

## **Charter Renewal Application for the SIAM Activity Group on Uncertainty Quantification**

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Uncertainty Quantification. The SIAG/UQ was originally formed under the aegis of SIAM in December 2010 by the SIAM Council and by the SIAM Board of Trustees with its initial operating period beginning December 11, 2010 and ending December 31, 2012. This will be the first charter renewal for SIAG/UQ. This SIAG had 282 members, including 143 student members, as of 12/31/2011.

According to its Rules of Procedure, it is the purpose of the SIAM Activity Group on Uncertainty Quantification to foster activity and collaboration on all aspects of the effects of uncertainty and error on mathematical descriptions of real phenomena.

- It seeks to promote the development of theory and methods to describe quantitatively the origin, propagation, and interplay of different sources of error and uncertainty in analysis and predictions of the behavior of complex systems including biological, chemical, engineering, financial, geophysical, physical, and social/political systems.
- The SIAG serves to support interactions between mathematicians, statisticians, engineers, and scientists working in the interface of computation, analysis, statistics, and probability.
- Together with its partner UQ Interest Group in ASA, the SIAG organizes a biennial conference, sponsors minisymposia at conferences, publishes a newsletter biannually, and maintains an electronic discussion group.

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

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

The SIAG on UQ will organize activities in Uncertainty Quantification. The SIAG is expected to:

1. Organize minisymposia at the SIAM Annual Meeting in years where there is no SIAG conference.
2. 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.
3. Organize a biennial SIAM Conference on Uncertainty Quantification. 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.
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.

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).*

- Chair: Donald Estep
- Vice-Chair: Max Gunzburger
- Program Director: Roger Ghanem
- Secretary: Habib Najm

As current Chair, I have begun the process of seeking nominations for the next set of officers. The approved nominating committee is Roger Ghanem (USC), Guillaume Bal (Columbia), Karen Willcox (MIT), and Andrew Stuart (Warwick), while I am serving as chair. We have sent out calls for nominations and have received a reasonable number so far.

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 two years?*

UQ is a relatively young field that is undergoing an explosion of activity. This is spurred in part by the increasing recognition of the fundamental role of UQ in scientific inference, and the related increases in funding opportunities for UQ. It is also a field that is appealing to young researchers because there are a great many interesting research problems while progress is wide open.

The research activity in UQ spans an almost bewildering range of directions. Partly this is because the specifics of technical UQ research is tied to the particular situation in each application, e.g. quality and type of available data, state of models, state of numerical approximations, application/scientific goals. One can see general trends, e.g. the conference featured quite a few sessions on polynomial chaos methods, sampling in high dimensions, rare events, Bayesian inference, and a posteriori error analysis. But, it would be quite reasonable to expect to see a much different slate of activities during the next conference.

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 officers of the UQ SIAG were first of all focused on organization of the first SIAM-ASA-USACM Conference on Uncertainty Quantification (held in Raleigh, North Carolina 4/1-4/5), which is reported on below. Najm and Estep were co-chairs (along with David Higdon of the ASA, and Ghanem and Gunzburger were on the organizing committee.) The interdisciplinary nature of the meeting and the desire to include a broad constituency took extra effort to insure success.

Estep and Gunzburger were additionally focused on proposing the establishment of the new SIAM-ASA Journal on Uncertainty Quantification, which gained approval in January of 2012.

The SIAG had 282 members going into the conference and increased its membership during and after the Conference. The SIAG now (5/22/12) has 378 members. SIAM gained over 25 new members as a result of the conference.

Since UQ is a relatively young field in many ways while the SIAG officers and members are all actively engaged in UQ research, keeping in touch with developments on the mathematics and applications sides is not an issue at present. One consequence of the Conference was increased

exposure of developments in statistics that touch on many of the same issues but of course with a different perspective.

It is crucial to at least sustain if not increase communications between the statistical and mathematical communities in UQ. The new SIAM-ASA Journal on Uncertainty Quantification will be very important for this effort. It is also a good idea to strengthen ties with the sister activity group in uncertainty quantification in ASA. Estep is a member of both and expects to become more involved with the ASA group once his term on the SIAM UQ SIAG is over.

It is equally crucial to broaden the close interactions with different application communities. We have currently a strong connection to one group in engineering (USACM), but there are other engineering groups that we should interact closely with. There are also several scientific disciplines that should be more closely involved. My feeling is that Geosciences might be a reasonable choice for increasing focus.

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 UQ organizes the biennial conference on Uncertainty Quantification. This list of conferences may be found at: <http://www.siam.org/meetings/archives.php#UQ>. The first SIAM Conference on Uncertainty Quantification was held in Raleigh, NC on April 2-5, 2012. This conference has a pre-registration number of 162 attendees including 111 paid non students and 19 paid students attending. In total, 487 people registered for the conference. We had to extend the conference an extra day because of the interest. As I wandered around the meeting, I received many positive comments about the Conference. The only complaint I heard was the perennial issue of too many minisymposium talks. I explored many ideas for this, but of course there is no easy solution.

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 is too young to have had a track record yet. The current officers did not carry out any SIAG-wide organizational effort towards the annual meeting, given the focus on organizing the first UQ conference.

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?*

- As noted, the SIAG organized the first SIAM ASA USACM Conference on Uncertainty Quantification, which was a huge success. The UQ SIAG membership directory is online and there is a UQ SIAM electronic mailing list. There is also the first charter renewal.
- Currently, we are seeking nominations for stories for SIAM News about UQ research coming out of the Conference. The intention is to focus on individual talks in a series of short stories (following a suggestion of James Crowley).
- Jim Berger (ASA, Duke), Estep and Gunzburger worked on the proposal to create the new SIAM ASA Journal on Uncertainty Quantification. Since it was approved in January, 2012, the three

have been working with the SIAM and ASA staffs on details of the journal organization. SIAM staff have done a great job in getting the mechanics worked out, and the journal web site went online on May 10, 2012.

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

- Organization of the next SIAM ASA Conference on Uncertainty Quantification. As SIAM's request, I (Estep) have begun organization of some aspects of the next conference. My own major concern is to solidify the interdisciplinary nature of the organization of the conference and the very close working relationship with ASA in particular. This is absolutely key to the continued success of the conference. My intention is to do everything I can to get ASA buy in to the conference and to carefully choose the co-Chairs with this goal in mind.
  1. SIAM is looking at specific locations and times based on suggestions I solicited.
  2. I have identified the lead co-chair from SIAM (Max Gunzburger, FSU), and a co-chair from ASA (Phil Stark, UC Berkeley. Both candidates have expressed a strong desire to strengthen the SIAM-ASA cooperation, while Gunzburger provides continuity to the first edition of the conference. My intention is to look for a co-chair from Geosciences and another co-chair from SIAM. I will work with the current SIAG officers as well as Stark and Gunzburger before passing the suggestions to SIAM for approval.
  3. I am also soliciting some suggestions for potential organizing committee members from outside SIAM to pass to the co-chairs, though of course they will be selecting their own OC members.
  4. I will take care of any further organizational issues that SIAM sends requests about up until I step down as SIAG Chair in January.

I wish to emphasize that I am confining my influence to the specific issues raised by SIAM as needing attention now. I fully expect to enjoy the second UQ conference as a spectator!

- Increasing UQ SIAG membership. I believe that there are significant numbers of SIAM members that could reasonably be part of the UQ SIAG (specifically members currently in the CSE SIAG). I think the next officers should make a point of increasing the membership.
- Establishing an active UQ SIAG website, wiki, electronic posting board. I have received a number of suggestions that an active web page/electronic communication board for UQ would be useful. This is another activity that could be considered by the next officers.
- Increasing ties with ASA and the ASA sister group on UQ. I think there is a lot of room to increase connections with ASA through UQ. I personally am interested in doing this and plan to work on it. But it is something that the next officers could consider taking on.
- I received two suggestions for UQ SIAG activities for the future
  1. Organize the establishment of benchmarks and standards: (1) Industry-relevant benchmark UQ problems, and (2) Better UQ for measurements used to calibrate and validate engineering models. This might be carried out in cooperation with NIST. This was suggested by Mark Campanelli.
  2. Create regional UQ "Sandboxes", which are informal gatherings aimed at seeding research. I have included details of this as an appendix. This was received by Abani Patra.

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

The SIAM staff have been extremely helpful in all aspects of organizing the UQ SIAG. I think exploring the issues involved with creating a UQ web site and ideas about increasing membership would be a natural

place for SIAM to provide additional support and encouragement. Also increasing ties to ASA and other professional organizations is an area that requires SIAM help.

9. *How can the activity group help SIAM in its general role of promoting Uncertainty Quantification?*

I think many of the suggested activities for the SIAG would be a great help in promoting SIAM activities in UQ.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two year operating period beginning January 1, 2013.

Donald Estep  
SIAG/UQ Chair  
5/22/2012

# **APPENDIX A**

## **Regional Uncertainty Sandbox Symposia (RUSS)**

### **1. What? & Why?**

- An informal setting for researchers (especially those new to the field and graduate students) and practitioners to share issues and common challenges and benefit from each other's experiences; expedite problem solving and discovery;
- Rapid development and greatly diversified nature of the work (many academic communities are involved) makes it difficult for most researchers to communicate effectively in the normal conference and journal modes, which tend to be community centered.
- Inspired by the very successful finite element circus series started by Babuska and others several decades ago – we could plan a simple and strict format of 1.5 days (Friday post-lunch to Saturday evening) with structured conversations (no formal talks) on ongoing research issues. Topics and discussion leaders to be suggested by participants up until Friday lunch when a time allocation will be made.
- We hope that this evolves into a forum for people to share and leverage each other others' in-progress ideas (accelerating progress for all). However, such sharing will require a level of trust and respect for each other's intellectual property. While, no official publications will arise from each meeting, each host will be tasked with preparing a short summary with principal ideas attributed to proposers in a blog-style post. We will explore the idea of journals or the proposed SIAG wiki etc. posting this "summary" attributed to all participants.

### **2. When?**

*Four a year – 1 per region;*

### **3. Where?**

*(NE,SW,W,NW)*

*Received by Abani Patra*