

## CHARTER RENEWAL APPLICATION

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Computational Science and Engineering (SIAG/CSE). The SIAG/CSE was originally formed under the aegis of SIAM on December 2, 2000 by the SIAM Board of Trustees and on December 15, 2000 by the SIAM Council with its initial operating period beginning January 1, 2001 and ending December 31, 2003. Its charter has been renewed by the council and board four times thereafter. This SIAG has **2,115 members** as of December 31, 2009.

According to its Rules of Procedure, the objective(s) of the SIAG are to

- Foster collaborations among applied mathematicians, computer scientists, domain scientists and engineers in those areas of research related to the theory, development, and use of computational technologies for the solution of problems in science and engineering.
- Promote and facilitate Computational Science and Engineering as an academic discipline.
- Promote computational simulation as a peer to theory and experiment in the process of scientific discovery.

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

Its proposed functions are:

- 1) Organize minisymposia at the SIAM Annual Meeting on years where there is no SIAG conference.
- 2) Organize a track of at least six minisymposia at the SIAM Annual Meeting at least once every five years. The SIAM Vice President for Programs and the SIAM Vice President at Large will coordinate the scheduling with the SIAG/CSE Chair.

Other activities can include:

- 3) Organize a biennial SIAM Conference on Computational Science and Engineering. 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 Chair of the SIAG/CSE or their designee. The organizing committee must be approved by the SIAM Vice President 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, and conduct special one- or two-day meetings immediately before or after a regular SIAM meeting. Other SIAG meetings may be organized only with the approval of the SIAM President and Vice President for Programs.
- 5) Broker partnerships between academia, industry, and government laboratories. The SIAG will seek to facilitate the establishment of academic programs in CSE to foster its development as an academic discipline. The SIAG also will facilitate the placement of undergraduate and graduate students in internships in industry and government laboratories.
- 6) Work with other societies to promote CSE. The SIAG will work with other professional societies to promote CSE. For example, SIAM and another society might organize a workshop on a topic of mutual interest. The SIAG also would attempt to increase government support for CSE through various outreach activities.
- 7) Disseminate information. The SIAG may publish a newsletter, offer a members' list serve or maintain a Website to facilitate the exchange of information among its members and other interested parties.

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.

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 three years?

Computational science is a dynamic growing field. In the traditional areas of physical science such as physics, chemistry, environmental science, material sciences, etc., simulation is becoming increasingly important, serving as a third pillar of science, complementing theory and experiment. Computational techniques are increasingly being applied in the biological and social sciences as well. These new areas are not only taking advantage of well-established techniques to make new advances in their fields, they are also pushing the boundaries of existing computational methods to increase the applicability to their domain. Simulation as an engineering tool continues to grow in importance. A significant change in the recent past has been an increased emphasis on verifying, validating, and quantifying uncertainty in simulations so that computational results can be evaluated for use in informing decision and policy makers. Developing the mathematics and implementation technologies that will allow for these activities within scientific simulations is an area of strong need and recent emphasis within the field. In addition, new generation computers are expected to incorporate fundamental changes in architecture that will demand algorithmic changes for their efficient use in scientific simulations. The CS&E field has recently been emphasizing the interface with computer science to identify and address these issues. Lastly, the field continues to see significant growth dedicated to efficient handling of large volumes of data produced by modern simulations as well as in very large data analysis applications. We expect new programs and initiatives in CS&E will continue to highlight multi-disciplinary computational science teams such as those in the successful DOE SciDAC program.

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 continues to grow. Membership has increased by 41% over the past two years, from 1,499 in 2007 to 2,115 in 2009. A majority of the members (53%) are students, indicating the attraction of the field to new researchers.

The primary activity of the SIAG is the biannual CS&E conference, and it is primarily through this forum that we keep the SIAG current with changes in the field. For example, at the SIAM CSE09 conference, our invited speakers reflected a broad range of activities in many different application areas including complex networks, numerical optimization in engineering, simulation-based engineering, verification and validation, and biological applications where computational science has not been traditionally used, such as cognitive science and infectious disease modeling. Our conferences target a broad range of applications in order to facilitate transitions to use of computational science techniques in fields where computational work has not been emphasized in the past. This allows attendees to see the full spectrum of activities being pursued in the community and also potentially identify themes. Our meetings also emphasize computational science education through tracks of minisymposia. At the 2009 meeting, we also had a panel discussion on CS&E education.

SIAM exists to ensure the strongest interactions between mathematics and other scientific and technological communities through its activities. Because of the inherent multi-disciplinary nature of computational science, the CS&E SIAG offers an excellent forum for these interactions, particularly through its conference series. In the past several years, we have made a particular effort to include computational scientists as well as applied mathematicians on the organizing committees to ensure diverse conference attendance. This has allowed us to reach out into different communities.

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.

SIAM Conference on CS&E, March 1-6, 2009, Miami, FL had 750 attendees  
 SIAM Conference on CS&E, February 19-23, 2007, Costa Mesa, CA had 624 attendees

The SIAM CSE conference series has been highly successful. We attracted over 750 attendees at to CSE09 where there were about 700 presentations (155 minisymposia sessions, 20 contributed sessions, and 25 posters). CSE09 once again hosted a student paper competition sponsored by the Bavarian Graduate School in Computational Engineering. Eight students were selected as finalists in this competition and were invited to present their work in minisymposia at the conference. Of these eight, a finalist was chosen who spent a week in residence at the Bavarian Graduate School in Computational Engineering.

While these conferences have been very successful, it is suffering somewhat from its own success. The biggest complaint is about the large number of parallel sessions. However, we have little choice but to maintain the highly parallel format in order to present the breadth of the field. Instead, we attempt to schedule minisymposia to minimize conflicts within application areas. This conference is also held on weekdays in order to attract government and industry attendees who prefer not to travel on weekends; unfortunately, this has the negative consequence of making it difficult for university attendees to attend. However, we will keep the conference in the winter so as not to compete with the annual meeting for summer travel.

Some interest has been expressed in hosting these meetings in other countries in order to draw in more of the computational science community in Europe.

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 of minisymposia at an annual meeting?

The SIAG last organized a track at the SIAM 2008 Annual Meeting, which consisted of the following minisymposia:

1. Thomas M. Hagstrom and Tim Warburton, *Advanced Numerical Methods for Time-Domain Wave Propagation* (2 Parts)
2. Gunduz Caginalp and Mark DeSantis, *Mathematical Economics and Finance*
3. A. J. Meir and Yanzhao Cao, *Flow Through Porous Media and Related Topics: Modeling, Analysis, and Numerical Simulation* (2 parts)
4. Monika Neda and Leo Rebholz, *Algorithm Analysis, Design and Computation for Turbulent Flows* (4 parts)
5. Don Estep, *Computational Solution of Multiphysics Problems* (4 parts)
6. Juan Meza, *Recent Advances in Electronic Structure Calculation Methods*
7. Jeff Banks, *Computational Methods for Compressible Flow*
8. George Karniadakis and Xiaoliang Wan, *Algorithms and Analysis in Uncertainty Quantification*
9. Michael Pernice, Dana Knoll, and Glen A. Hansen, *Progress and Challenges in Computational Nuclear Engineering* (2 parts)
10. Victor Ginting, *Advances in Uncertainty Quantification*
11. Valerio Pascucci, *Visualization and Analytics for Science Discovery*
12. Peter Turner, *CSE Undergraduate Education: Research Opportunities and Experiences*
13. Thomas Bewley and Daniel Tartakovsky, *Advanced Methods for Data Assimilation and Adaptive Observation of Multiscale Systems* (3 parts)

At the SIAM 2009 Annual Meeting, we organized one three-part minisymposium:

1. Lois Curfman McInnes and Carol S. Woodward, *Implicit Nonlinear Solvers in Multimodel Simulations* (3 parts)

For SIAM 2010 Annual meeting, we have organized the following minisymposia:

1. Daniel Dunlavy and Brett Bader, *Algorithmic Advances in Data Mining Applications* (2 parts)
2. Michael Pernice, *Advances in Modeling and Simulation for Nuclear Energy* (2 parts)
3. Richard Lehoucq, *Reduced Order Models for Dynamical Systems*
4. David Bader, *Analyzing Massive Real-World Graphs* (2 parts)

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

The other activities sponsored by the activity group include the CSE mailing list, a SIAG Wiki, and articles in SIAM news.

- CSE Mailing List. The CSE mailing list is open to all SIAG members who are automatically subscribed when they join the SIAG. We encourage the following types of postings to the mailing list: solicitations for SIAG/CSE sponsored conferences, announcements of CSE-related conferences/events, calls for nominations of prizes, new technical reports, papers, software, open positions, and SIAM announcements such as electronic publication, general conference announcements and other news. The list is now fully moderated in order to prevent redundant or inappropriate posts. Information on the list can be found at <http://lists.siam.org/mailman/listinfo/siam-cse>
- SIAG Wiki. The CSE SIAG established a Wiki where information relevant to the field can easily be exchanged. Appropriate material for posting includes listings of upcoming meetings of interest to the field, presentation slides from CSE meetings (all but one plenary from CSE09 are on this page), links to external relevant pages, business meeting notes, etc. The Wiki is not yet fully utilized by the constituency, but we expect increased use as more people become aware of it. Two volunteers help to maintain content.
- SIAM News. The SIAG contributed two articles on educational activities to the May 2009 issue of SIAM News. In addition, SIAM News devoted an issue to the field of CS&E in June 2009 supplied with seven articles solicited from the SIAG during the CSE09 meeting. In addition, Jim Crowley supplied a writeup of Tinsley Oden's plenary talk from the CSE09 meeting. Comments on the article from Gail Corbett were that the issue helped the rest of SIAM know more about the field of CS&E and what sorts of activities are going on within it. We continue to encourage our membership to submit articles to SIAM News.

In addition to these activities, one SIAG officer serves as the managing editor of SISC, and is implementing a policy of including a section specifically dedicated to CS&E papers. Several CSE SIAG officers and members are involved in the SIAM CS&E Book Series on Computational Science and Engineering and some of our members have been helping SIAM contribute to a Math in Industry report for NSF.

There is also the SIAM/ACM Prize in CS&E. This is not directly associated with the SIAG/CSE. SIAM and ACM jointly award this prize that recognizes outstanding contributions to the development and use of mathematical and computational tools for science and engineering problems. The prize is awarded at the CSE biannual meeting; in 2009 it went to Cleve Moler.

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

The principal activity for the CS&E SIAG over the next two years is the CSE11 conference. In addition, we are preparing to update Linda Petzold's report on CS&E Education over the next 1-2 years and continuing to populate the CSE Wiki site to make it a community resource.

Plans for the CSE11 conference are already well underway. The conference co-chairs are Ulrich Rude and Padma Raghavan. The conference will be held Feb. 28 – March 4, 2011 in Reno, Nevada. The themes have also been decided and again include a wide range of computational science activities, numerical methods, and computer science topics. Invited speakers are being determined and minisymposia and contributed talks will be solicited shortly.

The CS&E SIAG is ideally suited to co-sponsoring sessions or conferences with other SIAGs. In addition to sponsoring minisymposia tracts at the annual meeting, the SIAG should also encourage members to submit tracks to conferences such as SIAM Parallel Processing, the SIAM conference on Mathematical and Computational Issues in the Geosciences, the SIAM conference on the Life Sciences, etc.

The SIAG/CSE is considering organizing a prize for significant software contributions in CSE. More will be reported on this activity in the next renewal application.

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

SIAM can best help the CS&E community by continuing to promote CS&E and lobby for increased funding from federal agencies (in particular NSF and NIH) that traditionally have had difficulty supporting the interdisciplinary research essential to CS&E. This could be done as a joint effort among professional societies that emphasize modeling and computation, for example USACM, IEEE, APS, AIChE, ASME.

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

SIAM is well positioned to be the professional society of choice for CS&E. This community is growing quickly and applied mathematics is an integral part of the field. By providing useful information for professionals in the CS&E field through its conference series and list serve, the SIAG can continue to be a home for this community. This can help broaden SIAM by expanding the base for SIAM membership. By exposing more applied scientists and mathematicians to each other through the CS&E conference, the SIAG can help ensure that new advances in applied mathematics are exposed to potential users of these ideas. In addition, the SIAG could be better utilized in gathering information from the community on a variety of topics and issues. For example, there may be times when input from the community could usefully serve and inform the SIAM Science Policy Board.

The SIAG could also take a more active role in helping SIAM promote CS&E education. Currently, some discussion on this topic occurs at the CS&E conference meetings, but there are opportunities for SIAG members to be more fully utilized in ensuring this discipline continues to gain footing at leading universities and colleges. Perhaps a call for participation in a CS&E education subgroup to help formulate official position papers, etc., specific to issues in CS&E could be of use to the SIAM Education committee.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2011.

Signed,



Tamara G. Kolda  
SIAG/CSE Chair  
June 9, 2010