

## CHARTER RENEWAL APPLICATION

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Linear Algebra. The SIAM Activity Group (or SIAG) to which this renewal applies was originally formed under the aegis of SIAM on July 19, 1982, by the SIAM Council and July 20, 1982, by the SIAM Board of Trustees with its initial operating period beginning January 1, 1983, and ending December 31, 1985. Its charter has been renewed by the council and board six times thereafter. This SIAG has 413 members as of May 15, 2002.

According to its Rules of Procedure, the objective of the SIAG 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 to conduct sessions at regular SIAM meetings, conduct special meetings, and participate in organizing publications in the areas of linear algebra and its applications.

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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?**

Linear algebra is the cornerstone of applied mathematics and computational science. There are virtually no computations that do not involve linear system or eigensystem computations, and our field is continually challenged with more and more difficult problems.

One of the primary thrusts in linear algebra is iterative methods and preconditioning for linear systems and eigenproblems. A complete understanding of iterative methods continues to elude us, but we are making progress. No one can argue, however, with the overall success of iterative methods because they enable us to solve problems that are simply intractable by direct methods. In addition to analysis of iterative methods themselves, much successful research is being done to find preconditioners for special matrices in fields ranging from image restoration to radiation transport.

Direct methods continue to advance as well, and in some cases may outperform iterative methods for problems of up to 100,000 unknowns (e.g., for linear systems in circuit simulation).

Some significant advances have been made in recent years in calculating higher-order decompositions useful in signal processing and other applications. Bart De Moor is organizing an SIAG/LA-sponsored minisymposium on that subject at this year's annual meeting.

Other advances are in applications. For example, the next SIAM Conference on Applied Linear Algebra features George Cybenko speaking on linear algebra in quantum computation.

Recent software packages for numerical linear algebra continue to improve on the state of the art, particularly in regard to highly accurate algorithms and high-performance computation. Numerical linear algebra has developed powerful and reusable paradigms for programming modern CPU architectures to maximize their performance. Examples of these paradigms include blocked algorithms and run-time code re-optimization. Other branches of scientific computing will benefit from these advances in two ways: they can use the software packages as subroutines either directly or via Matlab 6 (which incorporates LAPACK), and they can also adapt the paradigms to suit their own applications.

**2. How is the activity group doing? Is it remaining vibrant? Is it keeping up with the changes in the field? What is the role of mathematics, industry, and interdisciplinary activity?**

The activity group is doing well - see items 3-6 below for a list of our recent, on-going, and future activities. In addition to organizing a SIAM Conference on Applied Linear Algebra every three years, we sponsor numerous other conferences. We also work closely with other organizations such as the International Linear Algebra Society (ILAS).

We are keeping up with changes in the field by sponsoring minisymposia on new and diverse topics, recommending junior researchers as plenary speakers (see the sponsored plenary talks at the 2002 ILAS meeting listed below), and listing new publications and printing thought-provoking articles in our electronic newsletter.

We are well-connected to industry and other fields. Many of our members (and one of the officers) work in government labs and industry. Our academic members are often motivated by applications as well. We have sponsored several conferences focused on applications, including one specifically about information retrieval.

Interdisciplinary activity includes sponsoring conferences on parallel computing and linear algebra. We are also co-sponsoring a minisymposium on linear algebra in optimization at this year's annual meeting.

**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.**

As far as we know all the conferences in the following list were successful, so we limit our comments to any particular information that we can provide.

- In cooperation with SIAG/LA: International Conference on Preconditioning Techniques for Large Sparse Matrices from Industrial Applications, Minneapolis, MN, June 1999
- In cooperation with SIAG/LA: Householder Symposium XIV on Numerical Linear Algebra, Chateau Whistler, Whistler, B.C., Canada, June 14-18, 1999
- In cooperation with SIAG/LA: III International Workshop on Accurate Solution of Eigenvalue Problems, Arcadium Conference Center, Fernuniversitat Hagen, Hagen, Germany, July 3-6, 2000
- In cooperation with SIAG/LA: International Workshop on Parallel Matrix Algorithms and Applications, Neuchatel, Switzerland, August 18-20, 2000
- Sponsored by SIAG/LA: Computational IR Workshop, North Carolina State University, Raleigh, NC, October 22, 2000 *Special note:* this workshop, the first of its series, successfully attracted funding from the NSF, Boeing, M-CAM, and Telcordia.
- ORGANIZED by SIAG/LA: Seventh SIAM Conference on Applied Linear Algebra, North Carolina State University, Raleigh, NC, October 23-25, 2000  
*Special note:* In order to foster collaboration among all linear algebraists, this conference was organized jointly with the international linear algebra society (ILAS), and ILAS sponsored two plenary speakers (Hans Schneider and Hugo Woerdemann). A conference report appeared in *SIAM News*, vol. 34, no. 1, pp 19, 20 (2001); see below.
- Sponsored by SIAG/LA: Second International Conference on Preconditioning Techniques for Large Sparse Matrix Problems, Tahoe City, CA, April 29-May 1, 2001
- Sponsored by SIAG/LA: Random Matrices Conference, MIT, Boston, MA, August 12, 2001
- Sponsored by SIAG/LA: Fourth SIAM Conference on Linear Algebra in Signals, Systems and Control (LC01), Boston, MA, August 13-15, 2001
- Sponsored by SIAG/LA: Workshop on Numerical Linear Algebra in Scientific and Engineering Applications, The Fields Institute, Toronto, Canada, October 29-November 2, 2001

- In Cooperation with SIAG/LA: The 10th International Linear Algebra Society (ILAS) Conference, Auburn University, AL, June 10-13, 2002 *Special note:* SIAG/LA sponsored two plenary speakers (Michele Benzi and Misha Kilmer) at this conference.

- Sponsored by SIAG/LA: Householder Symposium XV, Peebles, Scotland, June 17-21, 2002

- Sponsored by SIAG/LA: IV International Workshop on Accurate Solution of Eigenvalue Problems, Split, Croatia, June 24-27, 2002

- Sponsored by SIAG/LA: 2nd International Workshop on Parallel Matrix Algorithms and Applications (PMAA'02)  
9-10 November, Neuchatel, Switzerland, 2002

**4. Please indicate the number of minisymposia directly organized by the activity group at the last two annual meetings.**

- Minisymposia sponsored by SIAG/LA at the 2001 SIAM Annual Meeting, San Diego, CA, July 9-13, 2001:

- \* Fast matrix algorithms, organized by Shiv Chandrasekaran
- \* Large scale linear algebra applications, organized by Rich Lehoucq
- \* Krylov space methods and preconditioners, organized by Anne Greenbaum
- \* Preconditioning KKT systems, organized by Ilse Ipsen
- \* Krylov Methods for Model Reduction of Large-scale Dynamical Systems, organized by Chris Beattie

- Minisymposia sponsored by SIAG/LA at the 2002 SIAM 50th Anniversary and Annual Meeting in Philadelphia, July 2002:

- \* Numerical Multi-Linear Algebra and Applications, organized by Bart De Moor
- \* Linear Algebra in Optimization, organized by Steve Wright, joint with SIAG/OPT

In addition to the minisymposia listed above and sponsored by the SIAG, many other linear algebra-oriented minisymposia were organized by SIAG/LA members and other researchers in linear algebra.

**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?**

Prizes

The SIAG established the SIAM Linear Algebra Prize in 1987, and has since awarded it every three years: in 1988, 1991, 1994, 1997, and 2000. In 2000, the prize was awarded to two parties: to Olga Holtz from the University of Wisconsin in Madison for her paper "Not All GKK Tau-Matrices are Stable" (Linear Algebra Appl. vol. 291, no. 1-3, pp. 235-244, 1999), and to the team of Alan Edelman from MIT and Erik Elmroth and Bo Kagstrom from the University of Umea in Sweden for their paper "A Geometric Approach to Perturbation Theory of Matrices and Matrix Pencils. Part I: Versal Deformations"(SIAM. J. Matrix Anal. Appl., vol. 18, no. 3, pp. 653-692, 1997).

Electronic Mailing List/Newsletter

In May 2001 the SIAG established an electronic mailing list for SIAG/LA members. Its purpose is to help the members of the SIAG stay better connected with one another and with the activities of the SIAG. All SIAG members can submit messages to the mailing list by sending email to [siagla@mail.siam.org](mailto:siagla@mail.siam.org).

Contributions to the newsletter have thus far included an article by Gil Strang ("Too much calculus"), conference announcements, announcements of preprints and technical reports, and contents lists of SIAM J. Matrix Anal. Appl.

By default, all SIAG/LA members have been subscribed in "digest" mode which means that they receive the collected postings once per week. The first issue of the "SIAG/LA Digest" was mailed on 14 May, 2001.

All past issues are archived by SIAM.

## Articles for SIAM News

Articles that the SIAG/LA has solicited for *SIAM News*:

- N.J. Higham: "A fitting tribute to a pioneering numerical analyst", *SIAM News*, vol. 32, no. 10, p.3 (1999).
- Ilse C.F. Ipsen and Volker Mehrmann: "SIAG/LA and ILAS Mark Twenty Years of Progress at Joint Applied Linear Algebra Meeting", *SIAM News*, vol. 34, no. 1, pp 19, 20 (2001).
- Osni Marques: "Soul Searching for Linear Algebra", *SIAM News*, vol. 34, no. 1, p 20 (2001).
- Michael W. Berry: "Growing Interest in Information Retrieval Draws 70 to Raleigh Workshop", *SIAM News*, vol. 34, no. 1, p 20 (2001).

## Web Page

The SIAG/LA webpage can be found at <http://csmr.ca.sandia.gov/~tgkolda/siagla/>.

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

We will continue to organize SIAM Conferences on Applied Linear Algebra. The eighth such conference is scheduled to be held in Williamsburg, VA in July 2003. This conference is chaired by Roy Mathias and Hugo Woerdeman, both of The College of William and Mary. It is being organized in cooperation with ILAS and ILAS is sponsoring two plenary speakers. The next conference will follow in the summer of 2006.

We will continue to work with other organizations such as ILAS and sponsor other linear algebra-related conferences such as the triennial Householder meeting.

We will continue to award the SIAM Linear Algebra Prize every three years.

We will continue to maintain our electronic mailing list and web page.

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

SIAM is already providing much support for the SIAG, with a journal, a conference and many SIAM books in our area, and the SIAM staff are very responsive and helpful.

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

We hope that it is already doing so through the activities reported above. We will continue to seek further ways of enhancing the role and effectiveness of the SIAG.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a three-year operating period beginning January 1, 2004.

Signed

Nicholas J. Higham

May 20, 2002

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