

## **SIAM Activity Group Geometric Design Renewal Application**

This CHARTER RENEWAL APPLICATION applies to the SIAM Activity Group on Geometric Design. The SIAM Activity Group (SIAG/GD) to which this renewal applies was originally formed under the aegis of SIAM in 1989 by the SIAM Council and by the SIAM Board of Trustees with its initial operating period beginning July 1, 1989 and ending December 31, 1992. Its charter has been renewed by the Council and Board thirteen times thereafter.

This SIAG has 116 members, including 27 student members, as of December 31, 2021.

According to its rules of procedure, the objective of the SIAG is to provide an environment for interaction between researchers and practitioners in the subjects of computer aided geometric design, curve and surface design, solid modeling and manufacturing, volumetric representations, computer graphics, supercomputing and graphics, and related topics.

Its purposed functions:

1. Organize minisymposia at the SIAM Annual Meeting and ICIAM in years where there is no SIAG conference.
2. At least once every seven 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 Computational Geometric Design. 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. 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.

List all current officers of the activity group (including advisory board, if relevant).

Chair: Hartmut Prautzsch  
Vice Chair: Jiri Kosinka  
Program Director: Lucia Romani  
Secretary: David Großmann

1. 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?

Geometric Design is essential to produce any real objects, their analysis, design and manufacturing, in physical simulations, animations or medical imaging. It is used, for example, with consumer goods, in aerospace, automotive, transportation, marine or construction and building industries. Thus, it participates in, enables and is driven by the overall technological development and emerging new techniques and methodologies such as additive manufacturing or machine learning. As an assistive technology, Geometric Design helps expand application domains and the number of solvable problems and obtain improved solutions. This can be seen in new directions such as architectural geometry making possible new building designs, isogeometric analysis integrating geometric design and structural analysis, and the development of geometric deep learning expanding machine learning techniques to non-euclidean data. All of this could be witnessed at the Geometric Design conference in 2021.

2. 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 widespread use of Geometric Design and new application areas have led to a fragmentation of the field within the last two decades, which is reflected in the stagnating number of members with a declining tendency. In an attempt to bring together various close and overlapping applied geometry conferences, Konrad Polthier, a former SIAG GD chair, initiated a geometry summit six years ago. The GD conference has been part of the second summit in 2019 in Vancouver and will be part of the third summit in 2023. Indeed, being part of the summit in 2019 helped increase conference attendance to the highest number in the last 18 years and raise member numbers by 19 % above the previous trend. GD's member composition reflects in a balanced fashion the wide spectrum and applicability of the field with members from industry and academia in mathematics, engineering, and computer science departments in a balanced fashion fitting to SIAM's goal to spread and turn to practical use mathematical knowledge.

3. 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 Geometric Design organizes the biennial conference on Geometric Design.

The 2019 SIAM conference on Computational Geometric Design was part of the Geometry Summit in Vancouver, Canada, with about 200 attendees. This successful event with a great portion of young participants invites repetitions in the future.

The 2021 SIAM Conference on Geometric and Physical Modeling (GD/SPM21) was held virtually due to travel and contact restrictions. The much different time zones in which the participants lived and missing social contacts during lunch and other breaks posed new challenges, but the excellent technical organization by SIAM staff helped to make the best out of it.

4. 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?

*\*Because of the number of Activity Groups, the current guidelines are that an Activity Group should organize a track about every seven (7) Annual Meetings or meet jointly with the Annual Meeting within a seven (7) meeting period. \**

The 2017 SIAM Conference on Industrial and Applied Geometry was co-located with the 2017 SIAM Annual Meeting.

A minisymposium on Automated Finite Element Analysis was organized at the 2018 SIAM Annual Meeting in Portland, OR.

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 has a webpage and a wikipage which are maintained by the SIAM staff and the SIAG secretary, respectively: <https://www.siam.org/membership/activity-groups/detail/geometric-design> and [http://wiki.siam.org/siag-gd/index.php/Main\\_Page](http://wiki.siam.org/siag-gd/index.php/Main_Page).

An Early Career Prize has been launched. It was awarded for the first time to Mina Konakovic Lukovic from MIT at the 2021 Geometric and Physical Modeling Conference (GD/SPM21).

A mentoring program has been set up to connect experienced professionals (mentors) with junior members (mentees) within the group as contact restrictions due to the pandemic were particularly difficult for junior members.

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

The activity group is preparing for the next Geometric Design conference that will be part of the Geometry Summit 2023 in Genua (see item 2 above).

It will focus on and support junior members by further promoting the mentoring program and continuing the Early Career award.

The John Gregory Memorial Award is presented to senior researchers for their lifetime impact on Geometric Design. Since it has no institutional affiliation and to bring together different Geometric Design activities, a future goal is to affiliate it with the SIAG.

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

Through financial and organizational management, conference support for in-person, hybrid, or virtual formats and idealistically by providing a wider context showing the importance of industrial and applied mathematics and opening bridges to related fields.

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

Geometry plays a key role in a wide range of applications and everywhere in industrial productions. It is needed in (scientific) visualization, computer vision and graphics, physical simulations, domain representations and other areas. Thus, the SIAG shares interests with other SIAM activity groups and tools it develops are beneficial in other disciplines. For example, computer-aided design (CAD) systems rely on robust and geometric kernels that require efficient computational algorithms to meet current industrial demands. In a very different area, health care, geometry processing plays a crucial role in the analysis of and decision making based on 3D patient data in the form of MRI scans. To mention another example, the recent advances in the resolution capabilities of additive manufacturing open the possibilities for micro-architected

materials. These need to be designed and analyzed using novel methods capable of bridging multiple spatial scales, thus bringing experts in material science, engineering, computational methods, and geometric design together.

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

Hartmut Prautzsch  
SIAG/GD Chair  
May 16, 2022