SIAG FME Newsletter

SPRING 2013

Introduction

by R. SIRCAR

Dear Members of the SIAG FME —

It is a pleasure to introduce the SIAM Financial Mathematics & Engineering Activity Group's first newsletter, on behalf of the four officers (Ronnie Sircar, Chair; Kay Giesecke, Vice Chair; Sebastian Jaimungal, Program Director; and Mike Ludkovski, Secretary) . We plan to produce these newsletters two or three times a year, with features and reports about Financial Mathematics and Engineering. As always, we welcome your suggestions and news items.

This Activity Group was started in December 2002, and there are now over 800 members from around the world. The SIAG has organized four increasingly successful 2-3 day conferences: Boston in 2006, New Brunswick NJ in 2008, San Francisco in 2010 and Minneapolis in 2012. As announced recently on the SIAG email list, the 5th SIAM Conference on Financial Mathematics and Engineering will be held on November 13–15, 2014 at The Palmer House Hilton Hotel, Chicago, US. Please save the dates! Further details will be posted here: `http://www.siam.org/meetings/fm14/`

The last conference in Minneapolis highlighted many of the interesting and challenging problem areas that Financial Mathematics has evolved into: energy and commodities markets, high-frequency and algorithmic trading, systemic risk, and liquidity risk, to name just a few. (The graphic on the right is a word cloud made from titles of the talks at the FM'12 meeting.) This is also seen in the diversity of papers in the SIAM Journal on Financial Mathematics (`http://www.siam.org/journals/sifin.php`) which was created out of a discussion at the SIAG's members meeting during the Boston conference.

The SIAG sponsors the *Junior Scientist Prize* awarded at the next conference, and we shall send a call for nominations in the next few months. We are also working with SIAM to establish a Student Prize (for graduate students and postdocs) to be awarded at the Chicago meeting.

In this first newsletter we have inaugurated several columns that we hope will become regular in the years ahead. Conference Reports provide some insight and summary of recent FME meetings; FME Bookshelf touches on some of the recent monographs of interest to our members. In addition, you can find on the next page an online interview with Steve Shreve who is one of our most distinguished members. We hope that this FME Interviews column will be an ongoing highlight feature of the Newsletter.

The Newsletter is a collective undertaking; in this issue you will find columns by A Cartea, J-P Fouque, K Giesecke, and S Jaimungal. Many thanks to Mike Ludkovski in particular for putting it all together. We are actively looking for guest columnists for future issues and welcome your ideas about other links or content to add.

Details of the SIAG's activities, and some links, can always be found on our webpage: `http://siam.org/activity/fme/`

Conference Reports

Since the flash crash of 2010, Algo and HFT have constantly been in the headlines and it is now a hot topic in financial mathematics. The department of Mathematics at University College London and the Department of Statistical Sciences at the University of Toronto, in partnership with the SIAG FME, recently held a three-day conference on "**Recent Advances in Algorithmic and High Frequency Trading**" to showcase that research.

The event took place at University College London in April where around 100 delegates had the chance to listen to leading academics and practitioners who are developing cutting edge research in their fields. Days were long and rewarding. Three days and thirty-four talks later everybody had the chance to learn about: high frequency market making, flash crashes, self-excitation, optimal liquidation/acquisition, market impact, FX, interest rates, market quality, market microstructure, VWAP, TWAP, limit order books, etc. The event wrapped up with a Roundtable discussion on the role that Algorithmic and High Frequency trading are playing in modern electronic markets.

A key aspect of the conference's success was to bring together mathematicians, economists and practitioners under one roof. For example, multiple viewpoints were presented on whether HF algorithms are takers or providers of liquidity and the very meaning of liquidity at the microstructure level. A lively debate was also held on the role of regulators and whether the end consumer is presently getting a fair deal. Overall, Algorithmic and High Frequency trading continues to be a fresh source of problems ranging from modelling issues, to mathematical challenges, to statistical estimation and basic economics. Moreover, as discussed by several presenters, the electronic platforms and regulations continue to evolve and HFT is proliferating beyond traditional equity markets. We certainly look forward to future meetings on the topic and where the markets and regulators will take us by then.

by Á. Cartea and S. Jaimungal

The **Fifth Western Conference on Mathematical Finance** (WCMF) was held on May 10-11, 2013 at Stanford University. It was co-organized by Kay Giesecke (Stanford) and Xin Guo (Berkeley). The conference showcased the recent work of junior and mid-career faculty as well as advanced graduate students from universities across the western US, including UT Austin, UCSB, USC, Berkeley, and Stanford. A particular highlight was the plenary talk by Shige Peng that gave a high-level overview of the latest developments in the theory of G-martingales and G-Brownian motion. The conference featured talks on a diverse collection of topics, including systemic risk, interacting stochastic systems, optimal investment and consumption, high-frequency trading, and dynamic stochastic control. It was well attended: approximately 50 participants were counted. The Sixth WCMF will be held at UCSB in Fall 2014. Stay tuned for the announcement!

by K. Giesecke

SIAG Elections

Fall 2012 saw the latest round of the biennial Activity Group elections. The newly elected SIAG Officers for the term Jan 2013—Dec 2014 are:

Chair: Ronnie Sircar (Princeton)

Vice-Chair: Kay Giesecke (Stanford)

Secretary: Mike Ludkovski (UC Santa Barbara)

Program Director: Sebastian Jaimungal (Toronto)

Member News

- Thaleia Zariphopoulou (UT Austin and Oxford Man Institute) was part of the SIAM Fellows Class of 2012. Thaleia who is very well known to our members was the plenary speaker at the FM'06 meeting.
- Sergey Nadtochiy (U of Michigan) received the 2012 SIAG Junior Scientist Prize, awarded during the FM'12 meeting in Minneapolis.
- Nizar Touzi (Ecole Polytechnique) was awarded the 2012 Louis Bachelier Award.
- Jean-Pierre Fouque (UC Santa Barbara) was nominated to the Financial Research Advisory Committee of the Office of Financial Research (OFR). The Committee will inform the OFR's research-and-data agendas.

Please contact Newsletter Editor Mike Ludkovski if you have any latest News of note.

FME Interviews: Steven Shreve

Steven E. Shreve is the Orion Hoch Professor of Mathematical Sciences at Carnegie Mellon University in Pittsburgh, PA. Steve is a SIAM Fellow and is perhaps best known as the author of several seminal textbooks, including *Brownian Motion and Stochastic Calculus*, *Methods of Mathematical Finance* (both with I. Karatzas), and the 2-volume *Stochastic Calculus for Finance*. Recently, Steve was a plenary speaker at the FM'12 in Minneapolis.

High-frequency trading (HFT) seems to be the newest subject everyone is talking about. Research on HFT has been exploding, and you yourself have worked on this subject. What do you find to be the most fruitful research questions arising from HFT?

SS: High-frequency trading is made possible by the move to electronic exchanges, where trading is done via limit-order books. In order for financial mathematics and engineering (FME) to say anything about HFT, we need to have models of limit-order books. Only primitive models presently exist, and for good reason. A complex multi-person zero-sum game plays out in limit-order book trading. Even if we leave that aside, writing down a model,

which is necessarily multi-dimensional with complicated interactions among order depth at different prices, order arrivals and order cancellations, is daunting. Models need to conform to the observed data, and they need to be tractable. This research area is of critical importance for financial markets.

There is increasing concern about side-effects of HFT and the need for regulators to step in. How do you think FME can contribute in terms of such policy-making?

SS: Presently FME has little to say about how to effectively regulate HFT because existing models are not up to the task. This underlines the need for research in this area.

Another subject where FME can potentially impact policy-making is systemic risk/financial networks. Do you think FME research is making progress on the pressing issues in this domain? Is the present research focus relevant for influencing policy makers and regulators?

SS: There seems to be a agreement that when Lehman Brothers failed and the U.S. Department of Treasury and the Federal Reserve tried to catch the falling economy by providing capital to banks with the intention that they would pass that through to the economy in the form of lending, the banks instead hoarded the cash. The consequences for the economy of the Lehman failure were thus far more severe than policy makers anticipated. Banks chose to build up their cash reserves because they feared for their own survival. On the other hand, the direct consequences to Lehman's creditors of its failure were managed and orderly. I can imagine that with much effort and extensive real-time data collection and analysis, we might get mathematical models to the point that the orderly dissolution of Lehman could have been predicted. That is a desirable goal, but it would have fallen short during the financial crisis. Panic is hard to model. There is the perhaps apocryphal story of a run on a bank that began because a new bus stop was set up in front of the bank, people queued for the bus, bank depositors saw the queue and panicked. How to you model that?

There is ongoing debate about the relation between FME and empirical data. Do you see research moving away or towards using data?

SS: Models are no good if they do not conform to data. That does not mean we all need to become empiricists, but it does mean we need to be sure our models pass the "laugh test" when examined by people familiar with the data.

"Big Data" has been a buzzword for a couple of years now. How relevant is Big Data for FME in your opinion? (For example, the Nasdaq trade messages generate dozens of gigabytes of data each day.) Do you see opportunities for new collaborations with colleagues in other disciplines (statisticians, computer scientists, engineers) through this?

SS: Yes, certainly. Machine learning, about which I know little, combines the skills of statisticians, computer scientists, and even mathematical optimizers. The search for patterns and predictability in the data is foreign to most of the people working in FME, but it is of growing importance. This year we introduced the course "Statistical & Machine Learning Methods for Financial Data" into our Master's program in Computational Finance.

During the financial crisis in 2008-09 you have written several op-ed pieces defending the role of FME vis-a-vis Wall Street. Now that the crisis is "old news" how do we as a community continue to burnish our public image as scientists working for the public good?

SS: Public relations is not my forte. My article "Don't Blame the Quants" in Forbes.com became a lightning rod attracting comments by those who do blame the quants. Last year Robert Merton gave a thoughtful interview by the same name, which is publicly available on Risk.net, and especially at the end where he talks about retirement planning, his case that quantitative methods are indispensible is compelling. I think the first step in burnishing our public image is to do good work, both in research and education, and the second step is to provide thoughtful interviews and essays whenever the opportunity arises. To do the latter, of course, we need to look up from our desks from time to time and pay attention to what is going on in the finance industry and society at large.

Online education and MOOCs is another hot subject in university hallways. Within our community, Master in Finance programs increasingly include remote learning as an option for students. Do you think we will see wholesale moves to online Masters programs in the near future and if so how will it impact demand for FME academics?

SS: First of all, no one has yet worked out the business model for Massive Online Open Courses. Secondly, at the undergraduate level universities provide much more than classroom education, e.g., extra-curricular activities, learning services, peer support, socialization, and learning to live away from home. However, I believe that the move toward online education at the professional master's level will continue and what we do for online students will feed back into our classrooms and make them more efficient for both students and professors. An example of that is on-line lecture modules with exercises that are recorded and students can view at a time of their choosing. I expect to see incremental but not wholesale moves to online Masters programs in the near future. We announced an online version of our Master's program in Computational Finance last year and admitted three students. In the coming year, we expect to have no more than that.

(Online interview conducted by Mike Ludkovski)

Upcoming Conferences

NEW SIAG FM'14 Meeting
Chicago, IL Nov 13–15, 2014

SIAM Annual Meeting
San Diego, CA July 8–12, 2013

Fields Institute Focus Program on Commodities, Energy & Environmental Finance (includes a Summer School and two research Workshops)
Toronto, Canada Aug 6–30, 2013

Stochastic Analysis and Applications
Oxford, UK Sep 23–27, 2013

Texas Quantitative Finance Festival
Austin, TX Oct 26–27, 2013

Rutgers Mathematical Finance and PDEs Conference
New Brunswick, NJ Nov 1, 2013

Bachelier Society World Congress
Brussels, Belgium June 2–6, 2014

FME Bookshelf: SIAM Book Series on Quantitative Finance

by J.-P. Fouque

Financial Mathematics is now well-established within SIAM with a large activity group (SIAG-FME) and a successful journal, the SIAM Journal on Financial Mathematics. Many books in this area have been written in the recent years and it was time for SIAM to launch its own book series to offer an attractive alternative to our authors. As the first editor-in-chief, I will be working with Sara Murphy, our acquisitions editor, and with a group of ten distinguished applied mathematicians who have accepted to be on the first editorial board. We are welcoming a variety of projects, ranging from research monographs and advanced undergraduate- or graduate-level textbooks, to other volumes of interest to a broader mathematical finance community or volumes more specifically addressed to practitioners in the financial industry.

We guarantee a short time to publication (5-6 months after receiving the final LaTeX files), professional help from experienced editors, print and electronic versions, reasonable pricing with significant discount to members, long-run availability of the books, and a full marketing plan for reviews, advertising and distribution.

New topics are emerging in financial mathematics and they are great opportunities to write books which will serve our community. I particularly encourage our young members to consider our new series as a venue for publishing their work.

To all, if you have an already advanced project or if you are thinking of one, please consider our new series and do not hesitate to contact me, or Sara Murphy, or any of our editorial board members who can be found on the web page: `http://siam.org/books/series/fm.php`

I am looking forward to hearing from you.

SIAM Journal on Financial Mathematics

Recently published articles (Vol 4, 2013):

- Efficient Pricing of European-Style Asian Options under Exponential Lévy Processes Based on Fourier Cosine Expansions by B. Zhang and C. W. Oosterlee
- Large Deviations for a Mean Field Model of Systemic Risk by Josselin Garnier, George Papanicolaou, and Tzu-Wei Yang
- Adjoint Expansions in Local Lévy Models by Stefano Pagliarani, Andrea Pascucci, and Candia Riga
- Price Dynamics in a Markovian Limit Order Market by Rama Cont and Adrien de Larrard
- Portfolio Selection with Small Transaction Costs and Binding Portfolio Constraints by Ren Liu and Johannes Muhle-Karbe
- The Stability of the Constrained Utility Maximization Problem: A BSDE Approach by Markus Mocha and Nicholas Westray
- Why Are Quadratic Normal Volatility Models Analytically Tractable? by Peter Carr, Travis Fisher, and Johannes Ruf
- Pricing and Hedging of Cliquet Options and Locally Capped Contracts by Carole Bernard and Wenbo V. Li
- An Optimal Dividend and Investment Control Problem under Debt Constraints by Etienne Chevalier, Vathana Ly Vath, and Simone Scotti
- Inverting Analytic Characteristic Functions and Financial Applications by Liming Feng and Xiong Lin
- Conditional Sampling for Barrier Option Pricing under the LT Method by Nico Achtsis, Ronald Cools, and Dirk Nuyens
- The Best Gain-Loss Ratio is a Poor Performance Measure by Sara Biagini and Mustafa C. Pinar
- Optimal Dual Martingales, Their Analysis, and Application to New Algorithms for Bermudan Products by John Schoenmakers, Jianing Zhang, and Junbo Huang
- Utility Maximization Trading Two Futures with Transaction Costs by Maxim Bichuch and Steven Shreve
- Risk-Minimization for Life Insurance Liabilities by Francesca Biagini and Irene Schreiber