

## **SIAG Dynamical Systems (DS)**

### **Charter Renewal Application**

The SIAG/DS was formed under the aegis of SIAM by the SIAM Council on December 2, 1988, and by the SIAM Board of Trustees on December 3, 1988. Its initial operating period began January 1, 1989, and ended December 31, 1991. Its charter has been renewed by the Council and Board every two years thereafter.

In accordance with the Rules of Procedure, the SIAG/DS aims to bring together researchers interested in the theory and applications of dynamical systems. Interests can range from fundamental mathematics of dynamical systems to the development of software for use in the study of dynamics, to applications in disciplines such as physics, chemistry, engineering, and the life sciences. The activities of the SIAG are designed to foster interactions between the academic community and researchers in industry and government laboratories, and to stimulate cross-disciplinary activities among people with similar interests but often different backgrounds. The SIAG had 1260 members as of 12/31/18 and of those 632 were students.

The SIAG/DS is currently responsible for the following activities:

- Organize a biennial Activity Group meeting (SIAM Conference on Applications of Dynamical Systems);
- Sponsor the Jürgen Moser Lecture at the biennial Activity Group meeting by an individual who has made distinguished contributions to nonlinear science;
- Award the J.D. Crawford Prize at the biennial Activity Group meeting to an individual for a recent outstanding publication on a topic in dynamical systems and nonlinear science;
- Award the "Red Sock" Prize at the biennial Activity Group meeting for up to four poster presentations in dynamical systems by students or postdocs at the meeting;
- Organize minisymposia at the SIAM Annual Meeting in years when there is no Activity Group meeting;
- 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
- Maintain and enhance the Dynamical Systems Web portal DSWeb (<http://www.dynamicalsystems.org/ap/ca/>) for members of the Activity Group and the public at large.

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The SIAG complements SIAM's activities and supports its functions. The answers to the questions below indicate how this was accomplished and what the officers propose as the future directions for the SIAG.

- **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?**

SIAG/DS continues to evolve and thrive as a diverse and interdisciplinary activity group. Our membership spans industry, government and academia and is strong both domestically and internationally. We have members who identify as engineers, physicists and life scientists in addition to many mathematicians who span the spectrum from the deeply theoretical to the highly applied. Our traditional mathematical areas of focus include multi-scale modeling, network science, differential equations and bifurcation theory, stochastic processes, pattern formation and dynamical systems methods for PDEs. Two current areas of growth are our connections to Network Sciences, reflected in the fact that NS19 is co-located with DS19, and our strong connections to the revolution in data science, including data assimilation, data-driven modeling, and data characterization and reduction.

- **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?**

SIAG/DS is the third largest of the SIAM activity groups, and it forms a strong and vibrant community. SIAM's infrastructure for meetings, publications and communication helps foster the SIAG/DS community. Its membership is stable with over 600 non-student members and more than 600 student members. Dynamical systems by its very nature is inherently interdisciplinary, and our membership has strong ties with other activity groups including Life Sciences, Nonlinear Waves and Coherent Structures, Mathematics of Planet Earth, Analysis of Partial Differential Equations, and most recently Data Mining and Analytics. Our membership is international and spans industry, government, and academia.

- **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/DS was formed in 1988, and has sponsored the SIAM Conference on Dynamical Systems in odd-numbered years since 1995, convening in Snowbird, UT; two earlier meetings took place prior to 1995: in 1990 (Orlando FL) and 1992 (Snowbird). The 2017 Snowbird meeting (DS17) had over 900 registered participants, and was by all accounts a dynamic gathering and a stellar success. With 990 pre-registrations for DS19, we expect this to be our largest meeting ever. This SIAM conference is generally accepted to be the most important international conference in applied dynamical systems.

Dynamical systems conference location in Snowbird has been a source of perennial debate. Problems include high elevation (for people prone to altitude sickness) and limited dining options. We've been forced to split the poster session over two nights due to size limitations. Many individuals like the secluded setting and resort feel that Snowbird provides and the branding of having the conference in the same location has helped the conference gain high visibility. After two extensive surveys of our membership, we've decided to try moving DS21 to a more urban and accessible location, namely Portland, Oregon.

- 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?

The SIAG organized a Dynamical Systems track at SIAM AN18; this was spearheaded by Chad Topaz who was on the organizing committee. There were six minisymposia (with a total of eight sessions):

- Applications of Dynamical Systems Methods to Emergent Dynamics and Patterns - Part I of II
- Applications of Dynamical Systems Methods to Emergent Dynamics and Patterns - Part II of II
- Network Dynamics
- Analysis, Design, and Control of Neural Systems
- Defects and Inhomogeneities in Pattern Forming Systems - Part I of II
- Defects and Inhomogeneities in Pattern Forming Systems - Part II of II
- Nonlinear Waves, Long-time Dynamics, and Stability - Part I of II
- Nonlinear Waves, Long-time Dynamics, and Stability - Part II of II

As 2019 is an ICIAM year, the SIAG is not formally represented at the annual meeting but our membership is well represented among the minisymposia tracks at this meeting.

- 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 DSWeb portal, which includes the periodical *Dynamical Systems Magazine*, has been highly successful as a promoter of dynamical systems, and as a site to advertise open positions and upcoming workshops, as well as report on research groups and important conferences and provide tutorials. Book reviews, editorial opinion, and vignettes of members are also featured on the site. We are grateful to Korana Burke and Anna Ghazaryan who co-edit DSWeb. There is an active @DynamicsSIAM twitter account, with more than 2,700 followers as of May 2019. We are grateful to Mason Porter who has stewarded this account.
  - The SIAG/DS has a strong and healthy relationship with SIAM News; Hans Kaper is its editor-in-chief and is a long-standing active member of our activity group.
  - The SIAG/DS gives out three awards at its biennial meeting:
    1. The Jürgen Moser Lecture, established in 2000, is awarded to a person who has made distinguished contributions to dynamical systems or nonlinear science. The prize consists of a special lecture along with a cash prize. The 2019 Moser

Lecture will be given to Philip Holmes for “*his fundamental contributions both to the mathematical theory of dynamical systems and to a broad range of applications in physics, optics, neuroscience, and engineering.*”

2. The J.D. Crawford Prize, also established in 2000, is awarded to a person for a recent outstanding publication on a topic in dynamical systems and nonlinear science, as evidenced by a publication (in English) in a peer-reviewed journal within the last four years. The 2019 J.D. Crawford Prize will be awarded to Margaret Beck for “*work using the Maslov index to determine stability of nonlinear waves, as well as for other outstanding contributions on coherent structures and nonlinear waves.*”
3. The Red Sock Award, elevated to the status of a recognized SIAM prize in 2012, is awarded for the best poster presentations in dynamical systems by a student or postdoc. Five winning posters were selected at DS17 and we expect to make (at least) six awards at DS19. This award contributes to the success of the poster sessions at the conference, which are engaging, very well attended, and a positive experience for our neophyte dynamicists.
  - DS17 added two new activities – a well-attended student ice-breaker event at the start of the conference, and a mentoring event. Each of these contribute to the professional development of SIAG/DS junior researchers. We’ve expanded the scope of these events at DS19 which reflects a strong commitment on the part of the SIAG leadership to creating a diverse and an inclusive community, and helping our colleagues grow and flourish.
  - To support the mentoring activities at DS19 and increase the number of Red Socks awards we created a gofundme site:

<https://www.gofundme.com/support-mentoring-and-diversity-in-dynamical-systems>

and raised over \$3,400. This is yet another sign of the strength and engagement of our membership.

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

One of the important activities will be planning for DS21, our biennial Conference on Dynamical Systems. We have just selected a nominating committee that will lay the foundation for elections of new officers, including Program Directors for this conference. Moving this conference to Portland will provide both challenges and opportunity. We are committed to the continued success of this conference. We also are committed to supporting DSWeb and more broadly our presence in social media. Our goal is to continue to be the nexus of the dynamical systems community.

- **How can SIAM help the activity group achieve its goals?**
  - We would ask that SIAM build into the budget for DS21 money for the Icebreaker and Mentoring activities. These are a strong priority for our community, and deserve support as an integral part of the conference.
  - SIAM offers travel grants to conferences including DS19. This year SIAM only supported 8 out of 55 applications for Early Career travel awards to DS19 (57 out of 133 applications for Student travel awards). We feel that this percentage is low given SIAG/DS's size. We would encourage SIAM to diligently pursue funds on this axis.
  - Moving DS21 to Portland, OR may create new (and unforeseen) challenges. We look forward to working with SIAM to ensure that this meeting is a success.
- **How can the activity group help SIAM in its general role of promoting applied mathematics and computational science?**
  - We will continue to promote dynamical systems and more broadly applied and computational sciences through DSWeb, our presence in social media, and through our contributions to SIAM news.
  - The interdisciplinary nature of dynamical systems naturally makes our SIAG a community of ambassadors to the mathematical world. We are committed to building and supporting these bridges to other areas of mathematics and the sciences.

This SIAG requests that the SIAM Council and Board of Trustees renew its charter for a two year operating period beginning January 1, 2020 through December 31, 2021.

Signed

*Andrew J. Bernoff*

Andrew Bernoff, Chair of the SIAG on Dynamical Systems

May 9<sup>th</sup>, 2019