HENRY SCHELLHORN

Last updated: January 2021

1237 N. Dartmouth Ave.
School of Mathematical Sciences
Claremont Graduate University
Claremont, CA 91711
USA
Henry.Schellhorn@cgu.edu

1512 Glendon Ave.
Los Angeles, CA 90024
USA
(310) 446-3903
hschellhorn@yahoo.com

EDUCATION

- University of California, Los Angeles. Operations Research (granted by the Electrical Engineering department). Ph.D. (1995).
- Stanford University. Operations Research. M.S. (1992).
- Ecole Polytechnique Fédérale de Lausanne, Switzerland. Electrical Engineering. Diplôme (1988).

EXPERIENCE

Claremont Graduate University, Claremont, California (2012-2013, 2019-2020).
Director, Institute of Mathematical Sciences (IMS). The IMS employs 5 core (tenured and tenure-track) faculty, 3 non-core faculty, 2 lecturers, and provides education to more than 130 graduate students. The directorship is a one-year rotating position among tenured faculty, and corresponds to chairing a department.

Claremont Graduate University, Claremont, California (2005-present).
Assistant, then Associate, then Full Professor in Mathematics.
Taught Probability, Stochastic Processes, Deterministic and Stochastic Control, Applied Analysis, Mathematical Finance, Numerical Methods in Finance, Credit Risk, Quantitative Risk Management, Optimal Portfolio Theory, Introduction to C++ Programming, Stochastic Methods in Operations Research, Stochastic Partial Differential Equations, Quantum Computing.

University of Lausanne, Switzerland (2002 -2005).
Maitre-Assistant.
Taught Numerical Methods in Finance.

Oracle Corporation, Santa Monica, CA (1997-2002)
Principal Research Engineer.

(2000-2001) Developed methodology and software prototypes for combinatorial auctions, revenue management, and stochastic programming for production planning.

(1997-2000) Responsible for R&D of financial analytics for Oracle Risk Manager. In 1999, this product held 4% of the global software market for Asset and Liability Management.

Conducted original research to accelerate Monte Carlo simulation (low-discrepancy sequences, control variates, and importance sampling). Calibrated several interest rate

and foreign exchange models, including Hull and White, Black-Karasinski, and 2-factor Libor model. Used these models to calculate market value and Value-at-Risk of large bank portfolios with Monte Carlo simulation, lattices, and finite differences.

Managed a team of 3 researchers (including another Ph.D.). Established contacts with universities and hired faculty members as consultants.

Treasury Services Corporation, Santa Monica, CA (1996-1997).
Product Manager and Senior Research Engineer.

In charge of the development of the Option-Adjusted Valuation software, in collaboration with Kamakura Corp., and Prof. Robert Jarrow from Cornell University.

Andersen Consulting, Geneva and Zurich, Switzerland (1988-1991).
Designed the financial futures risk analysis and margin requirement systems for the Swiss Options and Financial Futures Exchange (SOFFEX).

GRANTS

Swiss National Research Fund fellowship covering my studies in the USA (1991-1993). Amount: approximately $70,000.

Research grant from the Fitch credit rating agency (2007). This grant sponsored a mathematics clinic on credit risk at CGU. Amount: $25,000.

Research grant from Fair Isaac (2008). This grant sponsored a CRIAMS project on credit risk at CGU. Amount: $58,000.

Blais grant from CGU (2008). This grant covered research with professor Aksoy at CMC and 2 students. Amount: $12,000.

Research grant from Southern California Edison, a utility company (2014). This grant sponsored a mathematics clinic on reliability of electric networks. Amount: $60,000.

Research grant from Southern California Edison, a utility company (2018). This grant sponsored a mathematics clinic on forecasting forward gas and oil prices. Amount: $30,000.

Research grant from AIG, an insurance company (2019). This grant sponsored a mathematics clinic on modelling stochastic utility functions. Amount: $60,000.

PUBLICATIONS UNDER REVISION

28) “Free Market on the Freeway”, submitted. Co-author: Yuan Cheng.

27) "A String Model of Liquidity in Financial Markets", submitted. Co-authors: Sergei Lototsky and Ran Zhao.

REFEREED PUBLICATIONS

JOURNAL PAPERS

26) "Optimal Control of the SIR Model in the Presence of Transmission and Treatment Uncertainty", *Mathematical Biosciences*, forthcoming (2021). Co-author: Nicole Gatto.

25) "American Option Pricing with Regression: Convergence Analysis". *International Journal of Theoretical and Applied Finance* (2019). Co-authors: Chen Liu, Qidi Peng.

24) "A full asymptotic series of European call option prices in the SABR model with beta=1". *Applied Mathematics* (2019). Co-author : Zhengji Guo.

23) "Dyson Type Formula for Pure Jump Lévy Processes, with some Applications to Finance". *Stochastic Processes and Applications* (2019). Co-authors: Sixian Jin and Josep Vives.

22) "On the Distribution of the Extended CIR Model". *Statistics and Probability Letters*. Vol. 42, 23-29 (2018). Co-author: Qidi Peng.

21) "Semi-group Solution of Path-dependent Second Order Parabolic Partial Differential Equations." *International Journal of Stochastic Analysis*, Article ID 2876961, (2017). Co-author : Sixian Jin.

20) "Estimation of the Pointwise Holder Exponent of Multifractional Brownian Motion Using Wavelet Coefficients. " *Statistical Inference for Stochastic Processes*, (2016). Co-authors : Sixian Jin, Qidi Peng.

19) "A Representation Theorem for Expectations of Functionals of Brownian Motion. " *Stochastics,* vol. 88, 5, 651-79 (2016). Co-authors : Sixian Jin, Qidi Peng.

18) "Fractional Hida-Malliavin Derivatives, and Series Representations of Fractional Conditional Expectations. " *Communications on Stochastic Analysis,* vol. 9, 2, 213-238 (2015). Co-authors : Sixian Jin, Qidi Peng.

17) "Generating Random Vectors Using Transformation with Multiple Roots Transformation and its Applications. " *Applications and Applied Mathematics : an International Journal,* vol. 10, 1, 50-70 (2015). Co-author: Qidi Peng.

16) "A New Algorithm to Simulate First Exit Times of a Vector of Brownian Motions, withan Application to Finance. " *Journal of Applied Probability and Statistics,* vol. 10, 2, 41-65 (2015) Co-authors : Chiu-Yen Kao, Qidi Peng, Lu Zhu.

15) "A Trading Mechanism Contingent on Several Indices." *European Journal of Operational Research*, vol. 213, 3 (2011).

14) "A Theoretical Argument why the t-Copula Explains Credit Risk Contagion better than the Gaussian Copula". *Advances in Decision Sciences,* vol. 2010 (2010). Co-authors: Didier Cossin, Nan Song, Satajaporn Tungsong.

13) "Optimal Changes of Gaussian Measures, with an Application to Finance." *International Journal of Information and Management Sciences,* vol. 20, 225-242 (2009).

12) "A Differential Tree Approach to Price Path-Dependent American Options using Malliavin Calculus". *IAENG Transactions on Engineering Technologies Volume II.* American Institute of Physics (2009). Second author: Hedley Morris.

11) "A Double-Sided Multiunit Combinatorial Auction for Substitutes: Theory and Algorithms." *European Journal of Operational Research*, vol. 197, 2, 799-808 (2009)

10) "Credit Risk in a Network Economy". *Management Science,* vol. 53(10), 1604-1617 (2007). Co-author: Didier Cossin.

9) "A Note on the First Moment of Makespan in an Assembly Shop". *European Journal of Operational Research*, vol. 180, 2, 963-968 (2007).

8) "An Analytical Characterization for an Optimal Change of Gaussian Measures". *Journal of Applied Mathematics and Decision Sciences*, 10th Anniversary Special Issue (2006).

7) "A New Simulation Approach of the LIBOR Market Model". *Mathematical and Computer Modelling* (2006), vol. 44, 3-4, 382-396 (2006). Second author: Z. Chen.

6) "A Reverse Convex Formulation of a Combinatorial Auction". *Journal of Applied Mathematics and Decision Sciences*, vol. 9, 1, 19-33 (2005).

5) "Variance Reduction Techniques for Large Scale Risk Management". *Monte Carlo and Quasi-Monte Carlo 1998*. Springer-Verlag (2000). Second author: F. Kidani.

4) "Combination Trading with Limit Orders". *Journal of Applied Mathematics and Decision Sciences*, vol. 1, 2, 133-150 (1997).

PATENT

3) US Patent 7010510 "Variance Reduction Technique for Large Scale Risk Management."

CONFERENCE PROCEEDINGS

2) "An Algorithm for the Pricing of Path-Dependent American Options using Malliavin Calculus", World Congress on Engineering and Computer Science 2008 Proceedings (WCECS), ISBN:978-988-98671-0-2, 1035:1038. Second author: H. Morris.

1) "An algorithm for Optimal Stopping with Path-Dependent Rewards Based on Regression and Malliavin Calculus". In *Numerical Analysis and Applied Mathematics,* Proceedings of the International Conference on Numerical Analysis and Applied

Mathematics. American Institute of Physics (2007).

AWARDS

1) Best paper award. International Business Economics Research Meeting, 2003, Las Vegas.

2) Best paper award. World Congress on Engineering and Computer Science 2008.

3) Teaching award. Financial Engineering Program (2015).

INVITED PRESENTATIONS

"Malliavin Calculus and Applications", presented at:

- 5th international conference on probability and statistics, Guilin, China, November 23, 2019
- Shanghai Jiaotong University, November 28, 2019

"Free Market on the Freeway", University of Barcelona, January 15, 2019.

"Density Formula for compound Poisson processes with Malliavin calculus", USC mathematics seminar, April 13, 2018. Co-authors: Sixian Jin, Ivan Nourdin, Josep Vives.

"Free Market on the Freeway". Claremont Mathematics week-end, January 30, 2017.

"A String Model of Liquidity in Financial Markets", workshop on Quantitative Finance, Barcelona, March 29, 2017.

"The Malliavin Derivative Evaluated along a Stopped Path: applications, and generalization of the definition", University of Luxemburg, January 12, 2017.

"Représentation de martingales par formule de Dyson: application à des problèmes de diffusion", séminaire d'analyse, Université de Tours, France, September 29, 2016.

"Semi-group Solution of Second Order Fully Nonlinear Parabolic Partial Differential Equations", Claremont Mathematics week-end, January 30, 2016.

"Representation of Lévy Martingales": presented at the AMS sectional meeting, Fullerton, CA, October 24, 2015.

"A New Representation of Smooth Brownian Martingales", presented at:

- The University of Barcelona, July 1st, 2015.
- The CGU-CSUN Summit on Complex Systems, May 1st, 2015
- TU Vienna, July 23, 2013
- USC, March 26, 2012.

"Towards the Next Generation of High-Frequency Trading Models", Claremont Mathematics Colloquium, March 27, 2013.

” No-Arbitrage Model of Liquidity in Financial Markets involving Brownian Sheets”, presented at the UCSB applied probability seminar, February 13, 2012.

“Models for Credit Risk in a Network Economy”, presented at the Prognostics and Health Management Society Annual Conference 2010, October 2010, Portland. Keynote speaker.

"An Algorithm for the Pricing of Path-Dependent American Options Using Malliavin Calculus", presented at:

- Florida State University financial mathematics festival, February 2011.
- Claremont Colleges Operations Research seminar, October 2009
- UCSB applied probability seminar, March 2009
- Financial mathematics workshop, Tata Institute for Fundamental Research, Bangalore, May 2009

"Counterparty Risk in a Network Economy", presented (under various forms) at:

- Financial mathematics workshop, Tata Institute for Fundamental Research, Bangalore, May 2009
- Claremont Colleges mathematics colloquium, 2007, Claremont
- The Capital Group research meeting, 2006, Los Angeles
- USC, mathematics department, 2006, Los Angeles
- University of Lugano, 2004, Lugano
- European Investment Review Conference, 2003, Geneva
- University of Lausanne, 2003, Lausanne.

"A New Simulation Approach to the Libor Model", presented at the Monte Carlo I.M.A.C.S. Conference, 2005, Tallahassee, Florida.

"Interest Rate Models: the Libor Model in Details", presented at the Society of Actuaries Interest Rate Conference, 2000, New York.

"Interest Rate Models: an Overview", presented at the Society of Actuaries Interest Rate Conference, 2000, Denver.

"Building an Integrated Risk Management System: Numerical Considerations", presented at the 5th Annual European Conference on Asset/Liability & Risk Management, 1999, Paris.

"Integrating Market and Credit Risk for an Accurate and Effective Calculation of Value-at-Risk", presented at the SIAM Mathematics-in-Industry Conference, 1999, Los Angeles.

"Variance Reduction Techniques for Large Scale Risk Management", presented at the 3rd International Conference on Monte Carlo and Quasi-Monte Carlo Methods, 1998, Claremont, CA.

"Advances in Accelerating Monte Carlo Analysis", presented at the San Francisco Chapter Global Association of Risk Professionals Meeting, 1998.

OTHER PRESENTATIONS

"A string model of liquidity in financial markets":
Paris Financial Management Conference, December 13, 2016.

"A No-Arbitrage Model of Liquidity in Financial Markets involving Strings", presented at the 6th conference on High Frequency Trading and Data Mining, Stevens Institute of Technology, October 29, 2015.

"Representation of Fractional Brownian Motion and Lévy Martingales". European Meeting of Statisticians, Amsterdam July 2015.

"Representation of Lévy Martingales." European Meeting of Statisticians, Budapest, July 2013.

"Counterparty Risk: some new Advances in Structural Modelling, with an Application to the US Automotive Industry." CREDIT conference, Venice, September 2008.

"Counterparty Risk in a Network Economy". Presented (under various forms) at:

- Financial Management Association International Meeting, 2003, Denver
- International Business Economics Research Meeting, 2003, Las Vegas
- C.R.E.D.I.T. Conference, 2003, Venice
- French Finance Association (AFFI) Meeting, 2003, Lyon.

"Efficient Credit Risk Simulation by Optimal Mean-Reversion Adjustment", presented at the French Finance Association (AFFI) Meeting, 2003, Paris.

PROFESSIONAL SERVICE

Organizer of the symposium on Interest Derivatives, Claremont Graduate University, March 14, 2014.

Organizer of the symposium on Energy and Energy Derivatives, Claremont Graduate University, October 7, 2011.

Co-organizer of the workshop on Financial Mathematics: Stochastic Volatility and Credit Risk, Tata Institute of Fundamental Research, Bangalore, India. May 2009.

Associate Editor, *Journal of Applied Mathematics and Decision Sciences* (1999-2012).

Referee for *Mathematical Reviews, Stochastic Analysis, Journal of Applied Mathematics and Decision Sciences, European Journal of Operational Research, Mathematical and Computer Modelling, SIAM Review, Journal of Finance, Journal of Futures Markets, Mathematics of Operations Research, Proceedings of the Royal Society, Electronic Journal of Differential Equations, Princeton University Press, SIAM Journal of Financial Mathematics, Computational Economics, Economics, Management, and Financial Markets, Journal of Credit Risk.*

Created the transfer program between MSFE students of Claremont Graduate University and the University of Lausanne (2006).

Served in the following Claremont Graduate University committees:

- Search committee, vice-provost for academic research (2005)
- Faculty executive committee (2006-7) (2013-15)
- Search committee, mathematical sciences (2006-7)
- Admissions committee, FE program (2007).
- Financial Engineering Steering Committee, Co-director (since 2009)
- Investment Committee (2009)
- Budget Committee (2010)
- Search committee, school of management (2017-8)

Mentor of postdoctoral researcher Qidi Peng.

Ph.D. adviser of:

- Vigen Isayan, graduated (2009)
- Minet Mucka, graduated (2008)
- Thanh Hoang, graduated (2013)
- Zheng Liu, graduated (2014)
- Lu Zhu, graduated (2014), tenure-track assistant professor at Cal State Long Beach
- ByoungUk Yoon, graduated (2014)
- Sixian Jin, graduated (2016), visiting assistant professor at Fordham University
- Chen Liu, graduated (2015)
- Yuan Cheng, graduated (2019)
- Zhengji Guo, graduated (2019)
- Ran Zhao
- Max Baroi
- Sina Zareian.