Indranil SenGupta

CONTACT
INFORMATION

Department of Mathematics and Statistics
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ACADEMIC/
ADMINISTRA-
TIVE POSITIONS

Florida International University (FIU), Miami, Florida, USA
- *Full Professor*, Department of Mathematics and Statistics, August 2023- present.
- Joint appointment with Environmental Finance & Risk Management program, Institute of Environment (an FIU Preeminent Program), August 2023- present.

North Dakota State University (NDSU), Fargo, North Dakota, USA
Department of Mathematics:
- *Full Professor*, August 2022- August 2023.
- *Graduate Recruitment Chair* (equivalent to *Mathematics Graduate Program Director*), July 2015- August 2023.
- *Associate Professor*, August 2018- July 2022.
- *Assistant Professor*, August 2012- July 2018.

University of Texas- El Paso, El Paso, Texas, USA
Department of Mathematical Sciences: *Post Doctoral Fellow*, September 2010- July 2012.

EDUCATION

Texas A&M University, College Station, Texas, USA
Ph.D., Mathematics, August 2006- August 2010.
- *Dissertation topic*: Analysis of the three-dimensional superradiance problem and some generalizations.
- *Advisor*: Prof. Goong Chen.
- *Committee Members*: Prof. Goong Chen, Prof. Harold Boas, Prof. Dudley Herschbach (**Nobel laureate in Chemistry 1986**), Prof. Francis Narcowich.
- *GPA*: 4.0

University of Texas Rio Grande Valley (Formerly, University of Texas- Pan American), Edinburg, Texas, USA
M.S., Mathematics, August 2004- May 2006.
- *GPA*: 4.0

IIEST, Shibpur (Formerly, Bengal Engineering and Science University, Shibpur), West Bengal, India
Bachelor of Engineering (B.E.), Electronics and Telecommunication Engineering
August 2000 - May 2004.
- First Class.

RESEARCH
INTERESTS

Mathematical Finance, Stochastic Processes, Data Science and Machine/Deep Learning, Environmental Finance.

- Current research includes hedging of commodity markets, option and swap pricing, stochastic volatility and interest rate modeling, Lévy processes in mathematical finance, portfolio management, exotic option pricing, geophysical modeling, applications of machine learning, deep learning, and neural network. In addition, *Environmental Finance* related topics: weather derivatives, catastrophe bond, green bonds, etc.
- Past research includes harmonic analysis of superradiance problem in quantum mechanics, the study of Korteweg-de Vries-Burgers Equation with higher-order nonlinearities, Generalized Mittag-Leffler function.

PUBLICATIONS

1. *Stochastic volatility modeling of high-frequency CSI 300 index and dynamic jump prediction driven by machine learning* (2023), Electronic Research Archive, **31**(3), 1365-1386 (with X. Hui, B. Sun, Y. Zhou, and H. Jiang).

2. *Analysis of stock index with a generalized BN-S model: an approach based on machine learning and fuzzy parameters* (2023), Stochastic Analysis and Applications, **41**(5), 938-957 (with X. Hui, B. Sun, and H. Jiang).

3. *Machine learning and neural network based model predictions of soybean export shares from US Gulf to China* (2022), Statistical Analysis and Data Mining: The ASA Data Science Journal, **15**(6), 707-721 (with S. Awasthi, W. Wilson, and P. Lakkakula).

4. *A novel implementation of Siamese type neural networks in predicting rare fluctuations in financial time series* (2022), Risks, **10** (2):39 (16 pages) (with T. Basu, O. Menzer, and J. Ward).

5. *Analysis of optimal portfolio on finite and small time horizons for a stochastic volatility market model* (2021), SIAM Journal on Financial Mathematics, **12**(4), 1596-1624 (with M. Lin).

6. *Fractional Barndorff-Nielsen and Shephard model: applications in variance and volatility swaps, and hedging* (2021), Annals of Finance, **17**, 529–558 (with N. Salmon).

7. *Hedging and machine learning driven crude oil data analysis using a refined Barndorff-Nielsen and Shephard model* (2021), International Journal of Financial Engineering, **8**(4), 2150015 (29 pages) (with H. Shoshi).

8. *Stochastic analysis and neural network-based yield prediction with precision agriculture* (2021), Journal of Risk and Financial Management, **14**(9), 397 (17 pages) (with H. Shoshi, E. Hanson, and W. Nganje).

9. *First exit-time analysis for an approximate Barndorff-Nielsen and Shephard model with stationary self-decomposable variance process* (2021), Journal of Stochastic Analysis (formerly, Communications on Stochastic Analysis), **2** (1), Article 5 (26 pages) (with S. Awasthi).

10. *Refinements of Barndorff-Nielsen and Shephard model: an analysis of crude oil price with machine learning* (2021), Annals of Data Science, **8**(1), 39-55 (with W. Nganje and E. Hanson).

11. *Sequential hypothesis testing in machine learning, and crude oil price jump size detection* (2020), Applied Mathematical Finance, **27** (5), 374-395 (with M. Roberts).

12. *Multi-asset generalised variance swaps in Barndorff-Nielsen and Shephard model* (2020), International Journal of Financial Engineering, **7**(4), 2050051 (36 pages) (with S. Biswas and D. Mukherjee).

13. *Infinitesimal generators for two-dimensional Lévy process-driven hypothesis testing* (2020), Annals of Finance, **16** (1), 121-139 (with M. Roberts).

14. *Barndorff-Nielsen and Shephard model for hedging energy with quantity risk* (2019), High Frequency, **2** (3-4), 202-214 (with W. Wilson, W. Nganje, and S. Gebresilasie).

15. *Barndorff-Nielsen and Shephard model: oil hedging with variance swap and option* (2019), Mathematics and Financial Economics, **13** (2), 209-226 (with W. Wilson and W. Nganje).

16. *Volatility and variance swap using superposition of the Barndorff-Nielsen and Shephard type Lévy processes* (2019), Sankhya B: The Indian Journal of Statistics, **81** (1), 75-92 (with S. Habtemicael and M. Ghebremichael).

17. *Moments of the asset price for the Barndorff-Nielsen and Shephard model* (2018), Lithuanian Mathematical Journal, **58** (4), 408-420 (with A. Ihsan).

18. *A new analysis of VIX using mixture of regressions: examination and short-term forecasting for the S&P 500 market* (2018), High Frequency, **1** (1), 53-65 (with T. Miljkovic).

19. *Analysis of variance based instruments for Ornstein-Uhlenbeck type models: swap and price index* (2017), Annals of Finance, **13** (4), 401-434 (with A. Issaka).

20. *Feynman path integrals and asymptotic expansions for transition probability densities of some Lévy driven financial markets* (2017), Journal of Applied Mathematics and Computing, **54** (1), 159-182 (with A. Issaka).

21. *Pricing variance and volatility swaps for Barndorff-Nielsen and Shephard process driven financial markets* (2016), International Journal of Financial Engineering, **03** (04), 1650027 (35 pages) (with S. Habtemicael).

22. *Pricing covariance swaps for Barndorff-Nielsen and Shephard process driven financial markets* (2016), Annals of Financial Economics, **11**, 1650012 (32 pages) (with S. Habtemicael).

23. *Generalized BN-S stochastic volatility model for option pricing* (2016), International Journal of Theoretical and Applied Finance, **19** (02), 1650014 (23 pages).

24. *Numerical methods applied to option pricing models with transaction costs and stochastic volatility* (2015), Quantitative Finance, **15** (8), 1417-1424, (with M. C. Mariani and G. Sewell).

25. *PIDE and solution related to pricing of Lévy driven arithmetic type floating Asian options* (2015), Stochastic Analysis and Applications, **33** (4), 630-652, (with S. R. Chandra and D. Mukherjee).

26. *Pricing Asian options in financial markets using Mellin transforms* (2014), Electronic Journal of Differential Equations, **2014** (234), 1-9.

27. *Option pricing with transaction costs and stochastic interest rate* (2014), Applied Mathematical Finance, **21** (5), 399-416.

28. *Option pricing with transaction costs and stochastic volatility* (2014), Electronic Journal of Differential Equations, **2014** (165), 1-19, (with I. Florescu and M. C. Mariani).

29. *Ornstein-Uhlenbeck processes for geophysical data analysis* (2014), Physica A: Statistical Mechanics and its Applications, **399**, 147-156, (with S. Habtemicael).

30. *Lévy models and scale invariance properties applied to Geophysics* (2013), Physica A: Statistical Mechanics and its Applications, **392**, 824-839, (with M. C. Mariani, I. Florescu, M.P. Beccar Varela, P. Bezdek and L. Serpa).

31. *Spherical harmonics approach to parabolic partial differential equations* (2012), Analysis and Mathematical Physics, **2** (4), 461-471, (with M. C. Mariani).

32. *Spherical harmonics applied to differential and integro-differential equations arising in mathematical finance* (2012), Differential Equations and Dynamical Systems, **20**(2), 93-109, (with M. C. Mariani).

33. *Concentration problems for bandpass filters in communication theory over disjoint frequency intervals and numerical solutions* (2012), Journal of Fourier Analysis and Applications, **18**, 182-210, (with B. Sun, W. Jiang, G. Chen and M. C. Mariani).

34. *Solutions to integro-differential problems arising on pricing options in a Lévy market* (2012), Acta Applicandae Mathematicae, **118**, 237-249, (with M. C. Mariani and P. Amster).

35. *Nonlinear problems modeling stochastic volatility and transaction costs* (2012), Quantitative Finance, **12**(4), 663-670, (with M. C. Mariani).

36. *Numerical solutions for option pricing models including transaction costs and stochastic volatility* (2012), Acta Applicandae Mathematicae, **118**, 203-220, (with M. C. Mariani and P. Bezdek).

37. *Detecting Market crashes by analyzing long memory effects using high frequency data* (2012), Quantitative Finance, **12**(4), 623-634, (with E. Barany, M.P. Beccar Varela and I. Florescu).

38. *Two-point boundary value problems for a class of second order ordinary differential equations* (2012), International Journal of Mathematics and Mathematical Sciences, **2012**, Article ID 794040, 13 pages, (with M. C. Mariani).

39. *Spectral analysis and generation of certain highly oscillatory curves related to chaos* (2012), Physica A: Statistical Mechanics and its Applications, **391**, 1453-1468, (with G. Chen, M. C. Mariani and N. Mai).

40. *Solutions to a gradient-dependent integro-differential parabolic problem arising in the pricing of financial options in a Lévy market* (2012), Journal of Mathematical Analysis and Applications, **385**, 36-48, (with M.C. Mariani and M. Salas).

41. *Solutions to an integro-differential parabolic problem arising in the pricing of financial options in a Lévy Market* (2011), Nonlinear Analysis: Real World Applications, **12**, 3103-3113, (with M. C. Mariani).

42. *Solutions to a nonlinear Black-Scholes equation* (2011), Electronic Journal of Differential Equations, **2011**(158), 1-10, (with M. C. Mariani and E. K. Ncheuguim).

43. *Superradiance problem in a $3D$ annular domain* (2011), Discrete and Continuous Dynamical Systems, **2011**, Issue Special, 2011, 1309 - 1318, (with W. Jiang, B. Sun and M. C. Mariani).

44. *Spectral analysis for a three-dimensional superradiance problem* (2011), Journal of Mathematical Analysis and Applications, **375**, 762-776.

45. *Differential operator related to the generalized superradiance integral equation* (2010), Journal of Mathematical Analysis and Applications, **369**, 101-111.

46. *Korteweg-de Vries- Burgers equation with a higher-order nonlinearity* (2008), Differential Equations and Dynamical Systems, **16** (1 & 2), 3-27, (with Z. Feng).

47. *On a new nonlinear transformation and its applications to special functions* (2007), Advanced Studies in Contemporary Mathematics, **15**(2), 229-242, (with L. Debnath).

48. *Korteweg-de Vries-Burgers equation with higher-order nonlinearities* (2007), DCDIS A Supplement, Advances in Dynamical Systems, **14**(S2), 209-214, (with Q. Meng, Z. Feng, L. Debnath and Y. Li).

49. *Some properties of the Mittag-Leffler functions* (2007), Integral Transforms and Special Functions, **18**(5),329-336, (with L. Debnath).

50. *Broadband tuning limits on UWB antennas based on Fano's formulation* (2006), Proceedings of IEEE Antennas and Propagation International Symposium, Albuquerque, NM., 171-174, (with M. C. Villalobos, H. D. Foltz and J. S. McLean).

51. *On a new simple method for evaluation of certain multiple definite integrals* (2006), International Journal of Mathematical Education in Science and Technology. **37**(5), 624-628, (with L. Debnath).

Submitted: *Analysis of optimal portfolio on finite and small-time horizons for a stochastic volatility model with multiple correlated assets*, (with M. Lin).

Submitted: *Some asymptotics for short maturity Asian options*, (with H. Shoshi).

Submitted: *Estimation of VaR with jump process: application in corn and soybean markets*, (with M. Lin and W. Wilson).

Submitted: *From pixels to profits: a novel approach to identify rare events for a group of US equities*, (with L. Mondal, K. Chandak, and G. Chakrabarty).

Submitted: *A data-science-driven short-term analysis of Amazon, Apple, Google, and Microsoft stocks*, (with S. Ekapure, N. Jiruwala, and S. Patnaik). [*This is a Summer (2021) REU paper.*]

1. *Analysis of Strategic Market Management in Light of Stochastic Processes, Recurrence Relation, Abelian Group and Expectation*, Advances in Artificial Intelligence and Data Engineering, (part of the Advances in Intelligent Systems and Computing book series), N. Chiplunkar, T. Fukao (eds), Springer, 2021, Singapore, pp. 701-710 (with P. Chakrabarti, T. Chakrabarti, S. Bane, B. Satpathy, and J. A. Ware).

2. *Study of volatility structures in geophysics and finance using GARCH models*, Handbook of High-Frequency Trading and Modeling in Finance; I. Florescu, M. C. Mariani, H. E. Stanley, F. G. Viens (eds), Wiley, 2016, ISBN: 978-1118443989, New York, pp. 295-340, (with M. C. Mariani and F. Biney).

3. *Scale invariance and Lévy models applied to earthquakes and financial high-frequency data*, Handbook of High-Frequency Trading and Modeling in Finance; I. Florescu, M. C. Mariani, H. E. Stanley, F. G. Viens (eds), Wiley, 2016, ISBN: 978-1118443989, New York, pp. 341-370, (with M-P. Beccar-Varela and I. Florescu).

4. *Analysis of generic diversity in the fossil record, earthquake series, and high-frequency financial data*, Handbook of High-Frequency Trading and Modeling in Finance; I. Florescu, M. C. Mariani, H. E. Stanley, F. G. Viens (eds), Wiley, 2016, ISBN: 978-1118443989, New York, pp. 371-423, (with M-P. Beccar-Varela, F. Biney, M. C. Mariani, M. Shpak, and P. Bezdek).

5. *Solutions to integro-differential parabolic problem arising on financial mathematics*, Handbook of Modeling High-Frequency Data in Finance; F. G. Viens, M. C. Mariani, I. Florescu (eds), Wiley, 2011, ISBN: 978-0470876886, New York, pp. 347-382, (with M.C. Mariani and M. Salas).

6. *Existence of solutions for financial models with transaction costs and stochastic volatility*, Handbook of Modeling High-Frequency Data in Finance; F. G. Viens, M. C. Mariani, I. Florescu (eds), Wiley, 2011, ISBN: 978-047087688-6, New York, pp. 383-419, (with M.C. Mariani and E.K. Ncheuguim).

7. *Broadband tuning limits on UWB antennas based on Fano's formulation*, Ultra Wideband, Short Pulse Electromagnetics, Vol. 8, 2007, C.E. Baum, A.P. Stone, J.S. Tyo (Eds.), pp. 83-87, (with M. C. Villalobos, H. D. Foltz, and J. S. McLean).

- College of Science and Mathematics Paul Juell Award for Excellence in Mentoring, NDSU, 2023.
- Collaboration Grants for Mathematicians, Simons Foundation, *Proposal title:* "Refinement of stochastic processes via machine/deep learning", 2021-2026, PI, Amount: $42,000.
- Odney Excellence in Teaching Award, NDSU, 2019-2020.
- Featured in NDSU "Inspiring Teachers Series", (April, 2021). https://www.ndsu.edu/news/view/detail/62117/
- Emerald Literati Award in the category of Outstanding Reviewer, 2020.
- College of Science and Mathematics Award for Excellence in Teaching, NDSU, 2017.
- Collaborative Research funding by the Department of Agribusiness and Applied Economics, NDSU:
    - Summer research support (for 2 months), 2022,
    - Summer research support (for 2 months), 2021,
    - Summer research support (for 2 months), 2020,
    - Summer research support (for 2 months), 2019,
    - Summer research support (for 2 months), 2018,
    - Summer research support (for 2 months), 2017.
- *Nominated* for:
    - NDSU Excellence in Mentoring Award, 2021 and 2022.
    - College of Science and Mathematics Award for Excellence in Research, NDSU, 2020.

- Graduate Recruitment Award, NDSU, 2020.
- Research Development Travel Award, NDSU, 2018.
- Research Development Travel Award, NDSU, 2017.
- Lorraine Elvrum Murphy Faculty International Award, NDSU, 2015.
- CSM Research Travel Fund, July 2014-December 2014.
- ND NASA EPSCoR grant, *Proposal title:* "Earthquake modeling using stochastic processes", April 2013- April 2014, PI, Amount: $12,000.
- Provost travel and research grant, December 2013.
- **Travel awards**:
  - AIMS 2012 travel award.
  - AIMS 2010 travel award.
  - AMS 2010 International Congress of Mathematicians travel award.
- Outstanding Student Research Award in Mathematics:
  - Hispanic Engineering, Science & Technology (HESTEC) 2005 Science Symposium at the University of Texas- Pan American.
  - Hispanic Engineering, Science & Technology (HESTEC) 2004 Science Symposium at the University of Texas- Pan American.

PRESENTATIONS [1]

- **2024:**
  - *Finance-informed machine learning and portfolio management*, April 30, **2024**, Mathematics Colloquium, Department of Mathematics, North Dakota State University, Fargo, North Dakota, *invited talk.*
  - *Data science empowered risk management models with some applications in finance*, April 22, **2024**, Mathematics Seminar, Department of Mathematics, Texas A&M University, College Station, Texas, *invited talk.*
  - *An optimal portfolio analysis and machine learning*, March 19, **2024**, International Research Convention (IRC24), Sir Padampat Singhania University, Bhatewar, Udaipur, India, *virtual keynote talk.*

- **2023:**
  - *Risk management, data science-based improvements, and financial applications*, November 10, **2023**, Math Colloquium, Department of Mathematical Sciences, New Jersey Institute of Technology, Newark, New Jersey, *invited talk.*
  - *An optimal portfolio with jumps- an analysis over finite and small-time horizons*, November 2, **2023**, Financial Mathematics Seminars, Florida State University, Tallahassee, Florida, *invited talk.*
  - *Data Science in commodity markets*, 2nd World Conference on Business, Management, Finance, Economics and Marketing, May 25-26 , **2023**, London, United Kingdom. *Keynote Speaker.*
  - *A mathematical analysis of optimal portfolio on finite and small-time horizons*, April 21, **2023**, Minnesota Center for Financial and Actuarial Mathematics (MC-FAM) seminar, University of Minnesota, Minneapolis, Minnesota, *invited talk.*
  - *Fractional stochastic models with applications in finance*, AMS Special Session on *Stochastic Analysis and Applications*, Joint Mathematics Meetings 2023, January 4-7, **2023**, Boston, Massachusetts.

- **2022:**
  - *Some Data-Science-Based Refinements of Financial Models with Applications*, Session on *Finance Applications*, SIAM Conference on Mathematics of Data Science, September 26-30, **2022**, San Diego, California [Hybrid conference].

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[1]Does not include Seminar/Colloquium/Math Club/Actuarial Club talks at the home institute.

- *Stochastic volatility models and data-science-driven improvements*, Special Session on *High-Frequency Data Analysis, Complex Datasets, and Applications*, AMS Fall Central Sectional Meeting, September 17-18, **2022**, University of Texas at El Paso, El Paso, Texas.

- *Brownian motion, Lévy process, and Mathematical Finance*, April 7, **2022**, Electrical Engineering (EE) Graduate Seminar, South Dakota School of Mines & Technology, South Dakota, *invited virtual talk*.

- *Stochastic models, some generalizations, and relation to data-science*, February 17, **2022**, Probability and Stochastic Analysis Seminar, Ohio State University at Marion, Ohio, *invited virtual talk*.

- **2021:**

  - *Data science, finance, and risk management: a tour*, November 3, **2021**, Industry talk at Medallia, INC. *invited virtual talk*.

  - *Some data science-based improvement techniques of financial models*, September 24, **2021**, Department seminar, Department of Mathematics and Statistics, Texas A&M University at Corpus Christi, Texas, *invited virtual talk*.

  - *Refinement of the Barndorff-Nielsen and Shephard model through neural networks - applications in finance*, The 2nd International forum on Financial Mathematics and FinTech, August 13- August 15, **2021**, School of Mathematics, Renmin University of China, Beijing, China, *invited online lecture*.

  - *A machine/deep learning-based improvement of stochastic models with applications in finance*, Special Session on *Stochastic Analysis*, AMS Spring Eastern Sectional Meeting, March 20-21, **2021**, [virtual meeting hosted by the American Mathematical Society].

  - *Barndorff-Nielsen and Shephard model, a generalization, a data-science based improvement, and applications*, February 25, **2021**, Applied Probability and Statistics seminar, City University of New York- Hunter College, New York, *invited virtual talk*.

  - *A machine learning-driven crude oil data analysis, with applications in continuous-time quadratic hedging*, February 12, **2021**, Minnesota Center for Financial and Actuarial Mathematics (MCFAM) seminar, University of Minnesota, Minneapolis, Minnesota, *invited virtual talk*.

- **2020:**

  - *Barndorff-Nielsen and Shephard model in finance*, December 14, **2020**, as a part of MStat final year course on *Quantitative Finance*, Indian Statistical Institute, Kolkata, India, *invited virtual talk*.

  - *Barndorff-Nielsen and Shephard model: a data-science based refinement and oil data analysis*, October 12, **2020**, Probability Seminar, Department of Mathematical Sciences, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin, *invited virtual talk*.

  - *Machine learning-based refinement of stochastic models and oil data analysis*, Special Session on *High-Frequency Data Analysis and Applications*, AMS Fall Central Sectional Meeting, September 12-13, **2020**, [virtual meeting hosted by the American Mathematical Society].

  - *Refinement of the Barndorff-Nielsen and Shephard model with machine learning: analysis of various price indices*, AMS Special Session on *Stochastic Analysis and Applications in Finance, Actuarial Science and Related Fields*, Joint Mathematics Meetings 2020, January 15-18, **2020**, Denver, Colorado.

  - *Introduction to stochastic calculus with applications*, January 6, **2020**, Department of Mathematics, Ramakrishna Mission Vidyamandira, Howrah, West Bengal, India, *invited introductory level talk*.

- **2019:**

- *A data science driven improvement of hedging in the financial market*, Conference: Statistical Methods in Finance 2019, December 16-21, **2019**, Chennai Mathematical Institute, Chennai, India, *invited talk.*

- *Refinement of stochastic models: machine learning and the analysis of crude oil price*, December 4, **2019**, Department of Mathematics, Texas State University, San Marcos, Texas, *invited lecture.*

- *A machine learning driven refinement of some stochastic financial models*, September 5, **2019**, Statistics Seminars, Department of Statistics, University of Manitoba, Winnipeg, Canada, *invited talk.*

- *A machine learning based improvement of the Barndorff-Nielsen and Shephard model: analysis of crude oil price*, August 15, **2019**, Seminar in Financial Math (FM) program, North Carolina State University, Raleigh, North Carolina, *invited talk.*

- *Barndorff-Nielsen and Shephard model- application for derivative and commodity markets*, The first International forum on Financial Mathematics and FinTech, June 30- July 1, **2019**, Renmin University of China (Suzhou Campus), Suzhou, China, *invited lecture.*

- *Lévy processes, variance swaps, and applications in financial markets*, June 27, **2019**, School of Mathematics and Systems Science, Beihang University, Beijing, China, *invited talk at colloquium.*

- *Analysis of variance swaps with application in oil hedging problem*, April 2, **2019**, Computational Finance Seminar, Department of Statistics, Purdue University, West Lafayette, Indiana, *invited lecture.*

- *Hedging oil, corn, and soybean using the Barndorff-Nielsen and Shephard model*, AMS Special Session on *Stochastic Analysis and Applications in Finance, Actuarial Science and Related Fields*, Joint Mathematics Meetings 2019, January 16-19, **2019**, Baltimore, Maryland.

- **2018:**

    - *Lévy processes, variance swaps, and applications in oil hedging*, December 6, **2018**, Department of Mathematics, Texas Christian University, Fort Worth, Texas, *invited lecture.*

    - *Barndorff-Nielsen and Shephard Model for Hedging Energy with Quantity Risk*, Special Session on *Probabilistic and Statistical Problems in Stochastic Dynamics*, AMS Fall Western Sectional Meeting, October 27-28, **2018**, San Francisco State University, San Francisco, California.

    - *Barndorff-Nielsen and Shephard model with various applications in finance*, September 21, **2018**, School of Mathematical and Statistical Sciences, University of Texas-Rio Grande Valley, Edinburg, Texas, *invited talk at colloquium.*

    - *Analysis of variance based financial instruments for Ornstein-Uhlenbeck type models*, AMS Special Session on *Stochastic Processes, Stochastic Optimization and Control, Numerics and Applications*, Joint Mathematics Meetings 2018, January 10-13, **2018**, San Diego, California.

    - *Barndorff-Nielsen and Shephard model- oil commodity hedging with variance swap and option*, AMS Special Session on *Financial Mathematics, Actuarial Sciences, and Related Fields*, Joint Mathematics Meetings 2018, January 10-13, **2018**, San Diego, California.

- **2017:**

    - *Analysis of some variance based instruments for Ornstein-Uhlenbeck type models*, Conference: Statistical Methods in Finance 2017, December 16-19, **2017**, Chennai Mathematical Institute, Chennai, India, *invited talk.*

    - *Pricing Various Swaps*, Session on *Financial Engineering in Applied Probability*, INFORMS Annual Meeting, October 22-25, **2017**, Houston, Texas.

- *Generalized Barndorff-Nielsen and Shephard model with applications*, May 26, **2017**, Sampling and Official Statistics Unit (SOSU), Indian Statistical Institute, Kolkata, India, *Invited lecture at departmental seminar.*

- *Barndorff-Nielsen and Shephard model, its generalization, and implementation in pricing financial instruments*, April 18, **2017**, Concordia College- Moorhead, Minnesota, *Tri-College Colloquium.*

- *Generalized Barndorff-Nielsen and Shephard model with applications in financial swaps*, Special Session on *Financial Mathematics and Statistics*, AMS Spring Central Sectional Meeting, April 1-2, **2017**, Indiana University, Bloomington, Indiana.

- **2016:**

  - *Barndorff-Nielsen and Shephard model, its generalization, and implementation in pricing various swaps*, Conference: Statistical Methods in Finance 2016, December 18-22, **2016**, Chennai Mathematical Institute, Chennai, India, *invited talk.*

  - **Lecture series on mathematical finance**, **2016** (November 29, December 1, 6, 13, 14, 16). Sampling and Official Statistics Unit (SOSU), Indian Statistical Institute, Kolkata, India, *Invited lecture series.*

  - *Volatility, variance, and covariance swaps for Barndorff-Nielsen and Shephard process driven financial markets*, Special Session on *Financial Mathematics*, AMS Fall Sectional Meeting, September 24-25, **2016**, Bowdoin College, Brunswick, Maine.

  - *Pricing covariance swaps in Lévy driven market*, AMS Special Session on *Problems and Challenges in Financial Engineering and Risk Management*, Joint Mathematics Meetings 2016, January 6-9, **2016**, Seattle, Washington.

- **2015:**

  - *Analysis of volatility, variance, and covariance swaps in Lévy driven financial markets*, November 20, **2015**, Department of Mathematical Sciences, Northern Illinois University, DeKalb, Illinois, *invited talk at colloquium.*

  - *Generalized BN-S models in finance*, June 3, **2015**, Department of Mathematics, Jadavpur University, Kolkata, India, *invited talk at colloquium.*

  - *Pricing various swaps in Lévy driven market*, One day workshop on *Emerging Issues, Methods and Models in Finance*, May 26, **2015**, Indian Statistical Institute, Kolkata, India, *invited talk.*

  - *Volatility, Variance and Covariance swaps for Lévy process driven financial market*, Special Session on *Stochastic Analysis and Applications*, AMS Spring Sectional Meeting, March 27-29, **2015**, University of Alabama in Huntsville, Huntsville, Alabama.

  - *Heavy-tailed Lévy processes in pricing exotic options in finance*, AMS Special Session on *Heavy-Tailed Distributions and Processes*, Joint Mathematics Meetings 2015, January 10-13, **2015**, San Antonio, Texas.

  - *Ornstein-Uhlenbeck processes for geophysical data analysis*, AMS Session on *Game Theory, Economics, Control Theory, and Information*, Joint Mathematics Meetings 2015, January 10-13, **2015**, San Antonio, Texas.

- **2014:**

  - *Asian Option Pricing Using Mellin Transform for BN-S Models with Stochastic Volatility*, Session on *Stochastic Volatility*, SIAM Conference on Financial Mathematics and Engineering, November 13-15, **2014**, Chicago, Illinois.

  - *Earthquake Modeling using Stochastic Processes*, North Dakota NASA EPSCoR Annual Meeting, April 28, **2014**, North Dakota State University, Fargo, North Dakota.

- *Radial concentration problem using Radon transform*, Special Session on *Harmonic Analysis and Its Applications*, AMS Spring Sectional Meeting, April 4-6, **2014**, University of New Mexico, Albuquerque, New Mexico.

- *A traveling wave solution of arithmetic asian options in finance*, 37th Annual Texas Partial Differential Equations Conference, March 1-2, **2014**, University of North Texas, Denton, Texas.

- **2013:**

  - *Earthquake modeling with Lévy processes*, Session on *Applications and Simulations*, SIAM Conference on Geometric and Physical Modeling, November 11-14, **2013**, Denver, Colorado.

  - *Generalized Barndorff-Nielsen and Shephard Model and Volatility Smile*, The 5th Annual Modeling High Frequency Data in Finance Conference, October 24-26, **2013**, Stevens Institute of Technology, Hoboken, New Jersey, *invited talk*.

  - *Generalized BN-S model in finance*, August 14, **2013**, Bayesian and Interdisciplinary Research Unit, Indian Statistical Institute, Kolkata, India, *invited talk at colloquium*.

  - *Option pricing and BN-S models in finance*, August 5, **2013**, Department of Mathematics, Bengal Engineering and Science University, Shibpur, India, *invited talk at colloquium*.

  - *Bessel functions and rainbow option pricing PDE*, 36th Annual Texas Partial Differential Equations Conference, March 2-3, **2013**, University of Texas- El Paso, El Paso, Texas.

  - *Hedging in option pricing with stochastic volatility*, March 1, **2013**, Department of Mathematical Sciences Colloquium, University of Texas- El Paso, El Paso, Texas, *invited talk at colloquium*.

  - *Jump in financial market and estimation of earthquake- a similar analysis*, AMS Session on *Financial Mathematics and Winning Strategies*, Joint Mathematics Meetings 2013, January 9-12, **2013**, San Diego, California.

  - *PDE model, stochastic volatility and transaction costs*, AMS Special Session on *Stochastic Analysis of Stochastic Differential Equations and Stochastic Partial Differential Equations*, Joint Mathematics Meetings 2013, January 9-12, **2013**, San Diego, California.

- **2012:**

  - *Stochastic models applied to earthquake data*, Special Session on *Stochastic Analysis: Current Directions and Applications*, AMS Fall Southeastern Section Meeting, October 13-14, **2012**, Tulane University, New Orleans, Louisiana.

  - *Lévy models and scale invariance properties applied to Geophysics*, The 4th Annual Modeling High Frequency Data in Finance Conference, July 19-22, **2012**, Stevens Institute of Technology, Hoboken, New Jersey, *invited talk*.

  - *Hyper-spherical harmonics and jumps in financial markets*, Special Session on *Analysis and Simulations of Nonlinear Systems*, The 9th AIMS Conference on Dynamical Systems, Differential Equations and Applications, July 1-5, **2012**, Orlando, Florida.

  - *PDE model in option pricing of financial market*, 35th Annual Texas Partial Differential Equations Conference, March 3-4, **2012**, Texas A&M University, College Station, Texas.

  - *Option pricing problems in financial market*, January 23, **2012**, Department of Mathematical Sciences, University of Cincinnati, Cincinnati, Ohio, *invited talk at colloquium*.

  - *Financial models used in biology*, AMS Special Session on *Nonlinear Analysis of Partial Differential Equation Models in Biology and Chemical Physics*, Joint Mathematics Meetings 2012, January 4-7, **2012**, Boston, Massachusetts.

- *Existence of solutions for financial models with transaction costs and stochastic volatility*, AMS Special Session on *Theory and Applications of Stochastic Differential and Partial Differential Equations*, Joint Mathematics Meetings 2012, January 4-7, **2012**, Boston, Massachusetts.

- **2011:**

  - *Concentration problems for bandpass filters in communication theory*, December 1, **2011**, Department of Mathematics, North Dakota State University, Fargo, North Dakota, *invited talk at colloquium*.

  - *Weak solutions to a nonlinear Black-Scholes equation*, Conference: Modeling High Frequency Data in Finance 3, July 28-31, **2011**, Stevens Institute of Technology, Hoboken, New Jersey, *invited talk*.

  - *Solutions to gradient-dependent parabolic problems arising in Lévy market*, 7th International Congress on Industrial and Applied Mathematics (ICIAM 2011), July 18-22, **2011**, Vancouver, Canada.

  - *Band pass concentration problems and a generalization of prolate spheroidal functions*, May 30, **2011**, Physics and Applied Mathematics Unit, Indian Statistical Institute, Kolkata, India, *invited talk at colloquium*.

  - *Band pass concentration problems in communication theory*, May 27, **2011**, Department of Applied Mathematics, University of Calcutta, Kolkata, India, *invited talk at colloquium*.

  - *Option pricing with transaction costs and stochastic volatility in a financial market*, May 23, **2011**, Economic Research Unit, Indian Statistical Institute, Kolkata, India, *invited talk at colloquium*.

  - *Weak solutions to integro-differential parabolic problems in financial market*, May 20, **2011**, Department of Mathematics, Tianjin University of Technology and Education, Tianjin, China, *invited talk at colloquium*.

  - *Solutions to integro-differential parabolic problems arising in the Lévy market*, The Fifth International Conference on Recent Advances in Applied Dynamical Systems, May 16-18, **2011**, Shanghai Normal University, Shanghai, China.

  - *Existence of weak solution to an integro-differential parabolic problem in a Lévy Market*, May 13, **2011**, Department of Mathematics, Beijing Jiaotong University, Beijing, China, *invited talk at colloquium*.

  - *Nonlinear PDE analysis for financial model with transaction costs and stochastic volatility*, May 13, **2011**, School of Mathematics and Systems Science, Beihang University, Beijing, China, *invited talk at colloquium*.

  - *Analysis of integro-differential parabolic problems arising in the Lévy Market*, The 9th Joint UTEP/NMSU Workshop on Mathematics, Computer Science, and Computational Sciences, April 2, **2011**, New Mexico State University, Las Cruces, New Mexico.

  - *Option pricing with transaction costs and stochastic volatility*, March 28, **2011**, Department of Mathematical Sciences, Stevens Institute of Technology, Hoboken, New Jersey, *invited talk at colloquium*.

- **2004-2010:**

  - *Concentration problems in communication theory over disjoint frequency intervals*, Mathematics, Analysis and Control in Chemical Physics and Related Systems, December 14-17, **2010**, University of Nevada, Las Vegas, Nevada.

  - *Spherical harmonics approach to mathematical finance*, The 8th Joint UTEP/NMSU Workshop on Mathematics, Computer Science, and Computational Sciences, November 13, **2010**, University of Texas- El Paso, El Paso, Texas.

  - *Generalization of superradiance integral equation and applications*, Special Session on *Nonlinear Systems of Mixed Type and Applications*, The 8th American Institute of Mathematical Sciences (AIMS) Conference on Dynamical Systems, Differential Equations and Applications, May 25-28, **2010**, Dresden University of Technology, Dresden, Germany.

- *Differential operator related to the three-dimensional superradiance integral equation*, NSF/CBMS Regional Conference in the Mathematical Sciences: Nonlinear water waves with applications to wave-current interactions and Tsunamis, May 17-21, **2010**, University of Texas- Pan American, Edinburg, Texas.

- *Electrodynamics, Maxwell's Equations and Special Relativity*, Graduate student organization seminar, October 29, **2009**, Texas A&M University, College Station, Texas.

- *Spectral analysis of the three dimensional Dicke superradiance problem*, Special Session on *Mathematical Aspects of Spectral Problems Related to Physics*, AMS Sectional Meeting, October 16-18, **2009**, Baylor University, Waco, Texas.

- *On some differential operators commuting with integral operators related to the superradiance Problem*, Texas PDE Conference, March 28-29, **2009**, Texas State University, San Marcos, Texas.

- *Some properties of Mittag-Leffler functions*, Applied Mathematics Seminar, September 28, **2005**, University of Texas- Pan American, Edinburg, Texas.

- *Fractals and fractal geometry*, HESTEC Science Symposium, September 26, **2005**, University of Texas- Pan American, Edinburg, Texas.

- *On derivatives and integrals of fractional order with applications*, HESTEC Science Symposium, September 24, **2004**, University of Texas- Pan American, Edinburg, Texas.

TEACHING
EXPERIENCE Department of Mathematics and Statistics, Florida International University
Instructor, Fall 2023- present.
- *Instructor- regular class*:
    - Differential Equations (undergraduate level),
    - Risk Analysis and Management I (graduate level),
    - PDE in Risk Analysis and Management (graduate level).
- *Graduate reading courses*:
    - Brownian Motion,
    - Risk Analysis and Management II,
    - Financial Investmnt & Data Analysis.
- *Undergraduate reading courses*:
    - Weather Derivatives.

Department of Mathematics, North Dakota State University
Instructor, Fall 2012- Spring 2023.
- *Instructor- regular class*[2]:
    - Calculus-I (undergraduate level, large lecture class with 160+ students),
    - Calculus- II (undergraduate level, large lecture class with 160+ students),
    - Calculus- III (undergraduate level),
    - Introduction to Differential Equations (undergraduate level),
    - Intermediate Linear Algebra (undergraduate level),
    - Special Problems in Mathematics (undergraduate level),
    - Actuarial Exam Study (undergraduate level),
    - Advanced Actuarial Exam Study (senior undergraduate level),
    - Mathematical Software- Python (senior undergraduate/graduate level),
    - Topics in Linear Algebra (senior undergraduate/graduate level),
    - Complex Analysis (senior undergraduate/graduate level),

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[2]Some courses are offered more than once.

- Applied Differential Equations (senior undergraduate/graduate level),
- Partial Differential Equations (senior undergraduate/graduate level),
- Fourier Analysis (senior undergraduate/graduate level),
- Numerical Analysis- I (senior undergraduate/graduate level),
- Numerical Analysis- II (senior undergraduate/graduate level),
- Mathematical Methods in Physics- II (graduate level),
- Ordinary Differential Equations- I (graduate level),
- Partial Differential Equations- I (graduate level),
- Modern Probability Theory (graduate level),
- Topics in Applied Mathematics: Mathematical Stochastic Process (graduate level),
- Topics in Applied Mathematics: Probability Theory in Finance (graduate level),
- Topics in Applied Mathematics: Introduction to Machine Learning (graduate level),
- Deep Learning and Neural Networks (graduate level).

- *Instructor- North Dakota Governor's School* (Summer 2018 and 2019):
  - Game Theory.

- *Graduate reading courses*[2]:
  - Stochastic Differential Equations I,
  - Stochastic Differential Equations II,
  - Topics in Mathematical Finance,
  - Lévy Processes in Finance,
  - Stochastic Processes,
  - Financial Modeling using Lévy Processes,
  - Brownian Motion Calculus,
  - Stochastic Differential Equations,
  - Introduction to Financial Mathematics,
  - Machine Learning Algorithms,
  - Topics in Ordinary Differential Equations.
  - Mathematical Data Science.

- *Undergraduate reading courses*[2]:
  - Introduction to Financial Mathematics,
  - Stochastic Calculus,
  - Stochastic Calculus- II.

Department of Mathematical Sciences, University of Texas- El Paso
Instructor, Spring 2011- Spring 2012.
- *Instructor*: Applied Analysis I, Applied Analysis II, Mathematics for the Social Sciences I, Mathematics for the Social Sciences II.
- *Undergraduate reading course*: Individual Studies in Mathematics.

Department of Mathematics, Texas A&M University, College Station
Graduate Teaching Assistant, Fall 2006 - Summer 2010.
- *Instructor*: Mathematical Concepts -Calculus
- *Recitation TA*: – Calculus I, Calculus II.
- *Assistant for Online graduate level courses*: Mathematical Communication and Technology, Seminar in Geometry, History of Mathematics.
- *Grader – (Graduate level)*: Analysis for Applications, Differential Geometry, Methods of Applied Mathematics, Methods and Applications of Partial Differential Equations.
- *Grader – (Undergraduate level)*: Engineering Mathematics, Topics in Applied Mathematics.

Department of Mathematics, University of Texas- Rio Grande Valley
Graduate Teaching Assistant, Fall 2004- Spring 2006.
- *Instructor*: Intermediate Algebra, Elementary Algebra.

Department of Mathematics and Statistics, Florida International University (FIU)
- **Current postdoc**:
    1. Dr. Giancarlo Sanchez, Department of Mathematics and Statistics, FIU. 2023-2024.
- **Current graduate students**:
    1. *M.S. advisor*: Taylor Houtz, Mathematics and Statistics, FIU. Research supervision: Summer 2023- present.
    2. *M.S. advisor*: Adam Diaz, Mathematics and Statistics, FIU. Research supervision: Fall 2023- present.
- **Undergraduate**:
    1. Robert Lopez (Project: Predicting Rainfall in Florida Through Machine Learning and Neural Networks), Fall 2023.
    2. Jason Carranza (Project: Different aspects of weather derivatives), Spring 2024.
    3. Jorge Rodriguez-Anton (Project: Pricing weather derivatives), Spring 2024.

Department of Mathematics, North Dakota State University (NDSU)
- **Current graduate students**:
    1. *Ph.D. advisor*: Minglian Lin, Mathematics, NDSU. Research supervision: Fall 2019-present.
- **Previous Ph.D. students**:
    1. Semere Habtemicael (other last name used: Gebresilasie), Ph.D., December **2015**, Mathematics, NDSU.
    Dissertation Title: Modeling financial swaps and geophysical data using the Barndorff-Nielsen and Shephard model.
    First Job Placement: **Research Fellow at the Ragon Institute of MGH, MIT and Harvard, and Harvard Medical School**.

    2. Aziz Issaka, Ph.D., May **2018**, Mathematics, NDSU.
    Dissertation Title: Analysis of variance based financial instruments and transition probability densities: swaps, price indices, and asymptotic expansions.
    First Job Placement: **Assistant Professor (tenure-track) at the Department of Mathematics and Statistics, University of North Carolina at Charlotte**.

    3. Michael Roberts, Ph.D., August **2021**, Mathematics, NDSU.
    Dissertation Title: Hypothesis testing on time series driven by underlying Lévy processes, with machine learning applications.
    First Job Placement: **Visiting Assistant Professor at the Department of Mathematics and Statistics, Wake Forest University**.

    4. Shantanu Awasthi, Ph.D., December **2021**, Mathematics, NDSU.
    Dissertation Title: The first exit-time analysis of an approximate Barndorff-Nielsen and Shephard model, with data science-based applications in the commodity market.
    First Job Placement: **Data Scientist, at Medallia INC**.

    5. Humayra Shoshi, Ph.D., August **2022**, Mathematics, NDSU.
    Dissertation Title: Data-science-driven refinements of stochastic models with applications in oil data, short maturity Asian options, and yield prediction.
    First Job Placement: **Assistant Vice President of Credit & Obligor Risk Analytics, at Citi**.

    6. Nicholas Salmon, Ph.D., December **2022**, Mathematics, NDSU.
    Dissertation Title: Financial analysis with the fractional Barndorff-Nielsen and Shepherd model and hypergraphs: applications in swaps, hedging, classification,

and clustering.
First Job Placement: **Associate Data Scientist, at Experience IT**.

- **Previous M.S. student**:
  1. Austin Uden, M.S., May **2022**, Mathematics, NDSU.
     Thesis Title: Stochastic processes, and development of the Barndorff-Nielsen and Shephard model for financial markets.
     First Job Placement: High school Math teacher at Lincoln High School. Also, continuation of education in the Initial Certification at the Advanced Level at Doane University.

- **Visiting Ph.D. student supervision**:
  - Xianfei Hui (School of Management, Harbin Institution of Technology, China), Visiting Ph.D. student supported by China Scholarship Council. (January 2020- December 2020).

- **Graduate supervisory committee**:
  - *Ph.D. supervisory committee member*:
    1. Pratyush Mishra, *Mathematics*, NDSU, graduated: 2023.
    2. Kwame Asiam Addey, *Statistics*, NDSU, graduated 2022.
    3. Eric Sarfo Amponsah, *Mathematics*, NDSU, graduated 2020.
    4. Anirban Ghosh, *Electrical & Computer Engineering*, NDSU, graduated 2018.
    5. Guilherme Volpe Bossa, *Physics*, NDSU, graduated 2017.
  - *External examiner[3],[4]*:
    * *Ph.D. dissertation*: Milan Kumar Das, *Mathematics*, Indian Institutes of Science Education and Research (IISER) Pune, India, graduated 2019.
    * *Master's thesis*: Aakaash K. Gupta, *Statistics*, Indian Statistical Institute, Kolkata, India, graduated: 2021.
    * *Master's thesis*: Pavuluri Sushhma Seshu, *Mathematics*, Indian Institute of Science Education and Research (IISER) Tirupati, India, graduated: 2022.
    * *Master's thesis*: Siddhesh Sundar, *Mathematics*, Indian Institute of Science Education and Research (IISER) Pune, India, graduated: 2023.
  - *Master's supervisory committee member*:
    1. Shane Specht, *Software Engineering*, NDSU, graduated: 2023.
    2. Ogunjemilua Oluwafemi, *Agribusiness and Applied Economics*, NDSU, graduated: 2023.
    3. Kimia Zaman, *Computer Science*, NDSU, graduated: 2023.
    4. Bismark Asante, *Agribusiness and Applied Economics*, NDSU, graduated: 2023.
    5. Noah Carlson, *Agribusiness and Applied Economics*, NDSU, graduated 2021.
    6. Caleb Larson, *Mathematics*, NDSU, graduated 2018.
    7. Eric Kubischta, *Electrical & Computer Engineering*, NDSU, graduated 2018.
    8. Noopur Modi, *Electrical & Computer Engineering*, NDSU, graduated 2015.
    9. Peter Martin, *Statistics*, NDSU, graduated 2015.
    10. Mohammad Kamal Hossan, *Electrical & Computer Engineering*, NDSU, graduated 2014.

- **Undergraduate**:
  - **Senior Capstone project mentoring**:
    1. Zak Merrigan: *A data-science based analysis of financial market*, Spring 2023.
    2. Dylan Zapzalka: *Uncovering the mathematics behind neural networks*, Fall 2021.

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[3]The external examiner plays an important role in all degree level examinations in higher education in various countries such as India and UK. One of the purposes of having and external examiner is to ensure that standards are kept the same across universities.

[4]This is an outreach activity.

3. Vincent Casey: *Application of fractal measurements to economic models*, Fall 2021.
4. Alexander Wilcox: *Machine learning and statistical analysis of the S&P 500 index*, Fall 2020.
5. Raymond Hathaway: *Classification problems in machine learning*, Spring 2020.
6. Chase Anderson: *Game theory*, Spring 2020.
7. Callahan Stewart: *Stochastic gradient descent in machine learning*, Spring 2020.
8. Frankie Halter: *Mathematics of deep neural networks*, Fall 2019.
9. Jaxon Helland: *Mathematical finance: arbitrage, options, and Black-Scholes equation*, Fall 2019.
10. Dylan Vukelich: *Introduction to quantitative finance*, Spring 2019.
11. Sean Gunderson: *Tensor analysis with an application in modern cosmology*, Spring 2019.
12. Kristopher Heinle-Bodvig: *Feynman path integral with applications in finance*, Fall 2018.
13. Aditya Sinha: *Brownian motion with applications*, Spring 2018.
14. Ayushi Saxena: *Modeling gasoline prices using stochastic calculus*, Fall 2017.
15. Vijay Shah: *Hilbert spaces and their applications*, Spring 2017.
16. Eric Kubischta: *Prolate spheroidal wave Functions in communication theory*, Fall 2016.
17. Christopher Thibert: *Bounded variation and jump functions*, Spring 2016.
18. Elizabeth Varberg: *The Mathematics of Financial Investments*, Spring 2016.
19. Alex Koppy: *Special Relativity and Lorentz transformations*, Fall 2015.
20. Angela Cox: *Instruments in financial mathematics*, Spring 2015.
21. Robert Suppa: *Asset modeling and portfolio management*, Spring 2015.
22. Samantha Lamwers: *Self-similarities in finance*, Fall 2014.
23. Matthew Tucholke: *Volatilities in finance*, Fall 2014.
24. Jessica Zent: *Brownian motion calculus and finance*, Spring 2014.
25. Aaron Driessen: *Delta hedging strategies*, Spring 2013.
26. Kristopher Hudson: *Numerical methods to solve Schrödinger's equation*, Spring 2013.
27. John Lynch: *Tensor analysis and modern cosmology*, Spring 2013.

- **Reading course projects (undergraduate)**:
  - Ayushi Saxena (Fall 2016, Spring 2017), Nicholas Weis (Summer 2015), Robert Suppa (Spring 2014), Scott Haws and Jessica Zent (Fall 2013).

- **Mentorship for summer REU program**[5]:
  - Topic: *Artificial intelligence based improvement of stochastic models.*
  - Students: (1) Shubham Ekapure (*Major*: Mechanical Engineering, *Year of study*: 3), (2) Nuruddin Jiruwala (*Major*: Electrical Engineering, *Year of study*: 3), (3) Sohan Patnaik (*Major*: Mechanical Engineering, *Year of study*: 2).
  - Institute: Undergraduate students from *Indian Institute of Technology (IIT), Kharagpur, India.*
  - Duration: 3 months, Summer 2021.

Department of Mathematical Sciences, University of Texas- El Paso
- **Undergraduate reading course projects**: Senior level undergraduate Applied Mathematics major students: Sandra J. Cuevas and Julio H. Solis (Summer 2012), George M. Pineda (Spring 2012), Kate A. Lopez and Jaime J. Padilla (Summer 2011).

SELECTED DIVERSITY ACTIVITIES

- Mentor for the National Alliance for Doctoral Studies in the Mathematical Sciences ("Math Alliance"), *June 2020- present.*

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[5]This is an outreach activity.

- Student-presentation reviewer: SACNAS (Society for the Advancement of Chicanos/Hispanics and Native Americans in Science) 2020- The National Diversity in STEM Conference, 2020, Virtual Conference.
- Judge for SACNAS -The National Diversity in STEM Conference, student poster and oral presentations, October 19-24, 2020, Virtual Conference.
- College of Science and Mathematics representative of NDSU Faculty Senate Diversity, Equity, Inclusion Committee, (Spring 2021-Spring 2023).
- Executive Committee member for the NDSU President's Council for Diversity, Inclusion and Respect (PCDIR), (Fall 2021-Spring 2023).

SELECTED
PROFESSIONAL
DEVELOPMENTS
- Participant in NDSU Gateways-ND Cohort III program (2017-2019) to improve teaching effectiveness. Program consists of two-day trainings in January, May, and August, peer review of teaching, and participation in Faculty Learning Communities, which occur approximately 5 to 6 times a semester.
- Speaker in Science Café on Nov 14, 2017, College of Science and Mathematics, NDSU.
- Participated in multiple peer review of teaching at NDSU. Participated in NDSU Formative track and Summative track peer-review of teaching program.
- Attended more than 10 Faculty Luncheons/Pedagogical Luncheons[6] during the last 6 years.
- Attended NDSU Teaching and Learning Conference: "Best Teaching Practices for Enhanced Learning", August 20, 2014.

SELECTED
DATA-SCIENCE
RELATED
ACTIVITIES [7]
- PI for the grant "Refinement of stochastic processes via machine/deep learning" [Collaboration Grants for Mathematicians, Simons Foundation, 2021-2026.]
- Data science industry talk: *Data science, finance, and risk management: a tour*, November 3, **2021**, Industry talk at Medallia, INC. *invited talk.*
- Participant in Statistical and Applied Mathematical Sciences Institute (SAMSI)[8] semester-long program on *Data Science in the Social and Behavioral Sciences*, Spring 2021 [online].
- Participant in Statistical and Applied Mathematical Sciences Institute (SAMSI) semester-long program on *Deep Learning*, Fall 2019 [in-person].
- Working group member for *Uncertainty Quantification for Deep Models*, SAMSI, Fall 2019.
- Instructor for several data-science related courses at NDSU including: (1) Deep Learning and Neural Networks (Fall 2019), (2) Mathematical Software- Python (Fall 2019), (3) Introduction to Machine Learning (Spring 2019), (4) Machine Learning Algorithms (Spring 2018).

PROFESSIONAL
SERVICES
- **Associate Editor in the area of *finance and risk management***:
Journal of Modelling in Management, February 2015- present.

- **Associate Editor of *mathematical finance* section**:
Frontiers in Applied Mathematics and Statistics, March 2021-present.

- **Associate Editor-in-Chief**:
Mathematics, August 2014- August 2019.

- **Review Editor of *mathematical finance* section**:
Frontiers in Applied Mathematics and Statistics, March 2020-March 2021.

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[6]Faculty Luncheon/ Pedagogical Luncheon is co-sponsored by the Office of the Provost/Vice President for Academic Affairs, NDSU and NDSU FORWARD. This program is dedicated to various aspects of polishing and improving teaching skill.

[7]This does not include mentoring students related to data-science projects, or publications related to data-science.

[8]SAMSI is a partnership of Duke University, North Carolina State University (NCSU), and the University of North Carolina at Chapel Hill (UNC). SAMSI is part of the Mathematical Sciences Institutes program of the DMS at the NSF.

- **Other Editorial Board membership**:
  - *Stochastic Analysis and Applications*, (February 2020-present).
  - *International Journal of Financial Studies*, (February 2016-present).
  - *Stats*, (August 2017-present).
  - *International Journal of Mathematical Physics*, (May 2018-present).
  - *Global Journals*, (August 2017-present).

- **Faculty advisor of American Mathematical Society Student Chapter**: Mathematics graduate student group, NDSU, December 2017- Summer 2023. Web: `http://www.ams.org/programs/studentchapters`

- **Advisory board member of Preprints**, Web: `http://www.preprints.org`, a platform for hosting working papers, January 2017- present.

- **Instructor for North Dakota Governor's School**, Summer 2018 and Summer 2019.

- **Committee Chair at North Dakota State University**:
  - Mathematics Graduate Recruitment Chair (**Graduate Program Director**), July 2015- August 2023.
  - Department of Mathematics Graduate Committee Chair July 2015- August 2023.

- **Committee Member at North Dakota State University**:
  - University Committee:
    * College representative for NDSU Faculty Senate Research and Consulting Committee (2023).
    * College representative for NDSU Faculty Senate Diversity, Equity, Inclusion Committee, (Spring 2021-Summer 2023).
    * Executive Committee member for the NDSU President's Council for Diversity, Inclusion and Respect (PCDIR), (2021-2013).
    * University Curriculum Committee, College of Science and Mathematics representative (alternate), (Fall 2020-Summer 2023).
    * Campus Space and Facilities committee, (Fall 2020-Summer 2023).
    * College representative for Academic Integrity Faculty Senate Committee, (Summer 2019-Fall 2020).
    * Records Management Advisory Committee, (Fall 2018-Summer 2023).
    * Reviewer for Doctoral Dissertation Fellowships, 2020-2021.
  - College of Science and Mathematics Committee:
    * Professional Science Master's (PSM) Steering Committee, (Spring 2013- Spring 2014).
  - Department of Mathematics Committee:
    * Visitors Committee (Spring 2016-Summer 2023).
    * Social Media liaison (Spring 2016- Summer 2023).
    * Graduate Committee (Fall 2014- present).
    * Applied Mathematics Preliminary Examination Committee (2013-2023).
    * Graduate Program Working Group (2013-2014).
    * External Competitive Exams (include Putnam Exam, NCS/MAA team exam etc) Committee 2013-2014.
    * North Dakota Mathematics Talent Search Committee 2012-2013.

- **Organizer**:
  - **Conference**: Statistical Methods in Finance 2023, December 19- December 23, 2023.
  - **Conference**: Statistical Methods in Finance 2022, June 28- July 2, 2022, [on virtual platform].

- **Conference**: Statistical Methods in Finance 2021, June 27- July 1, 2021, [on virtual platform].
  - **Conference**: Statistical Methods in Finance 2019, December 16-21, 2019, Chennai Mathematical Institute, Chennai, India.
  - **Conference**: Statistical Methods in Finance 2018, December 17-20, 2018, Chennai Mathematical Institute, Chennai, India.
  - **Conference**: Statistical Methods in Finance 2017, December 16-19, 2017, Chennai Mathematical Institute, Chennai, India.
  - **Mini-conference**: Midwest mini-conference on stochastic processes and mathematical finance, April 8, 2017, North Dakota State University, Fargo, North Dakota.
  - **Conference**: Statistical Methods in Finance 2016, December 18-22, 2016, Chennai Mathematical Institute, Chennai, India.
  - Special Session on *Mathematical Finance*, AMS Sectional Meeting, April 16-17, 2016, North Dakota State University, Fargo, North Dakota.
  - Special Session on *Mathematical Finance*, AMS Sectional Meeting, April 5-6, 2014, University of New Mexico, Albuquerque, New Mexico.
  - Organizer of the Applied Mathematics Seminar, NDSU (every spring, started on Spring 2014).
  - **Conference**: 36th Annual Texas Partial Differential Equations Conference, March 2-3, 2013, El Paso, Texas.
- **Conference Co-chair**:
  - The Second International Conference on Physics, Mathematics and Statistics (ICPMS2019), May 22-24, 2019, Hangzhou, China.
- **Technical Committee Member**:
  - Intelligent Systems Conference (IntelliSys) 2023, August 24-25, 2023, Amsterdam, Netherlands.
  - Computing Conference 2023, June 22-23, 2023, London, United Kingdom.
  - 4th Annual 2016 International Conference on Geo-Informatics in Resource Management & Sustainable Ecosystem [GRMSE-2016], November 18-20, 2016, Hong Kong, China.
  - 8th Annual International Conference on Qualitative and Quantitative Economics Research (QQE 2018), June 11-12, 2018, Singapore.
  - 7th Annual International Conference on Qualitative and Quantitative Economics Research (QQE 2017), June 5-6, 2017, Singapore.
  - 6th Annual International Conference on Qualitative and Quantitative Economics Research (QQE 2016), May 30-31, 2016, Singapore.
  - 5th Annual International Conference on Qualitative and Quantitative Economics Research (QQE 2015), May 18-19, 2015, Singapore.
  - 4th Annual International Conference on Qualitative and Quantitative Economics Research (QQE 2014), April 28-29, 2014, Phuket, Thailand.
  - 3rd Annual International Conference on Qualitative and Quantitative Economics Research (QQE 2013), May 20-21, 2013, Bangkok, Thailand.
  - Annual International Conference on Qualitative and Quantitative Economics Research (QQE 2011), May 23-24, 2011, Singapore.

- **Judge for poster sessions and oral presentations**:
  - National:
    * Judge for SACNAS -The National Diversity in STEM Conference, student poster and oral presentations, October 19-24, 2020, *Virtual Conference*.
    * Judge for Mathematical Association of America (MAA) Undergraduate Student Poster Session, Joint Mathematics Meetings, 2020, Denver, Colorado.

- ∗ Judge for Mathematical Association of America (MAA) Undergraduate Student Poster Session, Joint Mathematics Meetings, 2019, Baltimore, Maryland.
      - ∗ Judge for Mathematical Association of America (MAA) Undergraduate Student Poster Session, Joint Mathematics Meetings, 2018, San Diego, California.
    - Local:
      - ∗ Judge for 5th Annual Graduate Student Council Research Symposium, NDSU, April 8, 2021.
      - ∗ Judge for North Dakota State Science & Engineering Fair, student poster and oral presentations, March 25-26, 2021, *Virtual Conference*.
- **Proposal Reviewer**:
  - Ad Hoc Reviewer for NSF proposal, 2023-2024.
  - Reviewer for **two** NSF Panels. 2021-2022.
  - Reviewer for **one** NSF EPSCoR program, 2020.

- **Journal Reviewer**: (1) *AMS Mathematical Reviews*, (2)*Mathematical Finance*, (3) *SIAM Journal on Financial Mathematics*, (4) *Annals of Finance*, (5) *Applied Mathematical Finance*, (6) *Quantitative Finance*, (7) *International Journal of Theoretical and Applied Finance*, (8) *Journal of Differential Equations*, (9) *International Review of Economics and Finance*, (10) *Finance Research Letters*, (11) *Journal of Mathematical Analysis and Applications*, (12) *Discrete and Continuous Dynamical System - A*, (13) *International Journal of Computer Mathematics*, (14) *Computers and Mathematics with Applications*, (15) *British Journal of Mathematics & Computer Science*, (16) *Physica A: Statistical Mechanics and its Applications*, (17) *Hacettepe Journal of Mathematics and Statistics*, (18) *International Journal of Applied and Computational Mathematics*, (19) *Chaos: An Interdisciplinary Journal of Nonlinear Science*, (20) *Open Journal of Finance*, (21) *Journal of Modelling in Management*, (22) *International Journal of Financial Studies*, (23) *Canadian Journal of Physics*, (24) *Applied Stochastic Models in Business and Industry*, (25) *Pacific Science Review A: Natural Science and Engineering*, (26) *Lithuanian Mathematical Journal*, (27) *Sustainability*, (28) *Risks - Open Access Risk Management Journal*, (29) *Energy Efficiency*, (30) *Advances in Nonlinear Analysis*, (31) *Japan Journal of Industrial and Applied Mathematics*, (32) *Differential Equations and Dynamical Systems*, (33) *Journal of Stochastic Analysis* (formerly, *Communications on Stochastic Analysis*), (34) *IEEE Internet of Things Journal*, (35) *Mathematics and Computers in Simulation*, (36) *The Canadian Journal of Statistics*, (37) *Mathematical modelling of natural phenomena*, (38) *Fractals*, (39) *Communications in Nonlinear Science and Numerical Simulation*, (40) *Journal of Behavioral and Experimental Finance*, (41) *Financial Innovation*, (42) *Czech Journal of Economics and Finance*, (43) *Journal of Geometric Analysis*, (44) *Journal of Statistical Computation and Simulation*, (45) *Algorithmic Finance*, (46) *SIAM Journal on Applied Mathematics*.

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AFFILIATIONS
- Member of *American Mathematical Society* (AMS), 2006-present.
- Member of *Institute for Operations Research and the Management Sciences* (INFORMS), 2017-2018.
- Member of *Society for Industrial and Applied Mathematics* (SIAM), 2010- 2015.
- FORWARD Ally, North Dakota State University, 2012-2023.
- Member of Dimensional-Scaling club, Texas A&M University (A club founded and mentored by Prof. Dudley R. Herschbach - *Nobel laureate in Chemistry,* 1986), 2008-2010.
- Member of Texas A&M University Chapter of Sigma Xi (a scientific research society for science and engineering), 2007-2010.