

SIAM - SIAG IMAGING SCIENCE (IS) CHARTER RENEWAL APPLICATION

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Imaging Science (hereafter called SIAG/IS). The SIAG/IS to which this renewal applies was originally formed under the aegis of SIAM on December 11, 1999 by the SIAM Board of Trustees and via electronic voting by the SIAM Council in January 2000. SIAG/IS began its operations on January 21, 2000. Its charter has been renewed by the SIAM Council and Board seven times thereafter. The SIAG had 472 members as of Dec 2014. From those, 146 are student members.

According to its Rules of Procedure, the objective of the SIAG/IS is to:

- 1) Provide a forum for conferences and scientific interaction between imaging science researchers and practitioners in academia, industry, medicine and government;
- 2) Encourage research that will provide a rigorous mathematical foundation for imaging science;
- 3) Foster research in mathematics and computation that has the potential for solving real-world problems in imaging science, and leads to new methods and techniques useful in this subject;
- 4) Provide the means for rapid publication and dissemination of novel methods in imaging science.

The SIAG/IS 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/IS.

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?

Imaging science is a truly interdisciplinary, multifaceted and expanding field that is growing in parallel with the technological progress and the development of new instruments, sensors, and imaging modalities. It has undergone a lot of exciting developments in recent years as e.g., hyperspectral imagery, ultra high resolution/high speed cameras, invisibility cloaking, sparse recovery, compressed sensing, super resolution, phase retrieval, inverse problems arising from new imaging techniques and hybrid methods, e.g., photo-acoustic or fluorescence tomography. To face the need for automated processing/analysis of images and to face 'big data' challenges, the focus is shifting more and more towards mathematics and the use of increasingly sophisticated mathematical, statistical, and computational methods. Strong and fruitful interactions are observed with many traditional and newer areas of applied mathematics such as harmonic analysis, nonlinear optimization, numerical linear algebra, discrete mathematics (including graph theory), integral equations, partial differential equations, differential geometry, topology, statistical estimation, stochastic modeling, information theory, computer graphics, machine learning, computer vision, uncertainty quantification, etc.

2. How is the activity group doing? Is it remaining vibrant? Is the size of the SIAG/IS stable or increasing? How is the SIAG/IS keeping up with the changes in the field? How are the broader interests of SIAM reflected in the activities of the SIAG/IS?

As the field it represents, the activity group is doing well and is definitely vibrant. After an initial period of growth, the size of the activity group seems now more or less stable, with nevertheless some decrease of the number of student members, which has been observed not only in this activity group but also almost all of the activity groups. Progress and new trends in the field can be most easily monitored through the SIAG/IS conferences and also through the papers published in the scientific literature and in particular by the SIAM Journal on Imaging Science (SIIMS) which started in 2008 and ranks remarkably well in applied mathematics in terms of impact factor (currently 2.87). Imaging science is a great source of new mathematical challenges, cutting across disciplines, and this stimulates research in various domains of applied mathematics. We also want to point out that we newly established the SIAG/IS Early Career Award, the first of which will be awarded at the SIAM/IS conference in May 2016. More about it in Item 5 below. Also, during this period, two members, Omar Ghattas and Peter Olver, were elected as SIAM Fellow.

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 major event organized by the SIAG is the biennial SIAM Conference on Imaging Science. The list of past conferences may be found at <http://www.siam.org/meetings/archives.php#imaging>. The last conference was in Hong Kong in May 2014, which was the first ever SIAG/IS conference held outside of the US; it comprised 6 invited plenary presentations (1 from industry), 1 prize lecture, 60 minisymposia, 11 contributed papers sessions, 1 poster session as well as 1 minitutorial. There were approximately 580 attendees, which was the record of this conference series. Among them about 29 % (more precisely 168) were students, which seems to be the record too. According to the survey performed among participants as well as to informal feedback, the conference was globally highly appreciated. Suggestions for improvements will be taken into account for the future IS conferences. For example, our next conference that will be held in Albuquerque, NM, in May 2016, will be the first ever SIAG/IS conference that spans 4 full days instead of 3 days. This change was the reflection of the comments we received during the Hong Kong conference as well as some earlier conferences pointing out that there were too many parallel sessions.

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?

A significant part of the program of the last two SIAM annual meetings is dedicated to imaging science. At the AN13 meeting in San Diego, two SIAG/IS members were honored: Stan Osher gave the John Von Neumann Lecture and Margaret Cheney the Sonia Kovalevsky Lecture. Jennifer Mueller was the SIAG/IS representative in the Organizing Committee (which included also the SIAG/IS member Omar Ghattas). Besides an invited talk on photoacoustic tomography by L. Wang, there were 17 minisymposia on various aspects of imaging science, organized by several SIAG/IS members: M. Cheney, G. Lerman, J.

Mueller, N. Saito, and H. Zhao. At the AN14 meeting in Chicago, we were also quite active and well-represented: two out of three SIAM Outstanding Paper Prizes were given to the SIAG/IS members, i.e., Aruja Flenner (coauthor: Andrea Bertozzi); Emmanuel Candès and Thomas Strohmer (coauthors: Yonina Eldar and Vladislav Voroninski); two invited plenary talks were delivered by SIAG/IS members, Omar Ghattas and Christopher Johnson; one member, Kirk Jordan (IBM), was in the Organizing Committee. Moreover, there were at least 4 minisymposia organized by the members (O. Ghattas; J. Calder; L. Borcea and C. Tsogka) and 1 contributed papers session directly related to imaging, inverse and sparse recovery problems.

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?

The SIAG/IS activity group aims at actively promoting the field of mathematical imaging to broad audiences, in particular through the following channels.

SIAG on Imaging Science Prize (SIAG/IS Prize) was established in 2010. It is to be awarded every two years at the SIAG/IS biennial conference to the authors of the best paper, as determined by the prize committee, on mathematical and computational aspects of imaging, broadly interpreted. Imaging includes image formation, inverse problems in imaging, image processing, image analysis, image interpretation and understanding, computer graphics, and visualization. The first and the second SIAG/IS Prizes have been awarded in May 2012 at IS12 in Philadelphia and in May 2014 at IS14 in Hong Kong, respectively.

To encourage, promote, and recognize early-career scientists in imaging sciences, SIAG/IS Early Career Prize has been established in 2015. This prize is awarded to an outstanding early career researcher in the field of imaging science for distinguished contributions to the field in the three calendar years prior to the year of the award. It is to be awarded every two year at the SIAG/IS biennial conference, and the very first prize will be given at the IS16 in Albuquerque, NM.

The calls for nominations for the above two 2016 Prizes will be posted very soon (see <http://www.siam.org/prizes/sponsored/siagis.php>).

SIAG/IS has a website at: <http://www.siam.org/activity/imaging/>. The website has been reorganized and comprises now a Wiki (http://wiki.siam.org/siag-is/index.php/Main_Page). As a forum for research in imaging, 'Featured Images' will be regularly displayed. Moreover, to give more visibility to young researchers, it has been decided to post announcements of defended PhD theses in the field of imaging. As an encouragement to students to join the field, information will also be collected about courses on imaging taught worldwide with links to the homepage of the course. Besides, announcements about conferences, jobs, etc. are regularly sent via the SIAG/IS mailing list.

We also distributed annual Newsletter in January for the last two years to all the SIAG/IS members. This is a good way to directly communicate our activities and information our officers obtained to our members. These newsletters have been archived at the above SIAG/IS website.

Samuli Siltanen has been our liaison representative with SIAM News for a long period of time by now. Articles about imaging science and its people appeared in SIAM News during the last two years include those by Anna Barry about an interview with a SIAG/IS member, David Mumford (May 2013); by a member Alison Malcolm (with A. Fichtner) about geophysical imaging (June 2013); by Carlos Fernandez-Grande (Ph.D. student of our member E. Candès) about super-resolution and compressed

sensing (October 2013); by Rebecca Willett, our current Program Director, about her work on photon-limited imaging (October 2014); by Michael Ng, a member and the co-chair of SIAG/IS 14, and Hongyu Liu about their summary on the successful SIAG/IS 14 Conference held in Hong Kong (October 2014).

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

The next biennial SIAM Conference on Imaging Science IS16 will come back to the US, i.e., Albuquerque, NM. The general Co-chairs are Rebecca Willett and Stefano Soatto. More information will be posted at <http://siam.org/meetings/IS16/>. The very first SIAG/IS Early Career Prize will be awarded at this event.

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

SIAM could help the activity group by establishing or reinforcing links with other scientific societies dealing with imaging problems (IEEE, OSA, ASA, etc.) as well as with applied mathematics societies in the world (GAMM, SMAI, SIMAI, JSIAM, etc.) and by encouraging and supporting joint activities. Contacts have been taken with the newly created GAMM-Activity Group "Mathematical Signal and Image Processing" (<http://www3.math.tu-berlin.de/numerik/GAMM-MSIP/>) with the aim of organizing a joint conference in the future. Their website now lists a link to our SIAG/IS website.

More financial support for young researchers to attend the IS conferences would also be welcome.

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

The activity group helps SIAM promoting applied and computational mathematics in the sense that, as already stressed in Items 1 and 2 above, the field of imaging science is a marvelous area where to see various branches of applied mathematics in action on some concrete scientific and industrial problems. It is also a source of nice new mathematical challenges, which is a good incentive for more researchers and students to join the field.

In conclusion, the SIAG/IS requests that the SIAM Council and Board of Trustees renew his charter for a two-year operating period beginning January 1, 2016.

Signed

Naoki Saito
Chair, SIAM Activity Group on Imaging Science
May 26, 2015

