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 seven times thereafter.

This SIAG had 295 members, including 101 student members and 194 non-student members as of 12/31/2021.

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 SIAM 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: Barbara Prinari
Vice Chair: Mark Hoefer
Program Director: Jens Rademacher
Secretary: Olga Trichtchenko

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 study of nonlinear waves and coherent structures as a sub-discipline of applied mathematics continues to be a very strong, diverse, and active area with a wide range of relevant applications and deep mathematical foundations. The health of the field is testified by the fairly large number of field-wide national and international conferences that, in addition to the biannual SIAM Conference on Nonlinear Waves and Coherent Structures, take place regularly in the US and abroad. In the last two and a half years, during which the pandemic prevented or drastically limited in-person gatherings, many conferences in the field have been organized in an online format, and multiple online seminars, organized by activity group members and advertised through the NWCS Engage community, have flourished (e.g., the NWCS webinar organized by S Charalampidis, C Chong and P Kevrekidis; the UW Applied Math PDE seminar organized by J Cisneros and B Deconinck; the Waves in One World webinar organized by D Ratliff in conjunction with ICMS Edinburgh, just to mention a few examples).

An area that has been attracting more and more attention in the last couple of years is the field of dispersive hydrodynamics, which has emerged as a unified mathematical framework for the description of multiscale nonlinear wave phenomena in dispersive media, encompassing both dynamic and stochastic aspects of wave propagation. This exciting new area had a large exposure in the recent “New Horizons in Dispersive Hydrodynamics” a virtual 2-week-long conference organized through the Isaac Newton Institute in Cambridge in June 2021. A dedicated 6-month research program at the Isaac Newton Institute will run from July–to December 2022.

Some additional, newer areas of interest to be featured at the 2022 SIAM NWCS conference

(Andre Nachbin and Jens Rademacher, co-chairs) include nonlinear waves in traffic flow, as well as the use of partial differential equations as models in climate and geoscience. Traditional areas of interest include the stability analysis of nonlinear waves and the analysis of soliton gases and integrable turbulence. Applications to water waves/fluid dynamics, low-temperature physics and Bose-Einstein condensation, granular media, and nonlinear optics remain of fundamental importance to the activity group.

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 size of the activity group remains stable at around 300 members, growing some during the years of the biannual NWCS conference (at the end of 2018, for instance, it peaked at 330 members) and decreasing a bit in the off years (it was 289 at the end of 2019). Although it is one of the smallest of the SIAGs by membership, we had seen a gradual increase in the number of student members (from 100 to 141 between 2015 and 2017 and up to 152 in 2019), but the pandemic seems to have negatively impacted the student membership, which now stands at 101. However, the decrease in student membership has been offset by an increase in non-student membership so that the current 295 membership slightly exceeds the numbers from 2020. There are growth opportunities in student membership, so increasing student engagement will be a primary focus of the next period of the charter. We have also made efforts to increase the number of members from developing countries, highlighting the benefits of the SIAM outreach membership in our 2019 and 2020 newsletters, which we will continue to do in 2022, and for the next charter period.

The SIAG attempts to keep up with changes in the field primarily by soliciting plenary lectures or minitutorials at the biennial meeting that relate to new or emergent areas of interest. Another activity that aims to enhance the interest in nonlinear waves for young researchers and/or students is the organization of a "hot topics" session at the biennial meeting. Although the fraction of SIAG NWCS members from industry or government labs is low compared to other SIAGs, a deliberate attempt is made to have representation from these sectors in prominent roles of the organization (e.g., in the prize committees) and invited presentations at the biannual meeting.

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.

Since 2004, the SIAG NWCS has been organizing the biannual conference on Nonlinear Waves and Coherent Structures. The complete list of NWCS conferences may be found here.

The 2020 NWCS conference was supposed to be held in Bremen, Germany, in July 2020, but it was cancelled due to the pandemic. Subsequently, it was decided to have the 2022 NWCS conference in the same location, from Aug 29 – Sep 2, 2022. The conference will have a hybrid format, and currently, the conference co-chairs Andre Nachbin and Jens Rademacher reported submission of 45 mini-symposia (4 speaker sessions), 43 contributed talks, and 7 posters. Workshops germane with the conference include "Analysis of dispersive systems" (Sep 5-9, Isaac Newton Institute for Mathematics) and "Spatial dynamics and related approaches" (Sep 5-7, University of Stuttgart).

The activity group also organized a track of minisymposia at the 2021 SIAM Annual Meeting (AN21), which was held virtually, Jul 19-23:

"Recent Advances in Dispersive Hydrodynamics" (3 parts)
"Advances in Integrable Systems and Inverse Scattering Transform" (3 parts)
"Nonlinear Waves in Lattice Dynamical Systems" (2 parts)
"The Unified Transform Method and its Applications"
"Water Waves: Instabilities, Singularities and Solitons" (2 parts)
"Asymptotics and Numerics in the Theory of Nonlinear Waves" (2 parts)
"Nonlinear Waves, Dynamics and Singularities in Hydrodynamics and Physics" (2 parts)

Tom Trogdon, University of Washington, was the designated SIAG member of the AN21 organizing committee. SIAG vice-chair Mark Hoefer delivered a plenary invited talk on "Dispersive Hydrodynamics: Dispersive Shock Waves, Solitons, and (Non)Convexity".

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 active in the Engage NWCS community, which is moderated by SIAG chair Barbara Prinari. In 2018 the SIAG introduced a newsletter for members of the activity group, aiming at highlighting the research and activities of the members, as well as communicating upcoming opportunities. The second issue of the newsletter was distributed to the membership of the SIAG via the mailing list in December 2019, and the third issue was made available to the community via the Engage platform in December 2020. Due to the pandemic, the newsletter was not sent out in 2021, but the current SIAG officers plan to send out a newsletter in 2022. The current leadership would also be very happy to assist in transferring the templates and other materials for preparing the newsletter to the next set of officers.

The SIAG regularly awards the Martin J. Kruskal Prize/Lecture as well as (since 2016) the T. Brooke Benjamin Prize, which is specifically targeted at honoring the achievements of mid-career researchers. The 2020 Kruskal and Benjamin prizes were awarded respectively to Vladimir Zakharov, University of Arizona, and SIAG co-chair Mark Hoefer, University of Colorado Boulder. Since the 2020 NWCS conference was cancelled, Mark Hoefer delivered the Benjamin lecture in a virtual format in July 2021. The recipients of the 2022 Kruskal Prize/Lecture and Benjamin Prize were recently announced, and they are, respectively, Roberto Camassa, University of North Carolina Chapel Hill, and Toan Nguyen, Penn State University. The prizes will be awarded during the NWCS22 meeting.

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

The biggest task of the SIAG is planning and supporting the organization of the biannual SIAM Conference on Nonlinear Waves and Coherent Structures, and in the next period this will concern the 2024 meeting. A solicitation from members to propose a location for the 2024 meeting will be sent out shortly to the community through Engage, with a June 30, 2022, deadline. In the announcement we will stress that since SIAM leadership has declared that no two consecutive SIAG meetings can be abroad, we will need a US location for NWCS24. Proposals will be discussed at the business meeting to be held Aug 29 – Sep 2, 2022, as part of the upcoming NWCS conference in Bremen, Germany. In any case, it will be important to select the next

location carefully to reflect the interests of the broader SIAG membership in terms of physical location and venue type (e.g., hotel or university) while balancing them with the utility and advantages of SIAM staff expertise, which favors urban locations and hotel venues.

The SIAG also wishes to continue with the production of a regularly published newsletter, which was already expanded compared to its first issue, and which we hope to enhance in the future with new features. Other ideas include the use of social media such as a Twitter to update and modernize the way the SIAG communicates with its members and/or advertises its services to potential members. SIAG secretary Olga Trichtchenko is actively working with Daniel Ratliff on a SIAG-NWCS Twitter feed which will post at least twice a week. Tweets will include information about conferences and meetings, feature research articles published by NWCS members, current events of interest to the SIAG, and spotlight the diverse researchers and their work. These posts can be easily formatted to be included in a previously proposed SIAG blog and select stories can then be included in the newsletter.

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

SIAM could sponsor a new SIAM journal on Nonlinear Waves and Coherent Structures. Such a journal with the SIAM masthead would help to further promote the scientific activity of the SIAG, which could in turn increase membership. There are other venues in the SIAM journal system for different types of papers written by SIAG members (e.g., SIAM Journal on Mathematical Analysis for more mathematically-oriented papers on partial differential equation models, or SIAM Journal on Scientific Computing for numerical simulations of nonlinear waves) but there is no coherent publication home for the SIAG within SIAM. The success of the activity group has been limited by the lack of a dedicated dissemination venue with a faster cadence. The envisioned journal, exclusively focused on the field of Nonlinear Waves, would source its content from applied mathematics in a rich variety of areas and physical settings, with an emphasis onexcellence. The current SIAG-NWCS officers have submitted a mini-proposal for establishing such a journal. The proposal is currently being reviewed by the SIAM journal committee, and we hope for a positive recommendation.

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

Members of the SIAG could help SIAM promote the general area of nonlinear waves research by writing and/or proposing articles for SIAM News, or in the case of longer and more detailed articles, SIAM Review. Otherwise, the SIAG could maintain its efforts to make the biennial conference and other SIAG activities relevant to student members so that they remain active in SIAM when they become professionals.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two-year operating period beginning January 1, 2023.

Signed,
Barbara Prinari, SIAG/NWCS Chair