Shmoys (Cornell). The other organizing committee members are Cindy Phillips (Sandia National Laboratories, US) Fredrick Manne (U of Bergen, Norway), Dorit Hochhbaum (UC Berkeley, US), Adrian Tate (NAG, UK), Anne Benoit (ENS Lyon, France), Shang-Hua Teng (USC, US). We hope and anticipate this event can take place in person, which will simplify the continued and sustainable growth of the SIAG.

   We are going to continue the ACDA Online Seminar Series beyond 2022, with about 2-3 talks by distinguished speakers per year. Moreover, we will participate in other conferences such as SIAM CSE, SIAM PP, SIAM MDS, etc., to present ACDA-related work.

   For 2024, when there is no SIAM Conference on ACDA according to a biannual schedule, we intend to organize another ACDA Seminar, similar to the one in Aussois in September 2022.

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

   The SIAG will still need a few iterations of the ACDA Conference to fully establish itself with sustainable growth. While the first ACDA Conference in 2021 was a success, it was still affected by the Covid-19 pandemic and was hosted virtually. For an event whose main purpose is to start building a community, this was particularly challenging. Consequently, strategic decisions such as switching to an annual model are difficult based on this first edition.

   Discussion of a suitable SIAM journal for publishing work on ACDA is still ongoing. Currently, journal papers on ACDA are submitted to at least five different SIAM journals (SISC, SIREV, SIDMA, SIMAX, SIMODS). It would be helpful to avoid some of this fragmentation while building community.

   Patience with these processes will be helpful.

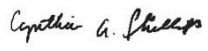
8. How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?

   We see this activity group as the main organized place for the vibrant applied and computational discrete algorithms community. Within SIAM, it complements the existing Discrete Mathematics SIAG, which focuses on pure discrete mathematics. Due to their wide range of applications, the ACDA research areas are becoming increasingly important: we observe widespread use of graphs and other combinatorial techniques in CSE, Machine Learning, Data Mining, and Data Analytics, High-performance Computing, Network Science, Computational Biology, Cyber-security, and numerous other applications.

   SIAM is the natural professional home for applied discrete mathematics. We believe that this SIAG, and its growing sense of community, has the potential to attract members who are not currently SIAM members at all (e.g., computer scientists and operations researchers). We feel this SIAG can continue to play an important role in building and strengthening our community, as well as helping to exploit synergies between fields and disciplines. While it may take a few more years for ACDA to be fully established, we already see it flourishing in a promising way.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2023.

Signed,



Cynthia Phillips, SIAG/ACDA Chair
June 17th, 2022