

SIAM Activity Group Financial Mathematics and Engineering Charter Renewal Application

This CHARTER RENEWAL applies to the SIAM Activity Group on Financial Mathematics and Engineering. The SIAM Activity Group (or SIAG) to which this renewal applies was originally formed under the aegis of SIAM on March 26, 2003 by the SIAM Council and on December 7, 2002 by the SIAM Board of Trustees with its initial operating period beginning January 1, 2003 and ending December 31, 2005. Its charter has been renewed by the Council and Board eight times thereafter.

This SIAG has 631 members, including 381 student members and 250 non student members as of December 31, 2019. Among student members 88 are female, and among nonstudent members 22 are female. Overall, 156 members are from academia.

It is the purpose of the SIAM Activity Group on Financial Mathematics and Engineering to foster activity in the area of financial mathematics, financial computation, and financial engineering. Its goals are listed below. According to its Rules of Procedure, the objective(s) of the SIAG are:

- To foster collaborations among mathematical scientists (including probability, statisticians, functional analysts interested in stochastic control and dynamic programming, numerical analysts interested in the numerical solution of parabolic PDEs), computer scientists, computational scientists, data scientists, and researchers and practitioners in finance and economics;
- To foster collaborations in those areas of research related to theory and to the development and use of mathematical and computational tools in quantitative finance in the public and private sector;
- To promote and facilitate the development of financial mathematics and engineering as an academic discipline.

Within the framework of SIAM, the SIAG will conduct activities that implement its purposes.

The SIAG on Financial Mathematics and Engineering will organize activities in financial mathematics. The SIAG is expected to:

- 1) Organize minisymposia at the SIAM Annual Meeting on years where there is no SIAG conference.
- 2) Organize a track of at least six minisymposia at the SIAM Annual Meeting at least once every five years. The VP for Programs and the VP at Large will coordinate the scheduling with the SIAG chairs.

Other activities can include:

3) Broker partnerships between academia, industry, and government. The SIAG will seek to facilitate the establishment of academic programs in FME and to foster its development as an academic and research discipline. The SIAG also will facilitate the placement of undergraduate and graduate students in internships in industry and government.

4) Work with other societies (such as the AMS, IMS, and INFORMS) to promote financial mathematics and engineering. The SIAG will work with other professional societies and industry groups to promote

FME. 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 FME through various outreach activities.

5) 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.

6) SIAG meetings, workshops, and conferences may be organized only with the approval of the SIAM president and the SIAM vice president for programs.

To which have been added:

- SIAG/FME Early Career Prize:
The SIAM Activity Group on Financial Mathematics and Engineering (SIAG/FME) Early Career (formerly Junior Scientist) Prize, established in 2010, is awarded to an outstanding junior researcher in the field of financial mathematics for distinguished contributions to the field in the three calendar years prior to the year of the award.
- SIAG/FME Conference Paper Prize: This prize is awarded by the SIAM Activity Group on Financial Mathematics & Engineering (FME). It aims to recognize outstanding research presented by students and/or postdocs at the biennial SIAM conference on FME. Up to six finalists will be selected to present their work and up to two awards are made at each conference; each award has equal merit and each winner receives a \$200 prize. It was established in 2014.

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 (including advisory board, if relevant).

Chair: Agostino Capponi
Vice Chair: Birgit Rudloff
Program Director: Igor Cialenco
Secretary: Stephan Sturm

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 FME has been always a dynamic research field that foreruns and adapts to the emerging fields in applied mathematics and finance. A prominent example of tracking the evolution of FME as a research field is the biennial FME conference. If a decade ago credit risk would be the prime topic of research in mathematical finance, and five years ago market microstructure, high-frequency trading, and counterparty risk would be the hot topics, over the last two-three years, one can notice a significant shift of FME towards applications of methodologies from machine learning and data mining to solving quantitative finance problems, ranging from classical topics (optimal portfolio selection, pricing and

hedging), to more modern themes (analysis of counterparty risk, risk management, high-frequency trading). Topics such as mean-field games, commodity markets, principal-agent problems, algorithmic trading, martingale transport, robust finance, rough volatility are becoming mature fields that find applications in various applied disciplines well beyond mathematical finance. The increasing regulatory requirements as well as globalization of modern financial markets surge new developments in the general theory of risk management, systemic risk and the management of counterparty risk. Similar to other applied mathematical disciplines, FME sees an increase in data-driven and interdisciplinary research. Over the last couple of years, the field has seen increasing research on topics related to personalized and automated investment, use of financial technology for risk intermediation, and use of alternative data and natural language processing to guide trading decisions. The field has also seen the synergistic interactions of the topics mentioned above, such as the use of reinforcement learning in mean-field games and market microstructure.

The FME field continues to remain a vibrant and modern educational hub, where many of the existing graduate programs adapted their curricula to reflect the current market needs, with more focus on enhancing data science type skills, while maintaining the high scientific standards rooted in probability and statistics.

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 SIAG FME has developed as a SIAM's prime outlet to the field of quantitative finance and financial engineering, which is one of the most agile fields of the modern applied mathematics. The size of SIAG remains stable, with 631 members in 2019, which is only a small decrease from 638 in 2018. Among these, 250 are non-student members, which increased from the previous year. The decrease in overall number of SIAG members is primarily due to the decrease in student members, 381 currently from 472 in 2017. Thus, proactive steps towards increasing the number of student members will be a priority of the activity group. About 30% of members are from industry, government, research laboratories, regulatory bodies, which makes the SIAG sponsored events well attended by different demographics.

The SIAG FME Conference became one of the major events in the FME international community, attracting the most prominent scientists in this field. The FM'19 conferences registered 375 participants, which is the highest number since the inception of the FM conference series (excluding the meetings held jointly with SIAM AN). The conference covers all areas of mathematical finance, with a wide range of thematic minisymposia, including the cutting-edge emerging topics (see above). In addition to usual activities, the SIAG introduced new activities during the FM conference, such as: panel discussions covering practically important and scientifically challenging themes (systemic risk and financial stability and FinTech and AI), industrial minisymposia on risk management and machine learning. Events geared towards early career SIAG members (poster session, paper prize, early career award, special minisymposia) make FM conferences an attractive event for PhD students and postdocs. FM also becomes the main "job market event" for math finance community.

The SIAG FME continues to be an active group within SIAM by sponsoring minisymposia during the Internal Conference on Industrial and Applied Mathematics, and during the SIAM Annual Meeting. The SIAG-FME has also contributed articles to the SIAM news and SIAM bulletin.

The SIAM Journal on Financial Mathematics, associated with the SIAG FME, celebrated its 10th anniversary. It is positioned itself as a high quality mainstream journal in the area of applied and theoretical mathematical finance. The journal receives a healthy and increasing numbers of submitted manuscripts, covering all areas of mathematical finance. In response to the changes in the financial engineering landscape, the editorial board of the journal introduced the short communications that would facilitate a fast track in publishing timely developments and discoveries.

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 FME organizes the biennial conference on Financial Mathematics and Engineering – the flagship event for the mathematical finance community. The list of past conferences can be found at <https://www.siam.org/membership/activity-groups/detail/financial-mathematics-and-engineering>. The last FME Conference took place in July 2019, at University of Toronto, Toronto, Canada. FM19 had a record number of attendees at 375; up over 100 attendees from 271 in 2017. This was the first time a university hosted the FME conference. Overall, the conference was a great success: over 86% of participants indicated that they agree or strongly agree that the technical program was excellent; 94% of participants agreed or strongly agreed that the sessions were interesting and focused on topics relevant to the conference themes; also a vast majority of participants found the plenary talks interesting and well presented.

During the International Congress on Industrial and Applied Mathematics (ICIAM 2019) SIAG FME organized a track of 8 thematic minisymposia, covering both the emerging of machine learning in finance, novel yet more mature topics such as mean-field games, and more classical topics such as interest rate modeling, insurance mathematics, and power markets. All sessions very well attended, a testament to the continued global growth of the Activity Group.

The Activity Group also sponsored the Conference on Mathematical Modeling in Finance, running from the end of August 2017 through beginning of September, 2017. The Conference was organized as part of the SIAG-FME international outreach activities and was co-sponsored by SIAM and London Mathematical Society. It was hosted in London, UK by the CFM-Imperial Institute of Quantitative Finance, and attracted more than 120 participants over 2.5 days of talks.

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?

The SIAG organized 6 sponsored minisymposia at SIAM AN18 in Portland, Oregon July, 2018 on the following topics: financial technology, algorithmic trading, mean-field games, and systemic risk. Sessions were well attended not only by people in the financial mathematics community, but more broadly by people of other sub-communities within SIAM, working on PDEs, probability theory, and theoretical aspects of machine learning.

The SIAG is organizing 10 sponsored minisymposia at SIAM AN20 (The 2nd Joint SIAM and CAIMS), in Toronto, July 2020, on a wide range of topics, such as: asymptotic methods in portfolio optimization,

model uncertainty in finance, mathematics and computation of financial technology, finance and climate change, deep learning in finance, environmental finance.

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

Since 2013 the SIAG publishes a newsletter which is sent out to the SIAG mailing list and posted online on the SIAG wiki. The latest edition was published in fall 2019. Overall, the SIAG-Newsletter receives very positive feedback from members, and all issues can be found at https://sinews.siam.org/Details-Page/tag/SIAG_FM_newsletters.

The SIAG FME maintains a wiki page that contains information about past conferences, business meetings, newsletter, etc. http://wiki.siam.org/siag-fm/index.php/Main_Page

SIAG FME members contribute on continuous basis to SIAM news with op-ed pieces. FME will continue to solicit submissions for this in the future.

The SIAM book series on Financial Mathematics was launched in 2013. The first volume in the series was published in Feb 2016 and is entitled “Lectures on BSDES, Stochastic Control, and Stochastic Differential Games with Financial Applications” by René Carmona. A book on “Systemic Risk in Financial networks: assessment and control” by Jimeng Peng & John Birge is planned for the near future, and two others, one on “Functional Ito Calculus” and one on “Computational Finance” are in the works.

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

SIAG-FME has started a new virtual series that will run till the next SIAG/FME Biannual Meeting in June 2021. The Group decided to start this new initiative to keep our SIAG/FME community connected during the challenging times of the COVID 19 crisis. The new series will tentatively run every two weeks and feature the diverse type of work the Financial Mathematics community engages in. Seminars will run remotely using Zoom and can host audiences of up to 500.

SIAG-FME plans to sponsor three thematic minisymposia at the Joint Mathematical Meeting 2021, Washington DC, January 6-9, 2021, that are coordinated with SIAM Coordinating Committee for the Joint Mathematics Meetings. Each thematic minisymposium will be three hours long focusing on modern topics in mathematical finance and engineering.

Organization of FM’21, planned to take place in Philadelphia, June 1-4, 2021. We plan to host eight invited plenary speakers. Following the overall success of the mini-tutorials during the last conferences, the plan is to organize two mini-tutorials on emerging topics in mathematical finance. In addition, multiple minisymposia and contributed sessions will be organized, with some minisymposia being specifically targeted to cover modern themes, such as Fintech and AI for finance. We plan to continue to hosting panel discussions – an effort started at the last FM conference. We are also considering the introduction of new initiatives at FM’21, such an ice-breaking session at the beginning of the conference, and a panel discussion focused on helping junior participants to enter the profession (academia or industry).

Organize several special sessions at the AMS-SMF-EMS Joint International Meeting, the July 5 - 9, 2021, Grenoble, France. The sessions will cover a broad range of topics in the field of financial mathematics, engineering, and applied probability.

The SIAG-FME has submitted a proposal for the Gene Golub summer school. If SIAG-FME wins the bid to host the Gene Golub SIAM Summer School in 2021, the SIAG will implement the plan outlined in the submitted proposal, and allocate the appropriate resources to organize G2S3 at the Gran Sasso Institute in Italy. Despite SIAG-FME never having organized a G2S3 so far, many of the members and officers have extensive experience with summer schools and similar events. The SIAG is confident in its capability to host G2S3. If SIAG-FME is not successful for a 2021 bid, we will re-apply before the end of the charter term.

SIAME-FME plans to have a solid representation at the SIAM annual meetings, and prepare for ICAM'23.

Continue publishing the SIAG-FME newsletter, at one-two issues per year.

Regular contribution of articles (twice a year) to the new SIAM News Online, in addition to continuing the SIAG Newsletter initiative.

8) *How can SIAM help the activity group achieve its goals?*

- Renewal of the SIAG charter.
- Development of corporate relations for sponsorship of FM'21 and future meetings.
- Help with marketing the Activity Group to students, to establish a more stable student membership. Perhaps increasing outreach to senior undergraduate students.
- Help with marketing the Activity Group to non-academic relevant institutions and increases the number of members outside of academia.
- Inviting senior members of the SIAG to speak in keynote or plenary talks at the annual SIAM meeting.

9) *How can the activity group help SIAM in its general role of promoting financial mathematics and engineering?*

The SIAG FME has contributed to SIAM's general goals by

- promoting SIAM membership and SIAM meetings to a broader audience including researchers and students involved in mathematical modeling in finance, as well as industry professionals and finance/business school academics
- promoting the use of mathematical models and methods in finance and enhancing visibility of research done by SIAM members to this wide audience
- establishing the importance of SIAM as a serious player and partner for dialogue with industry, governmental and regulatory bodies in issues related to the use of mathematical models in supervisory risk management, trading, finance and policy making.

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

Signed,

Agostino Capponi, SIAG/FME Chair

April 6, 2020.