MATTHEW LORIG

APPLIED MATHEMATICS
UNIVERSITY of WASHINGTON

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ACADEMIC APPOINTMENTS

2014- **Assistant Professor**, *University of Washington*.
Department of Applied Mathematics.

2011-2014 **Postdoctoral Researcher and Lecturer**, *Princeton University*.
Department of Operations Research and Financial Engineering.

EDUCATION

2005-2011 **Ph.D., Physics**, *University of California, Santa Barbara.*
Adviser: Jean-Pierre Fouque (Department of Applied Probability and Statistics).
Thesis: "Option pricing with fast mean-reverting stochastic volatility models."

2000-2004 **B.S., Physics**, *University of Minnesota, Twin Cities*.
Graduated Summa Cum Laude with Highest Distinction.

RESEARCH INTERESTS

- Probability Theory, Stochastic Analysis, Financial Mathematics, Partial Differential and Integro-differential Equations, Spectral Theory, Fourier Analysis, Regular and Singular Perturbation Methods, Stochastic Control, and Semiparametric Modeling.

PUBLICATIONS AND PREPRINTS

ARTICLES SUBMITTED OR UNDER REVISION AT REFEREED JOURNALS.

1. "Robust Replication of Volatility and Hybrid Derivatives on Jump Diffusions." P. Carr, R. Lee and M. Lorig. *Submitted.*
2. "An Analytical Expansion Method for Forward-Backward Stochastic Differential Equations." J. Detemple, M. Lorig, M. Rindisbacher, S. Sturm, L. Zhang. *Submitted.*
3. "Pricing Variance Swaps on Time-Changed Markov Processes." P. Carr, R. Lee and M. Lorig. *Submitted.* https://arxiv.org/abs/1705.01069.
4. "Short-Time Expansions for Call Options on Leveraged ETFs Under Exponential Lévy models With Local Volatility." J. Figueroa-López, Ruoting Gong and M. Lorig. *Minor revisions* at **SIAM Journal on Financial Mathematics**. http://arxiv.org/abs/1608.07863.
5. "Robust Replication of Barrier-Style Claims on Price and Volatility." P. Carr, R. Lee and M. Lorig. *Submitted.* http://arxiv.org/abs/1508.00632.

ARTICLES ACCEPTED FOR PUBLICATION AT REFEREED JOURNALS.

6. "Approximate pricing of European and barrier claims in a local-stochastic volatility setting." W. Barger and M. Lorig. *To appear* in **International Journal of Financial Engineering**. http://arxiv.org/abs/1610.05728.
7. "Small-Time Asymptotics for a General Local-Stochastic Volatility Model with a Jump-to-Default: Curvature and the Heat Kernel Expansion." J. Armstrong, M. Forde, M. Lorig and H. Zhang. **SIAM Journal on Financial Mathematics**. 2017, Vol. 8, No. 1, pp. 82-113. http://dx.doi.org/10.1137/140971397.
8. "Portfolio Optimization under Local-Stochastic Volatility: Coefficient Taylor Series Approximations & Implied Sharpe Ratio." M. Lorig and R. Sircar. **SIAM Journal on Financial Mathematics**. 2016, Vol. 7, No. 1, pp. 418-447. http://dx.doi.org/10.1137/15M1027073.
9. "Optimal Static Quadratic Hedging." T. Leung and M. Lorig. **Quantitative Finance**. 2016, Vol. 16, No. 9, pp. 1341-1355. http://dx.doi.org/10.1080/14697688.2016.1161229.

10. "Variance Swaps on Defaultable Assets and Market Implied Time-Changes." M. Lorig, O. Lozano-Carbassé and R. Mendoza-Arriaga. **SIAM Journal on Financial Mathematics**. 2016, Vol. 7, No. 1, pp. 273–307. http://dx.doi.org/10.1137/140955380.

11. "Indifference Prices and Implied Volatilities." M. Lorig. *To appear* in **Mathematical Finance**. http://dx.doi.org/10.1111/mafi.12129.

12. "Leveraged ETF Implied Volatilities from ETF dynamics." T. Leung, M. Lorig, and A. Pascucci. *To appear* in **Mathematical Finance**. http://dx.doi.org/10.1111/mafi.12128.

13. "Pricing Approximations and Error Estimates for Local Lévy-type Models with Default." M. Lorig, S. Pagliarani and A. Pascucci. **Computers and Mathematics with Applications**. 2015, Vol. 69, No. 10, pp. 1189–1219. http://dx.doi.org/10.1016/j.camwa.2015.03.013.

14. "From Characteristic Functions to Implied Volatility Expansions." A. Jacquier and M. Lorig. **Advances in Applied Probability**. 2015, Vol. 47, No. 3, pp. 837–857. http://dx.doi.org/10.1239/aap/1444308884.

15. "Analytical Expansions for Parabolic Equations." M. Lorig, S. Pagliarani and A. Pascucci. **SIAM Journal on Applied Mathematics**. 2015, Vol. 75, No. 2, pp. 468–491. http://dx.doi.org/10.1137/130949968.

16. "A Taylor Series Approach to Pricing and Implied Volatility for LSV Models." M. Lorig, S. Pagliarani and A. Pascucci. **Journal of Risk**. 2014, Vol. 17, No 2., pp. 1–17. http://dx.doi.org/10.21314/JOR.2014.297.

17. "Explicit Implied Volatilities for Multifactor Local-Stochastic Volatility Models." M. Lorig, S. Pagliarani and A. Pascucci. *To appear* in **Mathematical Finance**. http://dx.doi.org/10.1111/mafi.12105.

18. "Multiscale Exponential Lévy-type Models." M. Lorig and O. Lozano-Carbassé. **Quantitative Finance**. 2015, Vol. 15, No. 1, pp. 91–100. http://dx.doi.org/10.1080/14697688.2014.934712.

19. "Second Order Multiscale Stochastic Volatility Asymptotics: Stochastic Terminal Layer Analysis & Calibration." J.-P. Fouque, M. Lorig and R. Sircar. **Finance & Stochastics**. 2016, Vol. 20, No. 3, pp. 543–588. http://dx.doi.org/10.1007/s00780-016-0298-y.

20. "A family of density expansions for Levy-type processes." M. Lorig, S. Pagliarani and A. Pascucci. **Annals of Applied Probability**. 2015, Vol. 25, No. 1, pp. 235–267. http://dx.doi.org/10.1214/13-AAP994.

21. "The smile of certain Lévy-type models." A. Jacquier and M. Lorig. **SIAM Journal on Financial Mathematics**. 2013, Vol. 4, No. 1, pp. 804–830. http://dx.doi.org/10.1137/12090246X.

22. "The Exact Smile of Certain Local Volatility Models." M. Lorig. **Quantitative Finance**. 2013, Vol. 13, No. 6, pp. 897–905. http://dx.doi.org/10.1080/14697688.2012.749357.

23. "Pricing Derivatives on Multiscale Diffusions: An Eigenfunction Expansion Approach." M. Lorig. **Mathematical Finance**. 2014, Vol. 24, No. 2, pp. 331–363. http://dx.doi.org/10.1111/mafi.12007.

24. "Time-Changed Fast Mean-Reverting Stochastic Volatility Models." M. Lorig. **International Journal of Theoretical and Applied Finance**. 2011, Vol. 14, No. 08, pp. 1355-1383. http://dx.doi.org/10.1142/S0219024911006875.

25. "Spectral Decomposition of Option Prices in Fast Mean-Reverting Stochastic Volatility Models." J.-P. Fouque, S. Jaimungal, M. Lorig. **SIAM Journal on Financial Mathematics**. 2011, Vol. 2, No. 1, pp. 665-691. http://dx.doi.org/10.1137/100803614.

26. "A Fast Mean-Reverting Correction to Heston's Stochastic Volatility Model." J.-P. Fouque and M. Lorig. **SIAM Journal on Financial Mathematics**. 2011, Vol. 2, No. 1, pp. 221-254. http://dx.doi.org/10.1137/090761458.

ARTICLES PUBLISHED IN BOOKS OR REFEREED PROCEEDINGS.

27. "Asymptotics for d-dimensional Lévy-type processes." M. Lorig, S. Pagliarani and A. Pascucci. **Springer Proceedings on Large Deviations and Asymptotic Methods in finance** (eds. P.K. Friz, J. Gatheral, A. Gulisashvili, A. Jacquier, J. Teichmann), Springer Proceedings in Mathematics & Statistics (2015), pp. 321–343. http://dx.doi.org/10.1007/978-3-319-11605-1_12.

28. "Stochastic Volatility: Modeling and Asymptotic Approaches to Option Pricing & Portfolio Selection." M. Lorig and R. Sircar. **Financial Signal Processing and Machine Learning**, (eds. A. Akansu, S. Kulkarni, D. Malioutov, I. Pollak). Wiley (2016), pp. 135–161. http://dx.doi.org/10.1002/9781118745540.ch7.

PUBLICATIONS NOT RELATED TO MATHEMATICAL FINANCE.

29. "Elastic Solutions for Eccentrically Loaded, Slender, Rectangular Spandrel Beams." B. Mercon, A. Schultz, H. Stolarski, R. Magana and M. Lorig. **Journal of Structural Engineering**. 2012, Vol. 138, No. 7, pp. 911-921. http://dx.doi.org/10.1061/(ASCE)ST.1943-541X.0000498.

30. "Biomechanical Analysis of the Deadlift." M. Rippetoe and M. Lorig. **Starting Strength, 3rd Edition**. The Aasgaard Company (2011), pp. 122. http://aasgaardco.com/store/books/starting-strength-basic-barbell-training-413.

Preprints versions of most of my papers are available for download at: http://arxiv.org/a/lorig_m_1.html.

Links to published version of my papers can be found on my website: https://mattlorig.yolasite.com/.

Note: the convention in mathematics is to list all authors in alphabetical order by last name. The understanding is that each author contributes equally.

FUNDING

- NSF-DMS 1700717: 8th Western Conference on Mathematical Finance ($30,000). PI Matthew Lorig. Co-PIs Tim Leung and Soumik Pal. 100% of the funds were used to pay for travel and lodging of conference participants.

AWARDS AND HONORS

2016 SIAM Activity Group on Financial Mathematics and Engineering (SIAG/FME) Early Career Prize. [1]

2016 University of Washington Applied Mathematics Service Award.

2015 Fully funded visiting Scholar at the Institute for Pure and Applied Mathematics (IPAM). Los Angeles, CA.

2013 Fully funded visiting Scholar at the Tata Institute of Fundamental Research. Mumbai, India.

2005 National Defense Science and Engineering Graduate Research Fellowship. [2]

2005 University of California - Santa Barbara Central Fellowship.

2003 Barry M. Goldwater Scholarship. [3]

INVITED AND CONTRIBUTED TALKS

Unless stated otherwise, all talks are **invited**.

1. Ritsumeikan University: minicourse on Coefficient Polynomial Expansions. December 5-15, 2017. Kyoto, Japan.
2. SIAM Workshop on Mathematical Modeling in Finance. August 31-September 2, 2017. Imperial College. London, England.
3. Tenth Anniversary of CFMAR Conference. May 19-21, 2017. University of California at Santa Barbara. Santa Barbara, CA.
4. Oberwolfach conference on Mathematics of Quantitative Finance. February 27 - March 3, 2017. Oberwolfach, Germany.
5. 5th SIAM Conference on Financial Mathematics and Engineering. November 17-19, 2016. Austin, TX.
6. Mathematical Finance, Risk and Uncertainty Seminar. September 13, 2016. University of Illinois. Champaign, IL.
7. Imperial College, Finance and Stochastics Seminar. June 8, 2016. London, England.
8. École Polytechnique Bachelier Seminar. June 6, 2016. Paris, France.
9. Seventh Western Conference in Mathematical Finance. October 10-31, 2015. University of Texas. Austin, TX.
10. Broad Perspectives and New Directions in Financial Mathematics. June 7-12, 2015. Lake Arrowhead, CA.
11. Stochastic Portfolio Theory and related topics. May 8-9, 2015. Columbia University. New York, NY.
12. Mathematical Finance and Partial Differential Equations Conference. May 1, 2015. Rutgers University. New Brunswick, NJ.
13. Purdue University Computational Finance Seminar. April 21, 2015. West Lafayette, IL.
14. Illinois Institute of Technology Applied Mathematics Colloquium. April 20, 2015. Chicago, IL.

[1] The Early Career Prize, established in 2010, is awarded once every two years to an outstanding early career researcher for distinguished contributions to the mathematical modeling of financial markets in the three calendar years prior to the year of the award. See: https://www.siam.org/prizes/sponsored/siagfmecareer.php.

[2] The NDSEG fellowship is a highly competitive three-year fellowship similar to the NSF Graduate Research Fellowship. On average, only 8% of physics applicants are selected as NDSEG fellows each year. See: https://ndseg.asee.org/.

[3] The Goldwater Foundations provides scholarships to college sophomores and juniors who intend to pursue research careers in the natural sciences, mathematics and engineering. See: https://goldwater.scholarsapply.org/.

15. 4th SIAM Conference on Financial Mathematics and Engineering. November 13-15, 2014. Chicago IL.
16. Sixth Western Conference in Mathematical Finance. September 25-27, 2014. Santa Barbara, CA.
17. New Directions in Financial Mathematics and Mathematical Economics. July 6-11, 2014. Banff International Research Station.
18. SIAM-SMAI Conference on Financial Mathematics. June 17-20, 2014. Paris, France.
19. University of Washington Applied Mathematics Seminar. February 27-28, 2014. Seattle, WA.
20. Columbia University IEOR Department Seminar. February 25, 2014. New York, NY.
21. Stanford University Applied Mathematics Seminar. February 12, 2014. Stanford, CA.
22. Georgia State University Robinson College of Business. February 10, 2014. Atlanta, GA.
23. University of Massachusetts Mathematics Colloquium. January 30, 2014. Amherst, MA.
24. University of Minnesota Industrial and Systems Engineering Colloquium. January 23, 2014. Minneapolis, MN.
25. Tata Institute of Fundamental Research. January 14, 2014. Mumbai, India.
26. Bocconi University Finance Seminar. November 28, 2013. Milan, Italy.
27. Università di Bologna: minicourse on local-stochastic volatility models. November 25-27, 2013. Bologna, Italy.
28. Universided de Chile: minicourse on local-stochastic volatility models. November 11-15, 2013. Santiago, Chile.
29. Columbia Mathematical Finance Seminar. November 7, 2013. New York, NY.
30. 4th Princeton-Humboldt Conference in Quantitative Finance. November 2, 2013. Princeton, NJ.
31. Rutgers University Mathematical Finance and Probability Seminar. November 1, 2013. New Brunswick, NJ.
32. INFORMS 2013 Annual Meeting. October 6-9, 2013. Minneapolis, MN.
33. University of Southern California Mathematical Finance Seminar. September 16, 2013. Los Angeles, CA.
34. University of Chicago Financial Mathematics Seminar. May 30, 2013. Chicago, IL.
35. 2nd Princeton-Lausanne Workshop on Quantitative Finance & Economics. May 3-4, 2013. Princeton, NJ.
36. AMS Sectional Meeting. April 6-7, 2013. Boston College. Boston, MA. (**Contributed**)
37. Worcester Polytechnic Institute Mathematics Seminar. April 5, 2013. Worcester, MA.
38. Mathematics of Energy Finance and Natural Resource Management. March 18-20, 2013. Santiago, Chile.
39. University of Oxford, Nomura Seminar on Mathematical Finance. November 23, 2012. Oxford, England.
40. Imperial College, Finance and Stochastics Seminar. November 21, 2012. London, England.
41. Mathematical Finance and Partial Differential Equations Conference. November 2, 2012. Rutgers University. (**Contributed**)
42. INFORMS 2012 Annual Meeting. October 14-17. Phoenix, AZ.
43. Rutgers University Mathematical Finance and Probability Seminar. October 1, 2012. New Brunswick, NJ.
44. 4th SIAM Conference on Financial Mathematics and Engineering. July 9-11, 2012. Minneapolis, MN.
45. 7th Oxford-Princeton Workshop on Financial Mathematics and Stochastic Analysis. April 27-28, 2012. Princeton, NJ.
46. Morgan Stanley Market Modeling Group. February 23, 2012. New York, NY.
47. Courant Institute Mathematical Finance Seminar. December 8, 2011. New York, NY.
48. INFORMS 2011 Annual Meeting. November 16. Charlotte, NC.
49. Mathematical Finance and Partial Differential Equations Conference. November 4, 2011. Rutgers University. (**Contributed**)
50. Instituto de Matematica Pura e Aplicada (IMPA). April 1, 2011. Rio de Janeiro, Brazil.
51. Universidad de Chile, Departamento de Ingeniería Industrial. March 23, 2011. Santiago, Chile.
52. Pontificia Universidad Catolica de Chile, Departamento de Ingeniería Industrial y de Sistemas. March 21, 2011. Santiago, Chile.

53. University of California at Santa Barbara Financial Mathematics Seminar. February 14, 2011. Santa Barbara, CA.
54. 6th World Congress of the Bachelier Finance Society. June 22 - 26, 2010. Toronto, Canada. (**Contributed**)
55. Workshop on Financial Derivatives and Risk Management at the Fields Institute. May 24 - 28, 2010. Toronto, Canada. (**Contributed**)
56. Third Western Conference in Mathematical Finance. November 13 - 15, 2009. Santa Barbara, CA.
57. INFORMS 2009 Annual Meeting. October 9 - 14. San Diego, CA. (**Contributed**)

TEACHING

Courses Taught

2014– **University of Washington**
CFRM 544: Options and Derivatives (Autumn of '14, '16, '17)
CFRM 559: Stochastic Calculus for Finance (Winter of '15, 16' and '17)
AMATH 572: Introduction to Applied Stochastic Analysis (Spring '16)
AMATH 569: Partial Differential Equations (Spring '17)
AMATH 561: Introduction to Probability (Autumn of '17)
AMATH 562: Advanced Stochastic Processes (Winter of '18)

2011–14 **Princeton University**
FIN/ORF 531: Computational Finance in C++ (Spring of '12,'13 and '14)
FIN 500: Graduate Level Mathematics for Finance (Autumn of '11, '12 and '13)
EGR 501: Engineering Ethics (Autumn of '11, as an Assistant Instructor)
ORF 478: Senior Thesis ('12-'13 and '13-'14, as an Adviser)

2005–11 **University of California, Santa Barbara** (as Teaching Assistant)
PSTAT 223A-B-C: Graduate Level Financial Mathematics Sequence
PSTAT 213A-B-C: Graduate Level Stochastic Processes Sequence
PSTAT 170: Undergraduate Level Financial Mathematics
PSTAT 120A: Undergraduate Level Probability Theory
PSTAT 5A: Undergraduate Level Statistics
PSTAT 5E: Statistics for Economics and Business

Courses Developed

- Created complete set of course notes (115 pages), homework sets and solutions for CFRM 544.
- Created complete set of course notes (173 pages), homework sets and solutions for AMATH 561-562.

SERVICE TO THE GREATER MATHEMATICS COMMUNITY

- **Editorial Board**: *Modern Trends in Financial Engineering* (2016–present).
- **Reviewer**: *Mathematical Finance*, *Finance and Stochastics*, *SIAM Journal on Financial Mathematics*, *SIAM Journal on Applied Mathematics*, *SIAM Journal on Optimization*, *Quantitative Finance*, *Applied Mathematical Finance*, *Journal of Computational Finance*, *International Journal of Theoretical and Applied Finance*, *Mathematics of Operations Research*, *Journal of Mathematical Analysis and Applications*, *European Journal of Operations Research*, *Journal of Banking and Finance*.
- **Co-organizer**: Special session in Financial Engineering and Risk management. AMS National Meeting. January 6-9, 2016. Seattle, WA.
- **Organizer**: Minisymposium on Robust Methods and Model Uncertainty. 5th SIAM Conference on Financial Mathematics and Engineering. November 17-19, 2016. Austin, TX.
- **Co-Organizer**: Eighth Western Conference on Mathematical Finance (WCMF). March 24-25, 2017. Seattle, WA. http://depts.washington.edu/amath/wcmf/.
- **Organizer**: Minisymposium on Hawkes Processes, Fractional Brownian Motion, and Levy Processes in Financial Engineering. INFORMS applied probability conference. July 10-12, 2017. Evanston, IL.

SERVICE TO THE UNIVERSITY OF WASHINGTON

- **Curriculum Committee** (2014 –). The committee oversaw creation of a new three-quarter sequence AMATH 561-562-563 on probability, stochastic processes and model uncertainty for first-year PhD students. The committee additionally reformed the qualifying exam process for PhD students.
- **CFRM Steering committee** (2015 –). The committee oversaw various aspects of the CFRM program including curriculum development, student job placement, admissions and overall direction of the program.
- **Math Finance Postdoc Search Committee** (2016-2017). The committee identified 4 postdoc candidates and interviewed them on campus. The department made offers to Ryan Donnelly and Bahman Angoshtari. Both have accepted and will join the department in the autumn of 2017.
- **Math Finance Postdoc Search Committee** (2015-2016). The committee identified 6 postdoc candidates and interviewed them via Skype. The department made offers to Bin Zou and Kerem Ugurlu. Both have accepted and joined the department in the autumn of 2016.
- **Math Finance Associate/Full Professor Search Committee** (2015-2016). The committee identified 4 candidates and interviewed them on Campus. The department made an offer to Tim Leung. He accepted and joined the department in the autumn of 2016.
- **Math Finance Associate/Full Professor Search Committee** (2014-2015). The committee identified 3 candidates and interviewed them on Campus. No hire was made.
- **Qualifying Exam Committee** (2014). The committee administered and graded the qualifying exam for PhD students.

ADVISING

- **Adviser (Ph.D.)**: Weston Barger (2015 –).
- **Adviser (Postdoc)**: Kerem Ugurlu (2016 –), Bin Zou (2016 – 2017).
- **Committee Member (Ph.D.)**: Niket Thakkar (2014 – 2017), Yian Ma (2016 – 2017), Yue Wang (2015 –) and Meghana Velegar (2017 –).
- **Graduate School Representative (Ph.D.)**: Leonard Wong (2015 – 2016), Clayton Barnes II (2015 –), Anthony Sanford (2016 –), Rory Mullen (2016 –).
- **Adviser for Independent Study (Masters)**: Warat Chalermpornpong (2015), Hui Sun (2016), Douglas Service (2016 –), Shaily Chawla (2016).

LANGUAGES

English (native) and Spanish (fluent).