

## **SIAM Activity Group on Nonlinear Waves and Coherent Structures Charter Renewal Application**

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Nonlinear Waves and Coherent Structures. The SIAG/NWCS was originally formed under the aegis of SIAM on December 7, 2002 by the SIAM Board of Trustees and on March 26, 2003 by the SIAM Council with its initial operating period beginning January 1, 2003 and ending December 31, 2005. Its charter has been renewed by the Council and Board 4 (four) times thereafter.

This SIAG had 245 members, including 100 student members, as of 12/31/2015.

According to its Rules of Procedure, the purpose of the SIAG is to foster activity in the area of Nonlinear Waves and Coherent Structures. Its goals are:

- To foster collaborations among applied mathematicians, physicists, fluid dynamicists, engineers, biologists, and economists in those areas of research related to the theory, development, and use of nonlinear waves and coherent structures.
- To promote and facilitate Nonlinear Waves and Coherent Structures as an academic discipline.

The SIAG on NWCS will promote and facilitate research in the area through a variety of activities, including:

1. Organize a biennial SIAM Conference on NWCS. The SIAG also will consider dovetailing specialized workshops and conferences with the SIAM Annual meeting. In particular, it is planned to have the biennial meeting alternate loosely between university-style meetings, ones dovetailed with SIAM Annual Meetings, and joint meetings with other SIAGs.
2. Broker partnerships between academia, industry, and government laboratories. The SIAG will seek to facilitate the establishment of academic programs in NWCS 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.
3. The SIAG will work with other professional societies to promote NWCS. 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 NWCS through various outreach activities.

Other activities may include:

4. Organize minisymposia at the SIAM Annual Meeting in years where there is no SIAG conference.
5. 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.

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 of the biennial Martin Kruskal Lecture Prize, established in 2012.
8. Award of the biennial T. Brooke Benjamin Prize, established in 2016.

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,*

Chair: Thomas Bridges

Vice Chair: Robert Pego

Program Director: Annalisa Calini

Secretary: Jon Wilkening

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?*

The subject of nonlinear waves (hereafter “nonlinear waves” is short for “nonlinear waves and coherent structures”) is an active and growing area of research. For example, in the subject of water waves, both pure and applied, new meetings are popping up all over, and the number of new PhD students is healthy and growing. A new focus direction, which is highlighted in NWCS16 is the introduction of stochasticity into the theory of nonlinear waves. Other directions which continue to be active are coherent structures in pattern formation, integrable systems (particularly the interaction with numerics), high-performance numerics, waves on lattices, Bose-Einstein condensates and vortex dynamics, derivation and validity of modulation equations, new directions in optics and communication, waves in physiology, and waves in metamaterials. Significant advances have been made in the theory of water waves, new numerics for nonlinear waves, nonlinear waves on networks (existence, stability, long time dynamics), validated numerics, and analysis of sophisticated NLS-type models in optics and communication. The NWCS meetings capture a wide range of the activity in these areas.

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 subject of nonlinear waves continues to be active and vibrant. The number of SIAG members is artificially low. Whereas the membership is at 245, the number of registered participants at the 2014 conference was over 400. This difference has been consistent throughout the history of this activity group. It attracts many more people to events than members. Queries have shown that many people are happy to attend the conferences but see no need to join SIAM or the activity group. This is particularly true for Europeans who join the mathematics society in their home country rather than SIAM, but then are happy to pay the extra fee to attend the NWCS conferences. Indeed, the participation (and to some degree the membership) is distinctly international. Although over half the current membership is US based, 30 other countries are represented in the current membership list. The countries outside the US with the largest NWCS membership are UK, Germany, Canada, Japan, and India.

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 NWCS organizes the biennial conference on Nonlinear Waves and Coherent Structures. This list of conferences may be found at: <http://www.siam.org/meetings/archives.php#nonlinearwaves>.*

In 2014 the SIAG/NWCS conference was held in Cambridge, UK. The principal organizers were Paul Milewski (Bath) and Beatrice Pelloni (Reading). It had 416 registered participants, which is the largest number of participants for an NWCS conference in the history of the activity group. All indications are that it was a great success academically and financially (and the weather wasn't bad). In the run-up to the 2016 meeting a key success was the award of a Gene Golub Summer School on stochastic differential equations and wave propagation, to take place July 25 to August 5, just before NWCS 16 in Philadelphia. This program will be held at Drexel University and organized by Ambrose, Moskow, Simpson, Song, and Wright.

- 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 at an Annual Meeting or meet jointly with the SIAM Annual Meeting? (Guidelines are that each activity group should organize a track about every 7 Annual Meetings or meet jointly with the Annual Meeting within a 7 meetings period.)*

We weren't called upon in this cycle to organize a track at an Annual Meeting. The most recent one was in 2013.

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 activity group has a group email address managed by the Secretary Jon Wilkening. The Kruskal Lecture has been awarded biannually since 2012. During the current cycle a new prize, the T. Brooke Benjamin Prize, has been introduced, with the first award to be made at the 2016 meeting. A fundraising initiative is underway to endow the TBB Prize.

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

The key activity will continue to be the biannual meeting with the next one in 2018. Since the location and timing changes with each meeting, there is a lot of planning and negotiation with SIAM to set up these venues. Proposals will be solicited for presentation at the 2016 business meeting. It is likely that the activity group will be organizing a track at the Annual Meeting. A potential new development is a blog, which will link in with the group email address (e.g. items posted on the blog, with the email used for notification).

A very low percentage of the NWCS membership is industry linked. In a step to improve this interaction, the organizers of SIAM NWCS 16, Annalisa Calini and David Ambrose, selected Misha Chertkov of Los Alamos National Laboratory as the top choice for an industry/lab plenary speaker. In the organization of NWCS 16 Mads Sorensen contacted several industry related research centers and Greg Lupton solicited many people from companies working in nonlinear optics. However, the NWCS conferences have a reputation for being predominantly academic. It would be advantageous for the next cycle of officers to look to further expand industry participation and interaction.

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

SIAM has been very supportive of this activity group. One weakness of this activity group is weak interaction with industry. Any support from SIAM which helps to increase industry interaction would be helpful.

8. *How can the activity group help SIAM in its general role of promoting nonlinear waves and coherent structures?*

By continuing and expanding its current activity.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two year operating period beginning January 1, 2017.

Signed by the SIAG Chair

*Thomas J. Bridges*

29 April 2016