

by M. LUDKOVSKI

Dear Members —

Welcome to the Winter 2015 Newsletter of the SIAM Activity Group in Financial Mathematics & Engineering. As happens every two years, January brought in several changes in SIAG Officers. The newly elected slate consists of Sebastian Jaimungal (Vice-Chair), Alexander Schied (Secretary), Tim Leung (Program Director) and yours truly as Chair. We thank the outgoing Chair Ronnie Sircar and Vice-Chair Kay Giesecke for their service and contributions to our Activity Group over multiple terms as SIAG officers.

The new year also brought other new faces. Jean-Pierre Fouque has taken over the helms as SIFIN's Editor in Chief, while Thaleia Zariphopoulou is the new Editor of the SIAM Book Series on Financial Mathematics (you can find a message from Thaleia on p. 5 of the newsletter).

Fall of 2014 saw the latest edition of our flagship conference SIAM FM'14 that took place in Chicago during Nov 13–15, 2014. The Conference was extremely successful, with over 200 speakers (an increase of nearly 20% on 2012) and over 270 registered participants. The meeting was also the occasion for the inaugural Conference Presentation Prize. Four young and enthusiastic SIAG members were finalists and competed for the best presentation during a special Prize session, with the winner announced “live” during the last day of the Conference. A detailed report on FM'14 is on p. 2. You can also browse minutes of the SIAG's Business Meeting that took place during the Conference, touching on the topics of SIAG student membership (how to grow it) and future SIAG meetings (how to make them even better). In the meantime, planning is well under way for FM'16 that will be taking place in November 2016, location TBD.

In 2015, a key event for the Activity Group will be the upcoming International Congress on Industrial and Applied Mathematics ICIAM 2015 that will take place in August in Beijing. The Activity Group is coordinating a stream of 11 Financial Mathematics and Engineering sessions that will include 44 presentations. We encourage you to attend the Congress sessions and support the SIAG presenters. A list of other future meetings can be found on p. 4.

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## Member News

- ▷ Tomoyuki Ichiba (UC Santa Barbara) was the Winner of the 2014 SIAG Junior Scientist Prize
- ▷ Daniel Lacker (Princeton) and Justin Sirignano (Stanford) were the joint winners of the 2014 SIAM FME Conference Paper Prize. Other finalists included Kyle Bechler (UC Santa Barbara) and Benjamin Bernard (U of Alberta)
- ▷ Jean-Pierre Fouque is the new Editor-in-Chief of the SIAM Journal on Financial Mathematics
- ▷ Thaleia Zariphopoulou is the new Editor-in-Chief of the SIAM Book Series on Financial Mathematics.
- ▷ Thaleia also was an Invited Speaker at the 2014 International Congress of Mathematicians (Seoul, Korea)
- ▷ Dylan Possamaï (Paris Dauphine) was the Winner of the 2013 Bruti Liberati prize
- ▷ Rene Carmona was a plenary speaker at the 2014 SIAM Annual Meeting in Chicago
- ▷ Alain Bensoussan was the Winner of SIAM's 2014 W.T. and Idalia Reid Prize in Mathematics.

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## SIAM FME'14 Report

Ever since the crash of 2007/08, financial markets have changed drastically. In response, the Financial Engineering and Mathematics community have opened up a number of new research directions. The diversity of topics in the field is quite staggering and during the SIAG/FME's 5th biennial meeting in Chicago (Nov 12th–15th, 2014) participants saw witness to this changing and interesting landscape of our fast moving field. The

event was very well attended with almost three hundred attendees from over thirty countries. The breadth of the conference was truly impressive with topics ranging from the applied to theoretical, and a number of financial economics inspired talks—precisely the kind of diversity which the SIAG is aiming for. It was a particular treat to have Lars Peter Hansen, winner of the 2013 Nobel Prize in Economics, deliver a lively and interesting talk on the so-called “Ross Recovery” problem.

As a reaction to the changing marketplace, counterparty, liquidity, and systemic risks have become major areas of research, raising interesting mathematical and modeling issues, and this was reflected in the number of contributed and minisymposia talks focusing on this topic. Mean field games, which aim to provide approximate solutions to stochastic games with a large number of interacting players, is another area of research that was brought to the limelight in FM 14 through minisymposia and contributed sessions. Also, in the last several years, algorithmic and high frequency trading has become an important aspect of the financial markets and sparked a number of interesting problems. We again saw a number of talks on this topic including two plenary talks, multiple minisymposia and contributed sessions. A number of speakers discussed alternatives to expected utility theory, including forward performance criteria and rank dependent utility among others. A final, but certainly not exhaustive, topic of wide recent interest is robustness to model uncertainty, and we were treated to two plenary talks and two minisymposia on this important issue. Of course, many “traditional” topics were well represented as well, and we saw a healthy number of minisymposia and contributed sessions devoted to various aspects of numerical methods, BSDEs, stochastic control, risk measures, asymptotic methods, and option valuation, among others.

The newest addition to the conference was the conference paper prize, which was open to students and young researchers within two years of graduation. During the conference we had four finalists deliver 15 minute presentations of their research, with Thaleia Zariphopoulou and Tomasz Bielecki in the role of judges and chaired by Sebastian Jaimungal. The winners of the inaugural award were Daniel Lacker from Princeton University who delivered a theoretical piece titled “A General Characterization of the Mean Field Limit for Stochastic Differential Games” and Justin Sirignano from Stanford University, who delivered an applied piece titled “Efficient Risk Analysis of Mortgage Pools and Mortgage-backed Securities”.

We also presented the third Junior Scientist award, which was chaired by Ronnie Sircar with Peter Bank, Erhan Bayraktar, Roger Lee and Mihai Sirbu as committee members, to Tomoyuki Ichiba from UC Santa Barbara, who delivered his prize talk on “Some Financial Markets with Discontinuities” where he discussed various aspects

of a “rank-based market model” which helps to explain the stability of the log-log capital distribution curves observed in practice.

To conclude this short report, we would like to mention some encouraging results from the anonymous attendee evaluations. We are very happy to report that over 85% of respondents found the plenary talks and conference overall of high quality and over 90% felt the same about the minisymposia and found that they have acquired information that they find will be useful in their own research. By any standards, this is a measure of a successful conference and we look forward to the 6th FME meeting in 2016.

by S. JAIMUNGAL & R. SIRCAR, CO-CHAIRS FME'14

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## Conference Reports

The **Labex Louis Bachelier - SIAM-SMAI Conference on Financial Mathematics: Advanced Modeling and Numerical Methods**, was held on June 17-20, 2014 in Paris, as the closing conference of the Labex Louis Bachelier Thematic Semester on Robust Management in Finance. This thematic cycle was co-organized by the major Parisian universities and engineering schools active in the domain of mathematical finance. The closing conference was jointly organized with SIAM and its French counterpart, Société de Mathématiques Appliquées et Industrielles (SMAI); a first such co-sponsorship for a math finance meeting. It gathered together more than 40 invited speakers and 20 young PhD or postdoc students invited to present their work as a poster, coming from all over the world. Around 60 other participants were registered. The conference featured talks related to models with price impact, robust hedging, systemic risks, statistics for stochastic processes, and numerical methods (typically asymptotic expansions).

by B. BOUCHARD AND R. ELIE

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The **Sixth Western Conference in Mathematical Finance (WCMF'6)** took place on the campus of UC Santa Barbara during September 25-27, 2014. The conference theme of Stochastic Asymptotics and Applications was on the occasion of the 60th birthday of Jean-Pierre Fouque. The meeting featured 23 talks with a healthy mix of senior speakers (from all over the world) and junior presenters (primarily from California and Western US). The talks covered stochastic volatility asymptotics, stochastic portfolio theory, high-frequency trading, as well as non-finance topics related to imaging and waves in random media. In attendance were over 70 participants. There were also several social events including a beach reception by the Pacific Ocean. Watch out for the next WCMF meeting to take place in Austin, TX in Fall 2015.

by M. LUDKOVSKI

## FME Interviews: René Carmona

René Carmona is the Paul Wythes '55 Professor of Engineering and Finance at Princeton University in the Department of Operations Research and Financial Engineering. René is a SIAM Fellow and was the founding SIAG/FME chair during 2003–2008.

*You were one of the founders of the Activity Group back in 2003. Looking back over the past decade plus: what were the main successes of the SIAG as you see them? What proved to be more challenging than you first expected?*

**RC:** The Activity Group was created at a time when the Financial Mathematics community was still in a nascent stage. The only existing association serving the community at that time was the Bachelier Finance Society whose main contribution was to organize a successful biennial congress. The very existence of SIAG FME, its visibility and dynamism, helped the Bachelier Finance Society change its ways and reach out for a broader base. Notwithstanding this positive impact, a significant achievement of the SIAG FME is to have showcased a vibrant research community, and pushed mathematics societies (such as the IMS – Institute of Mathematical Statistics – and the AMS – American Mathematical Society) which previously did not prioritize financial mathematics, to create and nurture activity and focus groups emulating SIAG FME.

*You were more or less SIAG member #1. Since then the SIAG has grown to over 500 members. What advice would you give to graduate students/junior faculty in terms of reasons for joining the SIAG today?*

**RC:** SIAGs offer unique opportunities to graduate students and isolated researchers to reach out to a broad community of applied mathematicians and practitioners. The way SIAG FME serves its constituency is standard. Like many organizations it offers a very popular biennial conference, a first class journal, prizes for graduate students and young researchers, and a bulletin with scientific articles, job search tips, and much more. However, the reasons for the health and the dynamism of the activity group go beyond these traditional levers. Its elected officers are frequently renewed, guaranteeing accountability and fresh ideas, and its members are young, in touch with the societal changes in academia and an industry constantly in motion.

*You were also the founding Editor-in-Chief of SIFIN, which was the first electronic-version only SIAM journal. With this experience, how do you see the evolution of publishing in our field? (For example, the increasing use of Arxiv.)*

**RC:** For having been involved in the creation of electronic journals in probability, I would be the last to worry about the fact that a journal is electronic-only. Right from the start, the SIAM label gave SIFIN credibility

and visibility that independently created journals would need years to acquire. Ronnie Sircar and I leveraged the society reputation to create a successful platform. Still, we worked very hard to make sure that the refereeing process was rigorous and fair, and I am convinced that this was a major factor in the success of the journal. Arxiv is a great service to the mathematics and physics communities because it offers the authors a “time stamp” for their original ideas, and the researchers a platform where to search for original work. However, the lack of peer review of the manuscripts remains the Achilles’ heel of this system.

*Online education has been another hot-button subject. Quantitative finance would appear to be well-suited for online lectures and several schools have offered one-off FME classes via MOOC’s. Do you think online ed will make inroads in FME UG/Masters programs?*

**RC:** Supply does appear when demand is detected, or suspected. The internet and social networks have revolutionized the way information is transmitted and shared. Mathematicians could make a better use of these forums (whether in the form of MOOCs or TEDx talks) to disseminate their knowledge and share their message with a wider audience. Financial education is important, and it should permeate undergraduate curricula. That said, I am concerned with the inflation of Masters programs in financial mathematics. Such professional degrees are for-profit to the universities or departments running these programs, and their proliferation may have already flooded a job market which lost its appetite for this kind of hires. I hope that we will rethink the educational mission of these programs, and stop treating them as cash cows subsidizing teaching positions.

*In contrast to the past, many new research directions in FME have been much more related to financial policy and regulation, such as systemic risk and environmental finance, both areas that you worked on. Do you think the gap between FM and policy maker is narrowing? If not, what needs to happen for our community to make more of a policy impact?*

**RC:** Mathematicians have a hard time getting the attention of regulators which could be due to the high level of abstraction of their works, or the technicalities of their arguments. Economists seem to be better at this game. Take environmental finance for instance: I am delighted to see cap-and-trade schemes and other forms of emission control get adopted and enacted by states and countries, but I fear that policies are driven by politics more than science. That said, systemic risk could offer a better opportunity for mathematicians to close the gap with regulators. These problems are not limited to finance, and the highly quantitative nature of systemic risk brings together engineers who control risk in large systems, such as the electric grid, mathematicians who introduce and analyze abstract models, and

network specialists who bring their craft to bear on large scale systems.

*Mean Field Games has been another recent research direction of yours. Can you mention some open problems that have been motivating you in this subject.*

**RC:** I was drawn to this area by a couple of entertaining lectures by Pierre Louis Lions and Jean Michel Lasry. I realized quickly that they weren't doing the depth of the theory justice with the mundane examples they use in their introductions to the subject. This, coupled with the fact that stochastic differential games are typically not part of the toolbox of stochastic analysts, peaked my curiosity.

I was intrigued by the possible connection of Mean Field Games with the well established theory of McKean-Vlasov stochastic differential equations and their description of large systems of particles interacting in a mean field way. While classical, this theory does not accommodate the optimization component inherent in the search for equilibria. The interplay between the large population asymptotics and the optimization is very subtle, and I believe that this is why the subject is so exciting. While lecturing and writing notes on the probabilistic theory of these games, I realized that many macro-economists and financial economists have used the mean field game paradigm for quite some time. Embarrassingly enough, this made me think of Mr Jourdain in Moliere's play "The Bourgeois Gentleman" who was amazed at the discovery that he had been speaking prose all along! Mean Field Games can be potentially used for a broad range of applications: from the social sciences of large populations behaviors (flocks of birds, schools of

fish, human herds, pedestrian crowds, stability of marriages, ...) to learning and the propagation of information in social networks. Engineering abounds with applications as well. Interestingly, the mean field game paradigm was introduced independently and simultaneously, though under a different name, by a group of Canadian electrical engineers and mathematicians working on cellular network applications. Nowadays, financial applications of mean field games are at the heart of many investigations, including understanding bank runs and price formation in electronic markets. One of the most remarkable characteristics of mean field games is the breadth of the mathematics needed to construct solutions. But these mathematical problems are rooted in concrete applications of great interest and importance, so the numerical implementation of the solutions when they exist, or the construction of approximate solutions, remains a challenge that members of SIAG FME should be well equipped to tackle.

*(Online interview conducted by Mike Ludkovski)*

## SIAG Officers

Fall 2014 saw the latest round of the biennial Activity Group elections. The newly elected SIAG Officers for the term Jan 2014—Dec 2015 are:

- Mike Ludkovski (UC Santa Barbara, Chair)
- Sebastian Jaimungal (Toronto, Vice Chair)
- Alexander Schied (Mannheim, Secretary)
- Tim Leung (Columbia, Program Director)

### Upcoming Conferences

Broad- Perspectives and New Directions in Financial Mathematics (5 workshops) Los Angeles, CA	March 9–June 12, 2015
Advanced Modelling in Mathematical Finance Kiel, Germany	May 20–22, 2015
Methods of Mathematical Finance (in Honor of Steve Shreve) Pittsburgh, PA	June 1–5, 2015
Journées à la mémoire de Marc Yor Paris, France	June 3–5, 2015
Fifth IMS-FIPS Workshop New Brunswick, NJ	June 25–27, 2015
International Congress on Industrial and Applied Mathematics, ICIAM 2015 Beijing, China	August 10–14, 2015
7th General AMaMeF and Swissquote Conference 2015 Lausanne, Switzerland	September 7–10, 2015
INFORMS Annual Meeting Philadelphia, PA	Nov 1–4, 2015

## FME Bookshelf: SIAM Book Series in Financial Mathematics

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. To further advance the field, SIAM launched in 2013 the SIAM Book Series in Financial Mathematics and Jean-Pierre Fouque served as its first editor-in-chief. Currently, there are three monographs under way, with one monograph expected to appear this year.

Starting January 2015, I have taken Jean-Pierre's place and will be working with our editorial board: René Carmona, Rama Cont, Kay Giesecke, Paul Glasserman, Paolo Guasoni, Steven Kou, Mike Ludkovski, Alexander Schied, Ronnie Sircar, Nizar Touzi and Xunyu Zhou, and with Elizabeth Greenspan as our acquisitions editor.

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  $\text{\LaTeX}$  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 Elizabeth Greenspan, or any of our editorial board members who can be found on the series web page.

I would like to thank Jean-Pierre and the first editorial board for their service.

I am looking forward to hearing from you.

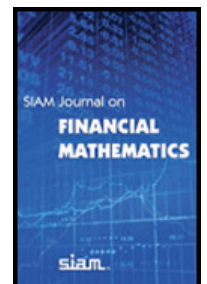
by T. ZARIPHOPULOU

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## SIAM Journal on Financial Mathematics

Recently published articles (Vol 5, 2014):

- ▷ On the Realized Risk of High-Dimensional Markowitz Portfolios by Nouredine 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
- ▷ Dynamics of Bankrupt Stocks by Xiao Li, Michael D. Lipkin, and Richard B. Sowers
- ▷ Transaction Costs, Shadow Prices, and Duality in Discrete Time by Christoph Czichowsky, Johannes Muhle-Karbe, and Walter Schachermayer
- ▷ When to Cross the Spread? Trading in Two-Sided Limit Order Books by Ulrich Horst and Felix Naujokat
- ▷ Dynamic Portfolio Execution and Information Relaxations by Martin Haugh and Chun Wang
- ▷ Approximation for Option Prices under Uncertain Volatility by Jean-Pierre Fouque and Bin Ren
- ▷ Shortfall Risk Minimization in Discrete Time Financial Market Models by N. Frikha
- ▷ Buy Low, Sell High: A High Frequency Trading Perspective by Álvaro Cartea, Sebastian Jaimungal, and Jason Ricci
- ▷ VWAP Execution and Guaranteed VWAP by Olivier Guéant and Guillaume Royer
- ▷ Generalizations of Functionally Generated Portfolios with Applications to Statistical Arbitrage by Winslow Strong



- ▷ An Affine Multicurrency Model with Stochastic Volatility and Stochastic Interest Rates by Alessandro Gnoatto and Martino Grasselli
- ▷ Construction of Mean-Self-Financing Strategies for European Options under Regime-Switching by G. N. Milstein and V. Spokoiny
- ▷ Monte Carlo Variance Reduction by Conditioning for Pricing with Underlying a Continuous-Time Finite State Markov Process by Juan Miguel Montes, Valentina Prezioso, and Wolfgang J. Runggaldier
- ▷ Optimal Exercise of Swing Contracts in Energy Markets: An Integral Constrained Stochastic Optimal Control Problem by Matteo Basei, Annalisa Cesaroni, and Tiziano Vargiolu
- ▷ Convex Risk Measures for Càdlàg Processes on Orlicz Hearts by Takuji Arai
- ▷ Forward Exponential Performances: Pricing and Optimal Risk Sharing by Michail Anthropelos
- ▷ Quasi- $\mathbb{Q}$ -Self Dual Exponential Lévy Processes by Thorsten Rheinländer and Michael Schmutz
- ▷ A Pricing Measure to Explain the Risk Premium in Power Markets by Fred Espen Benth and Salvador Ortiz-Latorre
- ▷ Option Pricing for Stochastic Volatility Models: Vol-of-Vol Expansion by S. M. Ould Aly
- ▷ Trading to Stops by Nora Imkeller and L. C. G. Rogers