SIAG Algebraic Geometry (AG)
<u>Charter Renewal Application</u>

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Algebraic Geometry (SIAG/AG). The SIAM Activity Group (or SIAG/AG) to which this renewal applies was originally formed under the aegis of SIAM on July 2009 by the SIAM Council and by the SIAM Board of Trustees with its initial operating period beginning January 1, 2010 and ending December 31, 2011. This charter was renewed by the Council and Board five times with the fifth term ending 12/31/19. As of 12/31/18 this SIAG had 435 members, including 194 student members.

According to its Rules of Procedure, the objective(s) of the SIAG are to provide a research community gathering point for research in applications of algebra and geometry. The activity group will welcome participation from both theoretical mathematical areas and application areas not on this list which fall under these broadly interpreted notions of algebraic geometry and its applications.

Its purposed functions were:

(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 Algebraic Geometry. 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.

- 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/three] years?

  The field of Applied Algebraic Geometry is continuing to grow into many areas of application building on methods in algebra, geometry, and topology. The core topics in this area, including Algebraic Statistics, Computational Algebraic Geometry, Computational Topology, Cryptography, Multilinear Algebra and Geometry of Tensors, Numerical Algebraic Geometry, Polynomial Optimization, and Systems Biology, have led to results in a variety of application areas, including chemical reaction networks, computer vision, genetics, machine learning, mechanical engineering, network science, neuroscience, phylogenetetics, and physics. In addition to strengthening the core areas, the group is also witnessing expansion in frame theory, material science, random algebraic geometry, and rigidity theory. One area that may be expected to have significant growth over the next two years is the use of applied algebraic geometry to develop mathematical foundations and understanding of machine learning methods.

- 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?

  Presently, SIAG/AG is very vibrant. One demonstration of this is the Fall 2018 Institute for Computational and Experimental Research in Mathematics (ICERM) semester on "Nonlinear Algebra," which was the largest semester program in its history. SIAG/AG continues to see strong attendance at relevant local, national, and international meetings. The number of members of SIAG/AG is stable (333 members in 2016, 436 members in 2017, and 435 members in 2018) with considerable growth in the SIAM Applied Algebraic Geometry Conference. For example, in 2017 in Atlanta, there were 106 minisymposia sessions, while the 2019 edition in Bern, Switzerland is scheduled to have 163 minisymposia sessions. The broader interests of SIAM are reflected in the variety of applications considered by members of SIAG/AG and the diversity of participation (e.g., employer, geographic, gender). Members of SIAG/AG continue to foster multidisciplinary interactions, break down barriers between disciplines, and broaden participation.

- Please list conferences/workshops the activity group has sponsored or co-sponsored over the past two years, and give a brief (one sentence or phrase) indication of the success or problems with each.

  SIAG/AG sponsors the biennial conference on Applied Algebraic Geometry.

  - ***SIAM Conference on Applied Algebraic Geometry (AG17),*** *Georgia Tech, Atlanta GA, USA, July 31- August 4, 2017. This conference had 443 participants, 106 minisymposia sessions plus 4 sessions for contributed presentations, and poster sessions. This was a very successful conference which was the largest in the series to date.*

  - ***SIAM Conference on Applied Algebraic Geometry (AG19),*** *University of Bern, Bern, Switzerland, July 9-13, 2019. This conference is a satellite conference held the week before the International Congress on Industrial and Applied Mathematics (ICIAM) in Valencia, Spain and currently has 163 minisymposia sessions with an additional 30 posters presentations. Based on*

the number of scheduled talks, the expected number of participants is expected to be over 600, which would significantly exceed the number of participants in AG17.

In addition, SIAG/AG was selected to organize a track of minisymposia at the 2018 SIAM Annual Meeting (AN18). This track consisted of 10 minisymposia.

Members of SIAG/AG are also very active in organizing conferences, workshops, and semester programs. A list of these can be found at http://wiki.siam.org/siag-ag/index.php/Current_events.

- 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 last time SIAG/AG organized a track was at the 2018 SIAM Annual Meeting (AN18). This track consisted of 10 minisymposia.

  Since SIAG/AG held its biennial conference just over two weeks after the 2017 SIAM Annual Meeting (AN17), SIAG/AG participation at AN17 was understandably sparse. The highlight related to SIAG/AG was the James H. Wilkinson Numerical Analysis and Scientific Computing Prize Lecture by Lek-Heng Lim.

- Please indicate other activities sponsored by the activity group, to include newsletters, prizes and web sites. Have each of these been active and successful?

  SIAG/AG sponsors the following activities:
  - *Early Career Prize, established in 2016, is awarded every 2 years. The first prize was awarded at AG17 and the second will be awarded at AG19.*
  - *Newsletter, delivered every month*
  - *Wiki page (http://wiki.siam.org/siag-ag/index.php/Main_Page) listing all current events, job postings, and books by SIAG/AG members.*

  The SIAM Journal on Applied Algebra and Geometry (SIAGA), established in 2016, is also associated with the research interests of SIAG/AG.

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

  Over the next two years, SIAG/AG will organize the following activities:
  - *SIAM Conference on Applied Algebraic Geometry (AG21). We are presently soliciting proposals for a location of this conference. It will be held in North America due to SIAM guidelines.*
  - *Soliciting nominations for the SIAG/AG Early Career Prize, which will be awarded at AG21.*
  - *Maintaining a useful monthly newsletter and wiki page (http://wiki.siam.org/siag-ag/index.php/Main_Page) listing all current events, job postings, and books by SIAG/AG members.*
  - *Organize minisymposia at the 2020 and 2021 SIAM Annual Meetings (AN20, AN21).*

- How can SIAM help the activity group achieve its goals?

  SIAM has been very supportive with SIAG/AG activities and we hope that this charter renewal is successful. As SIAG/AG continues to grow in terms of the number of SIAM Fellows and overall reputation, SIAM can help by having an increased presence of SIAG/AG members in general SIAM governance. This will continue to help build and strengthen connections between SIAG/AG and other groups. Many members of SIAG/AG are willing to volunteer for roles in SIAM which will allow SIAG/AG to contribute more to the general SIAM initiative.

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

  SIAG/AG is helping SIAM by increasing visibility via high quality publications in the SIAM Journal on Applied Algebra and Geometry (SIAGA) as well as other SIAM publications such as SIAM Journal on Discrete Mathematics (SIDMA), SIAM Journal on Matrix Analysis and Applications (SIMAX), SIAM Journal on Numerical Analysis (SINUM), SIAM Journal on Mathematics of Data Science (SIMODS), and SIAM Journal on Optimization (SIOPT). In particular, this exceptional applied research using tools for algebra, geometry, and topology helps in the promotion of applied mathematics and computational science.

  In general, SIAG/AG promotes foundational views of mathematics in a variety of areas that help to understand and describe mathematical behavior of phenomena based on algebraic, geometric, and topological structure arising in various applications. Additionally, SIAG/AG is helping to develop new generations of researchers who can interact with other researchers in various application areas in science and engineering. The SIAG/AG community has a strong commitment to graduate student training and postdoc mentoring that integrates mathematical tools with interdisciplinary applications thereby breaking communicational barriers between different fields. This was most recently demonstrated at the fall 2018 semester program at ICERM on "Nonlinear Algebra," which was the largest program to date in the history of ICERM.

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

Signed,

Jonathan Hauenstein, Chair of the SIAG on Algebraic Geometry

May 6, 2019.