

Yutian LI

Assistant Professor

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Chinese University of Hong Kong, Shenzhen
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Research Objectives

Analysis and Applications: asymptotic analysis, special functions, Painlevé transcendents

Partial Differential Equations: subelliptic operators, degenerate parabolic equations, mathematical ecology

Scientific Computing: computational electromagnetics, fractional PDEs

Mathematical Finance: option pricing, computational finance

Education

2007 – 2010 **Ph.D. in Mathematics**, *City University of Hong Kong*, Thesis: Hamilton–Jacobi Theory and Heat Kernels for Grushin Operators, Advisors: Roderick S.C. Wong & Peter C. Greiner

2005 – 2007 **M.Phil. in Mathematics**, *City University of Hong Kong*, Thesis: On a Class of Grushin Operators, Advisors: Roderick S.C. Wong & Peter C. Greiner

2001 – 2005 **B.Sc. in Mathematics**, *Jilin University*, Changchun, China

Work Experience

2017 – **Assistant Professor**, *Chinese University of Hong Kong, Shenzhen*
Present

2012 – 2017 **Research Assistant Professor**, *Hong Kong Baptist University*

2010 – 2012 **PostDoc Fellow**, *City University of Hong Kong*

Publications

A * indicates the corresponding author

IF stands for impact factor in JCR2022

Papers [1–16] are published after joining CUHK-Shenzhen.

- [1] W.-G. Long, Y.-T. Li*, and Q.-h. Wang, Connection problem of the first Painlevé transcendent between poles and negative infinity, *SIAM Journal on Mathematical Analysis*, accepted (2023), 32 pages. (Corresponding author, IF: 2.0)
- [2] Y. Zhang and Y. Li*, Dynamics of a Leslie-Gower predator-prey model with advection and free boundaries, *Discrete and Continuous Dynamical Systems, Series B*, published online, doi: 10.3934/dcdsb.2023097, 32 pages. (Corresponding author, IF: 1.2)
- [3] X. Wen, H. Song, R. Zhang, and Y. Li*, Primal-dual active-set method for the valuation of American exchange options, *East Asian Journal on Applied Mathematics*, published online (2023), doi: 10.4208/eajam.2022-227.221222, 29 pages. (Corresponding author, IF: 1.2)
- [4] W.-G. Long and Y.-T. Li*, Connection problem of the first Painlevé transcendents with large initial data, *Journal of Physics A: Mathematical and General*, **56** (2023), article id: 175201, 20pages. (Corresponding author, IF: 2.1)
- [5] H. Song, J. Xu, J. Yang and Y. Li*, Projection and Contraction Method for the Valuation of American options under regime switching, *Communications in Nonlinear Science and Numerical Simulation*, **109** (2022), article id: 106332, 16pages. (Corresponding author, IF: 3.9)
- [6] X. Guo, Y. Li*, and T. Zeng, A finite difference scheme for Caputo-Fabrizio fractional differential equations, *International Journal of Numerical Analysis and Modeling*, **17** no. 2 (2020), 195–211. (Corresponding author, IF: 1.1)
- [7] Y.-T. Li, X.-S. Wang*, and R. Wong, Asymptotics of the Wilson polynomials, *Analysis and Applications*, **18** (2020), 237–270. (IF: 2.2)
- [8] W.-G. Long, D. Dai, Y.-T. Li*, and X.-S. Wang, Asymptotics of orthogonal polynomials with asymptotic Freud-like weights, *Studies in Applied Mathematics*, **144** no. 2 (2020), 133–163. (Corresponding author, IF: 2.7)
- [9] L.-H. Cao, Y.-T. Li*, and Y. Lin, Asymptotic approximations of the continuous Hahn polynomials, *Journal of Approximation Theory*, **247** (2019) 32–47. (Corresponding author, IF: 0.9)
- [10] L. Chen, Y. Li, and T. Zeng*, Variational image restoration and segmentation with Rician noise, *Journal of Scientific Computing*, **78** (2019) 1329–1352. (IF: 2.5)
- [11] X. Guo*, Y. Li, and H. Wang, A high order finite difference method for tempered fractional diffusion equations with applications to the CGMY model, *SIAM Journal on Scientific Computing*, **40** (2018), A3322–A3343. (IF: 3.1)

- [12] X. Guo, Y. Li*, and H. Wang, Tempered fractional diffusion equations for pricing multi-asset options under CGMY process, *Computers and Mathematics with Applications*, **76** (2018), 1500–1514. (Corresponding author, IF: 2.9)
- [13] X. Guo, Y. Li*, and H. Wang, A fourth-order scheme for space fractional diffusion equations, *Journal of Computational Physics*, **373** (2018), 410–424. (Corresponding author, IF: 4.1)
- [14] X. Guo, Y. Li*, and H. Wang, A fast finite difference method for tempered fractional diffusion equations, *Communications in Computational Physics*, **24** no. 2 (2018), 531–556. (Corresponding author, IF: 3.7)
- [15] S. Ji, J. Yin*, and Y. Li, Positive periodic solutions of the weighted p -Laplacian with nonlinear sources, *Discrete and Continuous Dynamical Systems*, **38** (2018), 2411–2439. (IF: 1.1)
- [16] P. Greiner and Y. Li*, A fundamental solution of a nonelliptic operator, II, *Analysis and Applications*, **16** (2018), 407–433. (Corresponding author, IF: 2.2)
- [17] H. Song, K. Zhang*, and Y. Li*, Finite element and discontinuous Galerkin methods with perfect matched layers for American options, *Numerical Mathematics: Theory, Methods and Applications*, **10** (2017), 829–851. (Corresponding author, IF: 1.3)
- [18] W.-G. Long, Y.-T. Li, S.-Y. Liu, and Y.-Q. Zhao*, Real solutions of the first Painlevé equation with large initial data, *Studies in Applied Mathematics*, **139** (2017), 505–532. (IF: 2.7)
- [19] S. Ji, Y. Li, R. Huang, and J. Yin*, Singular periodic solutions for the p -Laplacian in a punctured domain, *Comm. Pure Appl. Anal.*, **16** (2017), 373–392. (IF: 1.0)
- [20] J. Zhu* and Y. Li, A new approach of eigenmodes for varying refractive-index profile's waveguides, *IEEE Transactions on Microwave Theory and Techniques*, **64** (2016), 3131–3138. (IF: 4.3)
- [21] X. Guo and Y. Li*, Valuation of American options under the CGMY model, *Quantitative Finance*, **16** (2016), 1529–1540. (Corresponding author, IF: 1.3)
- [22] Y. Li and J. Zhu*, Efficient approximations of dispersion relations in optical waveguides with varying refractive-index profiles, *Optics Express*, **23** (2015), 11952–11964. (IF: 3.8)
- [23] D.-C. Chang and Y. Li*, Small time asymptotics of the heat kernels for the Heisenberg subLaplacian and step two Grushin operator, *Proceedings of the Royal Society A*, **471** (2015), article no.: 20140943. 19 pages. (Corresponding author, IF: 3.5)

- [24] Y. Li, S. Liu, S. Xu, and Y. Zhao*. Asymptotics of Landau constants with optimal error bounds, *Constructive Approximation*, **40** (2014), 281–305. (IF: 2.7)
- [25] L.-H. Cao and Y.-T. Li*: Linear difference equations with a transition point at the origin, *Analysis and Applications*, **12** (2014), 75–106. (Corresponding author, IF: 2.2)
- [26] Y.T. Li* and R. Wong. Global asymptotics for Stieltjes–Wigert polynomials, *Analysis and Applications*, **11** (2013), article no.: 1350028, 12 pages. (Corresponding author, IF: 2.2)
- [27] J. Han, M. Gao, Q. Zhang*, and Y. Li, Option prices under stochastic volatility, *Applied Mathematics Letters*, **26** (2013), 1–4. (IF: 3.7)
- [28] D.-C. Chang*, O. Calin and Y. Li, On the heat kernel of a left invariant elliptic operator, in: *Excursions in Harmonic Analysis*, Vol. 2, 197–209, edited by T. D. Andrews *et al.*, Birkhäuser/Springer, New York, 2013.
- [29] Y. Li, S. Liu, S. Xu and Y. Zhao*, Full asymptotic expansions of the Landau constants via a difference equation approach, *Applied Mathematics and Computation*, **219** (2012), 988–995. (IF: 4.0)
- [30] O. Calin, D.-C. Chang*, J. Hu, and Y. Li, Heat kernels of a class of degenerate elliptic operators using stochastic method, *Complex Variables and Elliptic Equations*, **57** (2012), 155–168. (IF: 0.9)
- [31] O. Calin, D.-C. Chang*, J. Hu, and Y. Li, On heat kernels of a class of degenerate elliptic operators, *Journal of Nonlinear and Convex Analysis*, **12** (2011), 309–340. (IF: 1.1)
- [32] D.-C. Chang* and Y. Li, SubRiemannian geodesics in Grushin plane, *Journal of Geometric Analysis*, **22** (2012), 800–826. (IF: 1.1)
- [33] Y. T. Li and R. Wong*, Integral and series representations of the Dirac delta function, *Communications on Pure and Applied Analysis*, **7** (2008), 229–247. (IF: 1.0)

Submitted for publication

- [1] J. Han, Q. Zhang*, and Y. Li, Analytic approximate solutions for option prices under Heston model of stochastic volatility, submitted, under revision.
- [2] X. Wen, H. Song, Y. Li*, and Z. Guo, A primal-dual active set method for American regime-switching options, submitted.

Awards and Honors

2022 师风师德优秀奖 , *Chinese University of Hong Kong, Shenzhen*

2010 **Outstanding Research Thesis Award (PhD)**, *City University of Hong Kong*

Grants

2014–2016 **Heat Kernals for High Step Subelliptic Operators**, *Hong Kong Research Grants Council*, General Research Fund, no. 12303515, HK\$ 592,987

PI

2015–2018 **Heat Kernals for High Step Subelliptic Operators**, *Hong Kong Research Grants Council*, General Research Fund, no. 12303515, HK\$ 451,255

PI

2016–2019 **The index theorem for subelliptic operators on contact manifolds – A heat kernel approach**, *Hong Kong Research Grants Council*, General Research Fund, no. 12328416, HK\$ 488,501

PI

2019–2021 **On a class of subelliptic operators** (关于一类次椭圆算子的研究) , *National Natural Science Foundation of China*, 青年科学基金, no. 11801480, CNY 300,000

PI

2021–2024 **带有薄层的区域上的扩散方程**, *National Natural Science Foundation of China*, 面上项目 General Fund, no. 12071394, CNY 624,000

Co-I

2022–2025 **光波导的复特征值问题的快速高精度算法**, *Shenzhen Science and Technology Program*, 稳定支持计划, CNY 287,500

PI

Conferences and Presentations

1. Department Colloquium: “Asymptotics of the associated Meixner–Pollaczek polynomials”, Shenzhen University, Guangdong, Dec. 2022.
2. 非线性偏微分方程会议, 吉林大学, 长春, 2022年8月。
3. Department Colloquium: “On ratios of two Laplace integrals”, Fudan University, Shanghai, April 2022.
4. 第五届非线性扩散方程会议, 长春, 2021年5月。
5. The 3rd International Workshop on Numerical Analysis and Applications of Fractional

- Differential Equations, Foshan, Nov. 2020.
6. Colloquium talk: “Applications of fractional diffusion equations”, Shandong University, Jinan, Dec. 2019.
 7. Workshop on Partial Differential Equations, Dalian, Aug., 2019.
 8. 37th SPP Physics Conference, Bohol, Philippine, May, 2019.
 9. International Conference on Special Functions: Theory, Computation and Applications, Hong Kong, Jun. 6–9, 2017.
 10. Department Colloquium, South China Normal University, Guangzhou, Sept. 17, 2016
 11. International Workshop on Asymptotic Analysis, Taiyuan University of Technology, Jul. 21 – 24, 2016.
 12. Mainland–Hong Kong NSFC–RGC Joint Youth Forum on Mathematics, South University of Science and Technology of China, Shenzhen, Jul. 7–8, 2016
 13. International Conference on Applied Mathematics, Hong Kong, May 30 – June 2, 2016.
 14. NCTS Workshop on Geometric Analysis and Subelliptic Operators, Taipei, May 24–26, 2016.
 15. International Congress on Industrial and Applied Mathematics (ICIAM2015), Beijing, Aug. 10–14, 2015.
 16. Seminar of Analysis, University of Tokyo, Tokyo, Jul. 14, 2015.
 17. International Workshop on Applied Analysis and Optimization, China Medical University, Taichung, Jun. 26–28, 2015.
 18. 2015 NCTS Workshop on Geometric and Singular Analysis, Taipei, Jun. 24–25, 2015.
 19. International Conference on Applied Mathematics, City University of Hong Kong, Hong Kong, Dec. 1–5, 2014
 20. 2014 NCTS Workshop on Geometric and Singular Analysis, Hsinchu, Taiwan, July 2–4, 2014.
 21. Constructive Approximations, Vanderbilt University, Nashville, USA, May 26–30, 2014
 22. International Workshop on Asymptotic Analysis, Fudan Univ., Shanghai, Oct. 15–17, 2013.
 23. 2013 NCTS International Conference on Geometric and Singular Analysis, Hsinchu, Taiwan, Jan. 8, 2013.
 24. International Workshop on Asymptotic Analysis, Beijing Univ. of Chemical Technology, Beijing, Oct. 15–17, 2012.
 25. Department Colloquium: “Asymptotic analysis of orthogonal polynomials via three-term recurrence relations”, Hong Kong Baptist University, Apr. 17, 2012.
 26. Workshop: “Geometric and Singular Analysis”, Potsdam, Germany, Mar. 2012.
 27. 2011 NCTS Workshop on PDEs and Geometric Analysis, NCTS, Hsinchu, Dec. 2011.

28. International Workshop on Asymptotics Analysis, Hong Kong, Dec. 2011.
29. Department Colloquium, Asymptotic Approximations for Three-Term Recurrence Relations with Applications, University of Macau, Macau, Nov. 23, 2011.
30. International Conference on Asymptotics and Special Functions, City University of Hong Kong, Jun., 2011.
31. Special Functions in 21st Century, NIST, Washington DC, Apr., 2011.
32. Workshop on Asymptotic Analysis, WIPM, Chinese Academy of Science, Wuhan, Sep. 26, 2010.
33. Ademia Sinica–NCTS/TPE Geometry Seminar, Academia Sinica, Taipei, Jun. 11, 2010.

Teaching

Teaching experience at CUHK-Shenzhen

- Spring 2018 MAT1005: College Mathematics for Business and Economics
- Spring 2018 MAT4220: Partial Differential Equations
- Fall 2018/19/20 MAT3253: Complex Analysis
- Fall 2018 MAT4001: Numerical Analysis
- Fall 2019/20/21 MAT2006: Elementary Real Analysis
- Spring 2020/21/22 MAT2007: Elementary Real Analysis II
- Full 2022 MAT3006: Real Analysis
- Spring 2023 MAT4010: Functional Analysis

Teaching experience at Hong Kong Baptist University

- Fall 2016 MATH3405: Ordinary Differential Equations
- Spring 2013–17 MATH3606: Partial Differential Equations
- Fall 2015 MATH3616: Numerical Methods for Differential Equations
- Fall 2014 MATH3720: Complex Analysis
- Fall 2012/13 MATH2140: Numerical Methods I

Graduate students supervised

- Yingshu ZHANG PhD, 2019–2023
- Runtian LI PhD candidate, 2018–2023 (expected)
- Zunming YANG PhD candidate, 2021–
- Ruijin WANG MPhil candidate, 2022–

Additional Activities

Services at CUHK-Shenzhen

- 2019–Present Coordinator (2019-2021) and Co-coordinator (2022-present), Mathematics and Applied Mathematics undergraduate programme
- 2020–Present Member, School Curriculum Committee
- 2020–Present Member, School Board
- 2023 Member, School Executive Committee

Conferences and Workshop organized

- Jul. 2016 **International Workshop on Asymptotic Analysis**, *Taiyuan University of Technology*, Taiyuan
- Jun. 2017 **International Conference on Special Functions: Theory, Computation and Applications**, *City University of Hong Kong*, Hong Kong
- Dec. 2021 **Asymptotic Analysis, Orthogonal Polynomials, and Special Functions a minisymposium at 2021 CMS Winter Meeting**, *Canadian Mathematical Society*, Vancouver and online
- Dec. 2021 **Workshop on Complex Analysis**, *Chinese University of Hong Kong, Shenzhen*, Shenzhen and online
- Nov. 2022 **SICIAM Conference on Parabolic and Elliptic Equations**, *Shenzhen International Center for Industrial and Applied Mathematics*, Online

Reviewer for Journals

Analysis and Applications, Analysis and Mathematical Physics, Applicable Analysis, Asymptotic Analysis, Constructive Approximations, IMA Journal of Applied Mathematics, Journal of Approximation Theory, Journal of Differential Equations, Journal of Geometric Analysis, Journal of Partial Differential Equations, Proceedings of the Royal Society A, Studies in Applied Mathematics.