SIAG FME Newsletter

WINTER 2014

Introduction

by R. SIRCAR

Dear Members —

Welcome to the second Newsletter of the SIAM Activity Group in Financial Mathematics & Engineering. Inside you will find reports on recent conferences, an interview with Professor Paul Glasserman related to the active research area of Systemic Risk, a book review of a Handbook on the same topic, and the latest publications in the SIAM Journal on Financial Mathematics.

We look forward to seeing many of you at the 5th SIAM Conference on Financial Mathematics & Engineering, to be held in Chicago, 13–15 November, 2014: http://www.siam.org/meetings/fm14/

We look forward to stimulating talks from our plenary speakers:

- Bruno Bouchard (Universié Paris-Dauphine)
- Jakša Cvitanić (Caltech)
- Lars Hansen (University of Chicago)
- Vicky Henderson (University of Warwick)
- Pierre Henry-Labordère (Société Générale) (to be confirmed)
- Peter Forsyth (University of Waterloo)
- Mike Ludkovski (University of California at Santa Barbara)
- Ciamac Moallemi (Columbia University)
- Jan Obłój (University of Oxford)
- Michael Sotiropoulous (Bank of America)

The deadline for minisymposium proposals is May 1st, and for contributed talks, the deadline is May 14th.

We are also looking forward to a conference joint between SIAM and its French counterpart SMAI on Financial Mathematics, partly sponsored by our Activity Group, to be held in Paris, June 17 to 20, 2014: https://www.ceremade.dauphine.fr/ModelsRisks/conference.html The Labex Louis Bachelier – SIAM-SMAI Conference on Financial Mathematics: Advanced Modeling and Numerical Methods will have **poster sessions dedicated to young researchers** during the lunch breaks. To apply, please send an email to ModelsRisks@gmail.com containing an abstract. The title of your email should be "Application to the poster session". SIAM will support 10 US-based students who are presenting posters at up to $750 each.

We also encourage you to submit nominations (deadline May 1st) for the 3rd SIAG/FME Junior Scientist Prize: http://www.siam.org/prizes/sponsored/siagfmejr.php. The prize is awarded biennially to an outstanding junior researcher for distinguished contributions to Financial Mathematics & Engineering in the three calendar years prior to the year of the award. Also stay tuned for news of a Student Paper prize we hope to announce soon.

Finally, the academic job market in FME continues to grow, with a number of universities (particularly in the US) recruiting in this area where they had not done so before. I hope that our student members will be encouraged to consider an academic career in this vibrant and vital area of study.

Member News

- Frederi Viens (Purdue) was part of the IMS Fellows Class of 2013.
- Philip Protter (Columbia) was elected last month to the American Association for the Advancement of Science (AAAS) Section on Mathematics.
- Marc Yor, one of the pioneers in the study of Brownian motion applied to finance, passed away in January 2014. A thoughtful obituary was published in the IMS Bulletin.

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

FME Interviews: Paul Glasserman

Paul Glasserman is the Jack R. Anderson Professor of Business at the Columbia Business School in New York, NY. Among his many honors and awards, Paul was Risk Magazine's 2007 Quant of the Year. He is also the author of the widely known *Monte Carlo Methods in Financial Engineering*. Paul was a plenary speaker at the inaugural FM'06 in Boston.

In the past few years, a new research direction within FME has developed in the area of systemic risk. What do you think are the most important problems where FME can contribute compared to other specialists (economists, computer scientists) in this domain?

PG: I see many opportunities and will mention four. (1) Network models. There's been a lot of activity in this area and a lot of nice work, but there's still room for models that capture the many types of interactions between firms and the combined effects of direct transactions between firms and indirect influences through market prices. (2) The analysis of novel securities such as contingent capital bonds that are intended to promote financial stability. (3) The changing structure of the derivatives markets with the move from bilateral trading to central clearing and the potential systemic effects of central counterparties. (4) General equilibrium models, typically formulated as stochastic control problems, in which the financial sector plays a meaningful role and thus in which failure of the financial system disrupts the broader economy. These are all rich topics for financial mathematics, both for theory and applications.

There is an ongoing debate about quantitative policy making related to "too-big-to-fail". How relevant are the present FME research foci for influencing policy makers and regulators in this?

PG: I see quantitative models serving two types of roles. First, a theoretical model can provide a framework to help guide thinking about a problem; second, quantitative models can guide implementation by helping to set parameter values and related details. Financial mathematics and engineering have been extraordinarily effective on both dimensions in the domains of derivatives, risk management, and portfolio selection. The problems that arise in the domain of financial stability would also benefit from both types of modeling work, though they are often somewhat messier – or perhaps they seem messier because they are less familiar. The traditional domains of FME research have benefited from a high level of communication between academics and industry quants. It would be helpful to the field to develop similar levels of communication with both industry and regulatory practitioners on policy related questions.

You spent part of your recent sabbatical visiting the Office of Financial Research (OFR). Can you comment on your experience at this new regulator and the opportunities for academics to get engaged in OFR activities?

PG: I was at the OFR full-time in 2011-2012 and have continued to work with the office since. I've found it to be a very valuable experience, particularly as a way of getting closer to live problems and, in some cases, to have access to data. The OFR is technically not a regulator because it has no authority to set regulations; this actually gives the office more flexibility to identify and study problems across the financial system and not just within a specific regulatory domain, and it frees the office from the demands of rule-making work that dominate some of the other agencies. The OFR is still growing, and the research group within the OFR is not yet up to full strength. My sense is that the OFR is eager to have academics involved and is working to streamline the process for getting people involved. I think there's particular interest in projects that integrate the OFR's research and data missions. I would encourage anyone interested in learning more to have a look at the OFR's annual reports for 2012 and 2013, which are available online.

Model risk is another emerging theme in FME and something you have been working on. What are some of the most interesting open challenges there that you would recommend to students and junior colleagues?

PG: Yes, this is definitely an important topic, and one I've been working on myself. Starting with Basel II, the general trend was to encourage financial institutions to develop sophistication in modeling and, in effect, to reward this investment through reduced capital requirements. The sense that these models did not do well in the lead-up to the financial crisis has cast doubt on this approach and put a new focus on model risk. The regulatory pronouncements call a lot of attention to the problem but say little about how to address it, so that creates a research need. My focus has been on what I call "robust Monte Carlo", by which I mean using simulation itself to quantify the potential impact of model risk in a

model evaluated through simulation. But this is just one dimension of the problem. There are also natural points of contact with the literature on risk measures and hedging in incomplete markets. Banks are also thinking about model risk, so this is a good area for exchanging ideas with practitioners.

"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 new opportunities for collaborations with colleagues in other disciplines (statisticians, computer scientists, engineers) through this?

PG: Yes, certainly. The connection is most immediate, as you suggest, in the market microstructure field. I think the potential for integrating many different types of data sources to try to identify sources of systemic risk has not been fully developed. There are also interesting research questions around data privacy: what sort of data can a regulator make public to enhance financial stability without revealing firm-specific confidential data. The OFR released a working paper that addresses some of these questions.

(Online interview conducted by Mike Ludkovski)

Conference Reports

The Joint Mathematics Meeting (JMM) in Baltimore, MD, January 15-18, presented the opportunity for the SIAM activity group to organize a **Minisymposium on Recent Advances in Financial Mathematics**. Overall 17 talks were given and more than 40 attendants participated, and many more who stopped by to listen, making this event a tremendous success.

The speakers came from academia as well as from industry and included presenters from institutions in the United States, Canada and Australia. The symposium was intended to give a broad overview about eminent topics in cutting edge research. Among the topics discussed and presented were systemic risk, large deviations, high frequency trading and trend discovery, the dynamics of the volatility surface, Cournot games in commodity markets, point processes and optimal bonuses for traders. The dinner Thursday night provided a casual setting to continue the discussions from the talks, to refresh old connections and personalize new contacts. The key success of the conference was to bring together current PhD students and PostDocs together with established mathematicians and practitioners from industry for a fruitful exchange of ideas and to showcase the current developments in financial mathematics to a larger mathematical audience.

by M. Bichuch and S. Sturm

During August 2013, the Fields Institute in Toronto hosted a **Focus Program on Commodities, Energy and Environmental Finance**. The Focus Program addressed the interaction of markets and environment, including sustainable development, effective risk management of weather events, and the role of finance in the production and consumption of energy. The busy month had a variety of activities, including three summer school mini-courses, two research workshops, and a lively seminar series. A particular highlight was provided by two panel discussions that explored how mathematicians can contribute to environmental policy making. There was also good industry involvement, particularly with participants from Electricité de France and Ontario Power Generation. Over 40 different presentations have been delivered on themes ranging from mean-field games to modeling of wind speeds to financialization of commodity markets. Nearly all events have been video recorded and archived, available for viewing any time.

Overall, the Focus Program was a great success, and has stimulated many new interactions among the participants. In particular, attendees commented on the multidisciplinary developments currently taking place in the subject, with mathematicians, probabilists, statisticians, industrial and operations engineers, economists and finance practitioners all working simultaneously (and frequently together) on the same problems. A volume of papers devoted to work presented during the Focus Program is in the works and will be published as part of Fields Communications Series later this year.

by M. Ludkovski

IPAM Thematic Program

During spring 2015, the Institute for Pure and Applied Mathematics at UCLA will host a 14-week program *Broad perspectives and new directions in financial mathematics*, focusing on various aspects of systemic risk: the stability of the network of financial institutions, the impact of high frequency and algorithmic trading, the financialization of commodity markets, and the challenges raised by the size and speed of trade data. This program is organized by René Carmona, George Papanicolaou, and Thaleia Zariphopoulou, and will include 5 focused 1-week workshops:

- Mathematical finance tutorials, 10-13 March 2015
- Workshop I: Systemic risk and the financial networks, 23-27 March 2015
- Workshop II: Mathematics of high frequency financial markets, 13-17 April 2015
- Workshop III: Commodity markets and their financialization, 4-8 May 2015
- Workshop IV: Forensic analysis of financial data, 18-22 May 2015

For more information or to participate, see the web page at `http://www.ipam.ucla.edu/programs/fm2015/`

Upcoming Conferences

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

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

Labex Louis Bachelier SIAM-SMAI Conference on Financial Mathematics
Paris, France — June 17–20, 2014

SIAM Annual Meeting
Chicago, IL — July 7–11, 2014

PIMS Summer School on The Economics and Mathematics of Systemic Risk and the Financial Networks
Vancouver, Canada — July 21–25, 2014

INFORMS Annual Meeting
San Francisco, CA — Nov 8–11, 2014

FME Bookshelf: Handbook on Systemic Risk, J.-P. Fouque and J. Langsam, Eds., Cambridge University Press

by K. GIESECKE

The financial crisis of 2007-09 highlights the need to better understand the behavior of systemic financial risk. The Handbook on Systemic Risk, written by experts from a multitude of academic and professional backgrounds, provides an introduction to the multi-faceted aspects of systemic risks facing the global financial markets. It explores the multi-disciplinary approaches to analyzing systemic risk, the data requirements for further research, and the recommendations being made to avert financial crisis. The Handbook is organized into eleven parts:

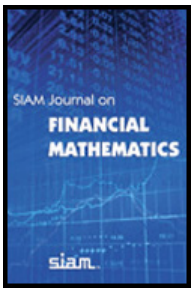
- Data: The Prerequisite for Managing Systemic Risk
- Statistics and Systemic Risk
- Measuring and Regulating Systemic Risk
- Networks
- Systemic Risk & Mathematical Finance
- Counterparty Risk and Systemic Risk
- Algorithmic Trading
- Behavioral Finance: The Psychological Dimension Of Systemic Risk
- Regulation
- Computational Issues and Requirements
- Accounting Issues

There is significant overlap in the topics covered in these parts. Data issues are addressed in both the data chapter and the computational chapter. Mathematical modeling is an important feature in multiple chapters. Economics, finance, and behavioral finance are addressed in several parts. This overlap reflects both the importance of the topics and the multiple approaches taken by different academic disciplines.

Each part features several chapters (there are 32 chapters in total). Each chapter provides researchers with an introduction to the field and with references to more advanced research articles. The Handbook is designed to encourage new researchers to investigate a topic with immense societal implications as well as to provide, for those already actively involved within their own academic discipline, an introduction to the research being undertaken in other disciplines.

The Handbook's editors, Jean-Pierre Fouque and Joe Langsam, have compiled a masterpiece. This Handbook will stimulate greater inter-disciplinary academic research on the critically important topic of systemic risk in the global financial markets.

SIAM Journal on Financial Mathematics



Recently published articles (Vol 4-5, 2014):

- On the Realized Risk of High-Dimensional Markowitz Portfolios by Noureddine El Karoui
- Stability in a Model of Interbank Lending by Jean-Pierre Fouque and Tomoyuki Ichiba
- The Smile of Certain Lévy-Type Models by Antoine Jacquier and Matt Lorig
- The Small-Maturity Heston Forward Smile by Antoine Jacquier and Patrick Roome
- Characterization of Optimal Strategy for Multiasset Investment and Consumption with Transaction Costs by Xinfu Chen and Min Dai
- Malliavin Calculus Method for Asymptotic Expansion of Dual Control Problems by Michael Monoyios
- Dimension Reduction in Discrete Time Portfolio Optimization with Partial Information by Andrew Papanicolaou
- Convex Order of Discrete, Continuous, and Predictable Quadratic Variation and Applications to Options on Variance by Claus Griessler and Martin Keller-Ressel
- On Controller-Stopper Problems with Jumps and Their Applications to Indifference Pricing of American Options by Erhan Bayraktar and Zhou Zhou
- Discrete Bidding Strategies for a Random Incoming Order by Alberto Bressan, and Giancarlo Facchi
- Approximating Lévy Semistationary Processes via Fourier Methods in the Context of Power Markets by Fred Benth, Heidar Eyjolfsson, and Almut Veraart
- Modelling Bid and Ask Prices Using Constrained Hawkes Processes: Ergodicity and Scaling Limit by Ban Zheng, François Roueff, and Frédéric Abergel
- Optimal Order Scheduling for Deterministic Liquidity Patterns by Peter Bank and Antje Fruth
- Time-Consistent Portfolio Selection under Short-Selling Prohibition: From Discrete to Continuous Setting by Alain Bensoussan, K.C. Wong, S.C.P. Yam, and S.P. Yung
- A Probabilistic Numerical Method for Optimal Multiple Switching Problems in High Dimension by René Aïd, Luciano Campi, Nicolas Langrené, N., and Huyên Pham