

## **CHARTER RENEWAL APPLICATION FOR THE SIAM ACTIVITY GROUP ON LINEAR ALGEBRA**

This Charter Renewal Application applies to the SIAM Activity Group on Linear Algebra. The SIAG/LA was originally formed under the auspices of SIAM on July 19, 1982 by the SIAM Council and July 20, 1982 by the SIAM Board of Trustees. Its initial operating period began January 1, 1983 and ended December 31, 1985. Its charter has been renewed by the Council and Board ten times thereafter. This SIAG had 600 members, including 197 student members, as of 12/31/2014.

According to its Rules of Procedure, the objective(s) of the SIAM Activity Group on Linear Algebra is to identify and explore the links between linear algebra and other applied sciences, to stimulate the applications of linear algebra, and to foster research in linear algebra and its applications. Within the framework of SIAM, the group will conduct activities that implement its purposes.

### **Its purposed functions were:**

The SIAG on LA will organize activities in Linear Algebra. The SIAG is expected to:

- (1) Subject to the conditions of ARTICLES III and IV, the SIAM Activity Group on Linear Algebra will conduct sessions at regular SIAM meetings, conduct special meetings, and participate in organizing publications in the areas of linear algebra and its applications.
- (2) The SIAG shall not present awards or otherwise recognize scientific achievement, professional service, or the like without prior approval by both the SIAM Major Awards Committee and the SIAM Council of the award criteria; the method of selection of recipient(s), the nature of the award, and all other aspects, if any, of each such award must have the prior approval of the SIAM Board of Trustees.

Other activities can include:

- (3) Organize minisymposia at the SIAM Annual Meeting in years where there is no SIAG conference.
- (4) At least once every five 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.
- (5) Organize a triennial SIAM Conference on Applied Linear Algebra. 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.

- (6) 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.
- (7) Award the triennial SIAG Linear Algebra Prize, established in 1987.
- (8) Maintain a website for the activity group (<http://siags.siam.org/siagla/>).

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) List all current officers of the activity group (including advisory board, if relevant).  
*Danny Sorensen (Chair), James Nagy (Vice-Chair), Françoise Tisseur (Program Director), David Bindel (Secretary).*
- (2) 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?

*Applied Linear Algebra is fundamental to most areas of computational science and remains as a very active research area. The discretization of an optimization problem or a partial differential equation almost always leads to a matrix computation. Large scale computational problems prevail: Internet, data analysis and machine learning applications give rise to linear systems and eigenvalue problems whose matrix dimensions are in the hundreds of billions. Data-intensive applications in biology, chemistry, nuclear engineering, and data mining give rise to high dimensional tensors that overwhelm the computational capabilities of current systems. Many model reduction and data compression ideas fall within the domain of numerical linear algebra and are recurring themes throughout scientific computing. Structure preserving matrix methods are crucial for the reliable solution of practical scientific and engineering problems. Nonlinear eigenvalue problems from civil and mechanical engineering pose substantial theoretical and algorithmic challenges.*

*Core problems in applied mathematics with active research in areas covered by the SIAG/LA (e.g., numerical linear algebra and matrix analysis) includes:*

- *Nonlinear eigenvalue problems*
- *Tensor algorithms and analysis*
- *Domain decomposition and multilevel methods*
- *Krylov space methods for linear systems and eigenvalue problems*
- *Algorithms for structured matrices*
- *Linear techniques in model order reduction*
- *Computation of matrix functions*
- *Randomized algorithms*
- *Application to optimization, differential equations, signal and image processing,*

*control, electronic structure calculations, data analysis, information retrieval, bioinformatics, as well as structural, mechanical and aerospace engineering.*

*Future directions that are likely to receive substantial attention by researchers in Applied Linear Algebra include:*

- The steadily increasing importance of parallel computing and algorithms that scale to the teraflop/petaflop level.*
- The severe limitations imposed by floating point accuracy on extreme matrix computations, such as those arising in search engine applications.*
- The contribution of numerical linear algebra to the development of efficient methods in data mining, search engine technology, and information retrieval.*
- The development of numerical methods in multilinear algebra for pattern identification in high-dimensional data sets.*

- (3) 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 had 600 members at the end of 2014, down from the 853 at the end of 2010. Most of the attrition was from student members now at 197 (down from 374 at end of 2010). The SIAG has been very active, with involvement in several conferences, including the Householder Symposium HHXIX (see below), ISSNLA Summer School, the SIAG/LA Prizes, the Newsletter, etc. The SIAG/LA is keeping up with changes in the field by organizing and soliciting minisymposia and tracks at SIAM conferences on emerging topics, by selecting researchers at the forefront of these fields as plenary speakers at the SIAM Applied Linear Algebra Conference (as well as ILAS), and by organizing the triennial International Summer School on Numerical Linear Algebra around such topics. The broader interests of SIAM are served by the SIAG in various ways, for instance organizing minisymposia on applications of linear algebra that have considerable overlap with other areas of applied and industrial mathematics, such as optimization, uncertainty quantification (UQ), data mining, PDEs, etc. Finally, the SIAG/LA solicits submission of articles on linear algebra to SIAM News.*

- (4) 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 SIAG/LA organizes the triennial conference on Applied Linear Algebra. The list of these conferences may be found at: <http://www.siam.org/meetings/archives.php#LA>. Since the last charter renewal application was approved, two SIAM ALA Conferences have been organized: one in Valencia, Spain, that was held on June 18-22, 2012, the second in Atlanta, Georgia, the Twelfth SIAM Conference on Applied Linear Algebra, to be held October 26-30, 2015. The Valencia conference was very successful with a record number of registered participants and submitted abstracts/minisymposia. The Atlanta conference is also projected to be a huge success. There will be 12 Invited speakers, 60 Minisymposia, 1 Minitutorial, 116 Contributed Lectures, 19 Contributed Posters (a projection of 391 contributors).*

*The vibrancy of the field is reflected in the record setting 289 applications to the Householder Symposium XIX (157 were selected). The SIAG/LA maintains its involvement in the ILAS*

Conferences which usually consists of having one SIAG/LA officer represent SIAM on the organizing committee (Françoise Tisseur), and selecting one of the plenary speakers, to be identified as “the SIAG/LA Speaker” on the conference materials; SIAM covers all the expenses for this speaker. The SIAG sponsored Andreas Frommer to the ILAS 2014 and have invited Fernando de Terán to be our sponsored speaker at ILAS 2016.

The SIAG/LA co-sponsored the following meetings: IWASEP 10 (June 2-5, 2014, Dubrovnik), Fourth IMA Conference on Numerical Linear Algebra (3-5 September, 2014, Birmingham), and Precon 15 (17-19 June, 2015, Eindhoven).

- (5) 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 or meet jointly with the SIAM Annual Meeting?

*The SIAG/LA solicited minisymposia at the following meetings: SIAM AN14 (five minisymposia - ten sessions ), and ICIAM 2015 (five minisymposia).*

*The SIAG/LA is organizing a track of minisymposia at SIAM AN16 (Françoise Tisseur is representing the SIAG/LA on the Scientific Committee).*

*There has never been a SIAM ALA meeting held jointly with a SIAM AN meeting.*

- (6) 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/LA Prize for the best paper in the field of applied linear algebra is awarded every three years at the SIAM ALA meeting. The 2012 prize was split between the authors of two papers: Grey Ballard, James Demmel, Olga Holtz, and Oded Schwartz (“Minimizing Communication in Numerical Linear Algebra”, SIMAX, 32: 866-901, 2011) and Sou-Cheng T. Choi, Christopher C. Paige, and Michael A. Saunders (“MINRES-QLP: A Krylov Subspace Method for Indefinite or Singular Symmetric Systems, SIAM Journal on Scientific Computing, 33:1810-1836, 2011). Andreas Frommer was Chair of the Prize Committee. The 2015 prize will be awarded to David Bindel and Amanda Hood (“ Localization Theorems for Non-linear Eigenvalue Problems”, SIMAX, 34(4), 1728-1749, 2013). James Nagy was Chair of the Prize Committee.*

*David Bindel manages the SIAG/LA website and compiles and sends out the newsletter. The SIAG/LA web site has been completely revamped by David, and has moved to a new location at*

<http://siags.siam.org/siagla/index.html>

*It now automatically lists upcoming conferences, job postings, SIAG/LA paper awards, and recent SIMAX papers based on simple text data files in a publicly accessible repository. The new web site also features periodic blog-type posts, including “This Month in Linear Algebra” posts that accompany the monthly email newsletter, which is typically issued on the first Monday of each month.*

*Last but not least, a major event bearing the mark of the SIAG/A is the International Summer School on Numerical Linear Algebra, which is held every three years (Michele Benzi has been Chair of the ISSNLA Steering Committee since 2009; see*

<http://siags.siam.org/siagla/meetings/summer.html>

for additional information). In July 2013 the ISSNLA was held at Fudan University in Shanghai, China. This was a great success, with 45 students from 15 countries attending two weeks of lectures by Peter Benner, Nicholas Higham, Marlis Hochbruck, Ren-Cang Li, and Xiaoye Li. While no SIAG/LA sponsored proposal was entered for the 2016 summer school, the SIAG is encouraging a proposal from Zdenek Strakos for 2017.

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

*The main events planned are: SIAM ALA 15. In addition, the SIAG/LA is involved in the 2016 ILAS Conference (Leuven, Belgium, July 11-15) and the 2017 Householder Symposium (Blacksburg, Virginia, June 18-23). Preparations are under way to select co-chairs for the 2018 SIAM ALA meeting. This meeting will be hosted locally by Michael Ng and the CMIV Hong Kong Baptist University and will be held in Hong Kong, May 4-8, 2018. SIAG/LA members will submit minisymposia proposals for the SIAM AN meetings in 2016 and beyond.*

*It should be mentioned that the four current SIAG/LA officers are reaching the end of their term in December 2015; a nominating committee is being formed to identify candidates for the four officer positions. Election of new officers will take place in the Fall of 2015.*

- (8) How can SIAM help the activity group achieve its goals?

*SIAM has been very supportive of the SIAG/LA activities and we hope to see this support continue. We are quite concerned with the sharp decline in student membership. Since SIAM student members receive two free activity group memberships, the drop is puzzling. Perhaps there is a lack of awareness that could be corrected. In general, SIAM has a lot of student related activities. However, we are uncertain as to how much of this is explicitly associated with the SIAGs. As part of the proposed track for the Boston annual meeting (assuming this is still planned), might it make sense to propose a SIAG/LA-sponsored student mini-symposium? Or are there other programmatic things that are in line with already-planned activities? The last charter renewal suggested the possibility of holding a future annual meeting in conjunction with a SIAM ALA meeting. That might also be a good way of boosting the SIAGs visibility (among student and non-student members alike).*

*When a SIAG has a whole new set of officers, it is difficult for them to know precisely all of the critical activities that should be addressed during their term. For example, we were unfortunately unaware of the fact that we should solicit proposals for ISSNLA16. Therefore, it would be helpful if SIAM could work with SIAG officers to prepare a list of critical items, which could be continually updated, archived by SIAM, and passed on to newly elected officers. This list of critical activities could also serve SIAM as a mechanism for sending out reminders to SIAG officers when certain critical activities need to be done. We intend to initiate such a list for internal SIAG/LA use, but formally coordinating with SIAM would be helpful in making sure the list remains current.*

- (9) How can the activity group help SIAM in its general role of promoting Linear Algebra?

*The SIAG/LA has been very active in terms of conference organization and co-sponsorship, minisymposia and tracks at other meetings, the award of the SIAG/LA Prize, the Summer Schools, the web site and the Newsletter. The SIAG/LA web site and Newsletter are particularly important for providing mechanisms to advertise conferences, summer schools, workshops, and jobs related to Linear Algebra.*

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a three year operating period beginning January 1, 2016.

Danny Sorensen  
SIAG/LA Chair  
1 June 2015