CHARTER RENEWAL APPLICATION
SIAM Activity Group on Computational Science and Engineering (CS&E)

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 three times thereafter. This SIAG has 1,499 members as of December 31, 2007.

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

> • 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 were:

> 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 VP for Programs and the VP at Large will coordinate the scheduling with the SIAG 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 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, 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 CS&E 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 CS&E. The SIAG will work with other professional societies to promote CS&E. 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 CS&E 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.

SIAG meetings, workshops, and conferences may be organized only with the approval of the SIAM President and the SIAM Vice President for Programs.

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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 is also growing in importance with computation playing a significant role in problems ranging from the design of new aircraft to energy production to drug design to improving the reliability of the power grid. As the capability of computational resources grows, the complexity of the phenomena that can be studied through simulation also grows; and so, too, must the algorithms and mathematics change to keep pace. Increasing the complexity of simulations often now requires the representation of many different physical phenomenon and many different scales. This in turn drives the need for new mathematics to link these multi-physics, multi-scale phenomenon. Furthermore, the sheer volume of data produced by simulations requires new mathematical techniques for mining the data to gain insight into the produced solution. Finally, the largest machines of today and tomorrow have 100,000 processors or more, which requires new algorithms and methods to take us to the promise of ultra-scalable computing. Finally, there is an increasing recognition of the power of multi-disciplinary computational science teams such as those evidenced by the DOE SciDAC program. This program is widely viewed as successful and new programs and initiatives in this area will likely continue to utilize this partnership/teaming model.

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 been and continues to do well. It was founded in 2001 and the membership grew quickly to be the largest SIAM SIAG. The membership has grown to 1499, which represents an increase of 33% over that past two years.

The primary activity of the SIAG is the biannual CS&E conference. It is primarily through this forum that we keep the SIAG current with changes in the field. For example, at the SIAM CSE07 conference, our organizing committee and invited speakers reflected a broad range of activities in many different application areas. This allows attendees to see the full spectrum of activities being pursued in the community and also potentially identify unifying themes. In particular, one of the interesting themes that emerged from the CSE07 was an active discussion of issues in graduate education in CS&E.

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 to increase overall membership in SIAM; for example, the CSE07 conference resulted in approximately 50 new SIAM memberships.

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, February 12-15, 2005, Orlando had 574 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 600 attendees at the last meeting. At CSE07 there were 530 presentations in 108 minisymposia sessions and 32 contributed sessions along with 63 posters. For the first time, CSE07 also hosted a student paper competition, sponsored by the Bavarian Graduate School in Computational Engineering. Thirteen students submitted papers and eight of those students were invited to present their work in a minisymposium at the conference.

There are a few issues that should be considered for future conferences. First, there are a large number of parallel sessions at these meetings which is one of the biggest complaints from attendees. In addition, the conference tends to be held over the course of a week and it is difficult for university attendees to attend the full conference.

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?

For the SIAM06 Annual Conference held in Boston, the CSE and Optimization SIAGs jointly organized a tract of 7 minisymposia with 10 sessions. SIAM did not hold an annual meeting in 2007 because of the ICIAM'07. However, there were several minisymposia held at ICIAM'07 that included CSE, in particular emphasizing undergraduate CSE curriculum. For the SIAM08 Annual Conference, the CSE SIAG has organized a tract of 9 minisymposia in 17 sessions.

SIAM 2008 Annual Meeting – CSE Minisymposia:

1. Peter Turner, CSE Undergraduate Education
2. Valerio Pascucci, Visualization and Analytics for Science Discovery
3. Thomas Bewley and Daniel Tartakovsky, Multi-resolution data assimilation and forecasting, I-III
4. Michael Pernics, Computational Nuclear Engineering, I-II
5. Juan Meza, Recent Advances in Electronic Structure Calculation Methods
6. George Karniadakis and Xiaoliang Wan, Uncertainty Quantification
7. Victor Ginting, Advances in Uncertainty Quantification
8. Jeff Banks, Computational High-Speed Fluids
9. Don Estep, Computational solution of multiphysics problems, I-VI

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 SIAG include the CSE mailing list, the SIAM/ACM prize in CS&E, 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. Information on the list can be found at http://lists.siam.org/mailman/listinfo/siam-cse

- SIAM/ACM Prize in CS&E. 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 and in 2007 went to Chi-Wang Shu of Brown University.
- SIAM News. We have encouraged our membership to submit articles to SIAM News, particularly in the areas of CS&E education and the undergraduate and graduate levels and on the challenges and tools available in the CS&E domain. One article that appeared recently was an overview of the CSE07 conference in which a number of representative plenary speakers and minisymposium sessions were highlighted. In the same issue there was also an article on stochastic partial differential equations, which was one of the themes of the CSE07.

In addition to these activities, several CSE SIAG officers and members are involved in the SIAM CS&E Book Series on Computational Science and Engineering. Currently four volumes have been published in this series with additional volumes in the pipeline.

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 CSE09 conference and continuing to flesh out the CSE web site to make it a community resource.   Plans for the CSE09 conference are already well underway. The conference co-chairs are Kirk Jordan and Carol Woodward. The conference will be held March 2-6, 2009 in Miami Florida.   The themes have also been decided and again include a wide range of computational science activities (including topics such as biological and medical simulations, discrete simulations, scientific data mining and multicore architectures), numerical methods, and applied mathematics 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.

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 be made into a home for a community that, as yet, has no real place to go. 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, 2009.

Signed
John B. Bell
6.11.2008