Joshua Lee Padgett

Curriculum Vitae

University of Arkansas
Department of Mathematical Sciences
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Academic Appointments

2020–Present **Assistant Professor**, *University of Arkansas*, Department of Mathematical Sciences.

2019–2020 **Research Associate**, *Texas Tech University*, Department of Mathematics and Statistics.

2017–2019 **Postdoctoral Research Associate**, *Texas Tech University*, Department of Mathematics and Statistics.

2017 **Teacher of Record**, *Baylor University*, Department of Computer Science.

2013–2017 **Teacher of Record**, *Baylor University*, Department of Mathematics.

Research Interests

Applied mathematics, numerical analysis, geometric and Lie group integration methods, mathematics of deep learning, operator splitting methods, algebraic structures of numerical methods, fractional differential equations, and stochastic differential equations

Education

2012–2017 **Doctor of Philosophy**, *Baylor University*, Mathematics.
Dissertation Title: *Solving Stochastic and Degenerate Kawarada Partial Differential Equations via Adaptive Splitting Methods*
Advisor: Qin Sheng

2008–2012 **Bachelor of Science**, *Gardner-Webb University*, Mathematics, *summa cum laude*.
Thesis Title: *Could Metabolism Hold the Key to New Cancer Treatment Options?*
Advisor: Cathleen Cielsielski

Grants and Awards

2. **Modeling in a Heterogeneous World (XVIII Red Raider Mini-Symposium)**; *NSF Conferences and Workshops in the Mathematical Sciences*; A. Peace, J. L. Padgett, W. Zhang, L. J. S. Allen, K. Schmidt; **Amount: $17,750**; (NSF-1956396)

1. **Onset of Turbulence in Dusty Plasma Liquids**; *NSF/DOE Partnership in Basic Plasma Science and Engineering*; E. Kostadinova, J. L. Padgett, C. Liaw, L. Matthews, T. Hyde; **Amount: $257,840**; (NSF-1903450)

Publications

15. J. L. Padgett, T. F. Jones, E. G. Kostadinova, and Q. Sheng, A series representation of the discrete fractional Laplace operator of arbitrary order, 2021 (submitted).

14. J. L. Padgett, T. F. Jones, and Q. Sheng, Intrinsic properties of strongly continuous fractional semigroups in normed vector spaces, 2020 (to appear in Operator Theory: Advances and Applications).

13. J. L. Padgett, Y. Geldiyev, S. Gautam, W. Peng, Y. Mechref, and A. Ibraguimov, Object classifi-

cation in analytical chemistry via data-driven discovery of partial differential equations, 2020 (to appear in Computational and Mathematical Methods).

12. E. G. Kostadinova, J. L. Padgett, C. D. Liaw, L. S. Matthews, and T. W. Hyde, Anomalous diffusion in semi-crystalline polymer structures, (to appear in Physical Review Research).

11. J. L. Padgett, E. G. Kostadinova, C. D. Liaw, K. Busse, L. S. Matthews, and T. W. Hyde, Anomalous diffusion in one-dimensional disordered systems: A discrete fractional Laplacian method, *Journal of Physics A: Mathematical and Theoretical*, (2020).

10. J. L. Padgett, Analysis of an approximation to a fractional extension problem, *BIT Numerical Mathematics*, (2019).

9. J. L. Padgett and Q. Sheng, Convergence of an operator splitting scheme for abstract stochastic evolution equations, *Advances in Math. Methods and High Performance Computing*, Editor-in-Chief: Vinai K. Singh, Springer-Verlag, Switzerland, 2019, 163–179.

8. M. A. Bearegard and J. L. Padgett, A variable nonlinear splitting algorithm for reaction diffusion systems with self and cross-diffusion, *Num. Meth. Part. Diff. Eq.*, **35** (2019), 597-614.

7. J. L. Padgett, The quenching of solutions to time-space fractional Kawarada problems, *Comp. Math. Appl.*, **76** (2018), 1583-1592.

6. J. L. Padgett and Q. Sheng, Numerical solution of degenerate stochastic Kawarada equations via a semi-discretized approach, *Appl. Math. Comp.*, **325** (2018), 210-226.

5. E. G. Kostadinova, K. Busse, N. Ellis, J. L. Padgett, C. D. Liaw, L. S. Matthews, T. W. Hyde, Delocalization in infinite disordered 2D lattices of different geometry, *Phys. Rev. B,* **96** (2017), 235408.

4. J. L. Padgett and Q. Sheng, On a Nonuniform Crank-Nicolson Scheme for Solving the Stochastic Kawarada Equation via Arbitrary Grids, *Num. Meth. Part. Diff. Eq.,* **33** (2017), 1305-1328.

3. M. Bearegard, J. L. Padgett, and R. Parshad, A nonlinear splitting algorithm for systems of partial differential equations with self-diffusion, *J. Comp. Appl. Math.,* **321** (2017), 8-25.

2. J. L. Padgett and Q. Sheng, On the stability of a variable step exponential splitting method for solving multidimensional quenching-combustion equations, *Modern Mathematical Methods and High Performance Computing in Science and Technology*, Editor-in-Chief: Vinai K. Singh, Springer Verlag, Singapore, 2016, ISBN: 978-981-10-1454-3

1. J. L. Padgett and Q. Sheng, On the positivity, monotonicity, and stability of a semi-adaptive LOD method for solving three-dimensional degenerate Kawarada equations, *J. Math. Anal. Appls.,* **439** (2016), 465–480.

Work in Progress

5. A Jentzen, B. Kuckuck, and J. L. Padgett, Overcoming the curse of dimensionality in the approximation of high-dimensional nonlinear partial differential equations via deep neural networks in the L^p-sense, (in preparation).

4. A Jentzen, B. Kuckuck, and J. L. Padgett, Strong L^p-error analysis of nonlinear Monte Carlo approximations for high-dimensional semilinear partial differential equations, (in preparation).

3. E. Servin and J. L. Padgett, Approximating Kawarada equations via nonlinear splitting methods, (in preparation).

2. J. L. Padgett, R. Ramirez, and J. Miller, *Hopf algebraic techniques for developing stochastic operator splitting methods of arbitrarily high order*, (in preparation).

1. J. L. Padgett, *Weak convergence of the abstract Lie-Trotter stochastic operator splitting*, (in preparation).

Presentations

30. *Beating the curse of dimensionality in high-dimensional stochastic fixed-point equations*; Third Annual Meeting of SIAM Texas-Louisiana Section; online (October 2020).

29. *Beating the curse of dimensionality in high-dimensional partial differential equations*; Applied Mathematics Seminar; Department of Mathematical Sciences, University of Arkansas; Fayetteville, Arkansas (September 2020).

28. *A proof that deep neural networks overcome the curse of dimensionality in the numerical approximation of semilinear heat equations*; Applied Mathematics Seminar; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (March 2020).

27. *A nonlinear splitting algorithm for preserving asymptotic features of stochastic singular differential equations*; Joint Mathematics Meetings; Denver, Colorado (January 2020).

26. *Modeling physical systems with the fractional Laplace operator and its use in the Anderson localization problem*; The Center for Astrophysics, Space Physics, and Engineering Research; Baylor University; Waco, Texas (November 2019)

25. *A semi-analytical approach to approximating non-local equations arising in porous media*; SIAM Northern States Section; Laramie, Wyoming (September 2019).

24. *A nonlinear splitting algorithm for approximating population models with self- and cross-diffusion*; Biomathematics Seminar; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (September 2019).

23. *Hopf algebraic structure of numerical integrators for integro-differential equations*; Geometry, Compatibility, and Structure-Preserving Conference; Isaac Newton Institute, Cambridge University; Cambridge, United Kingdom (July 2019).

22. *Semi-analytic methods for the approximation of abstract fractional extension problems*; Applied Mathematics Seminar; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (March 2019).

21. *Anderson localization in nonlocal models*; Analysis Seminar; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (February 2019).

20. *Operator splitting methods for approximating singular nonlinear differential equations* ; Numerical Analysis Seminar; Department of Mathematical Sciences, University of Delaware; Newark, Delaware (November 2018).

19. *Operator splitting methods for solving stochastic differential equations*; Department Colloquium; Department of Mathematics, Baylor University; Waco, Texas (November 2018).

18. *Hopf Algebras and Numerical Integrators*; Geometry Seminar; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (October 2018).

17. *Analysis of an approximation of a fractional extension problem*; SIAM Annual Meeting, Special Session; Eugene, Oregon (June 2018).

16. *Lie-Butcher series from an algebraic geometry point of view*; Geometry Seminar; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (April 2018).

15. *Approximating the fractional Laplace equation via operator theoretical methods*; West Texas Applied Math Symposium, Texas Tech University; Lubbock, Texas (April 2018).

14. *An introduction to geometric numerical integration*; Geometry Seminar; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (March 2018).

13. *Operator splitting methods for approximating differential equations*; Junior Scholar Symposium; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (February 2018).

12. *An operator theoretical approach to nonlocal differential equations*; Analysis Seminar; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (November 2017).

11. *Operator Splitting and Lie Group Methods for Geometric Integration*; Seminar in Applied Mathematics; Department of Mathematics and Statistics, Texas Tech University; Lubbock, Texas (November 2017).

10. *An exploration of quenching-combustion via globalized fractional models*; SIAM Annual Meeting, Special Session; Pittsburgh, Pennsylvania (July 2017).

9. *Solving degenerate stochastic Kawarada equations via adaptive operator splitting methods*; University of Central Arkansas, Graduate Mathematics Seminar; Conway, Arkansas (January 2017).

8. *An approach to the numerical solution of multidimensional stochastic Kawarada equations via adaptive operator splitting*; Joint Mathematics Meeting; Atlanta, Georgia (January 2017).

7. *Using Matlab to Solve Nonlinear PDE*; AMS Student Meeting; Baylor University; Waco, Texas (October 2016).

6. *Using an adaptive Crank-Nicolson scheme to solve the degenerate stochastic Kawarada equation on nonuniform grids*; SIAM Central States Section Meeting, Special Session; Little Rock, Arkansas (September 2016).

5. *Positive and Monotone Solutions to Quenching Differential Equations*; Differential Equations Seminar; Baylor University; Waco, Texas (April 2016, 6 lectures).

4. *A semi-adaptive LOD method for solving three-dimensional degenerate Kawarada equations*; AMS Spring Southeastern Sectional Meeting; Athens, Georgia (March 2016).

3. *A novel LOD method for solving degenerate Kawarada equations*; CASPER seminar; Waco, Texas (February 2016).

2. *Numerical Solutions to Singular Differential Equations*; AMS Student Meeting; Baylor University; Waco, Texas (October 2015).

1. *An Exploration of the Exponential Splitting*; Joint Mathematics Meeting, Special Session; San Antonio, Texas (January 2015).

Conference Organization

2. Highly accurate and structure-preserving numerical methods for nonlinear partial differential equations; Joint Mathematics Meeting Special Session 2020; organized by Q. Sheng, J. L. Padgett, and J. Macias-Diaz (accepted)

1. M3HPCST-2020 Research Conference Proposal, Indo-U.S. Science & Technology Forum (IUSSTF), India, 2019-2021; V. J. Singh, Q. Sheng, J. L. Padgett (accepted).

Students Advised

3. Yu Jung Nam (doctoral student, Texas Tech University) [with Magdalena Toda]

2. Yusup Geldiyev (doctoral student, Texas Tech University) [with Akif Ibraguimov]

1. Eduardo Servin (undergraduate student, Texas Tech University)

Travel Grants

5. **Graduate School Travel Award**; Baylor University; *An exploration of quenching-combustion via globalized fractional models*; Summer 2017.

4. **Student Travel Award**; SIAM; *An exploration of quenching-combustion via globalized fractional models*; Summer 2017.

3. **Graduate School Travel Award**; Baylor University; *An approach to the numerical solution of multidimensional stochastic Kawarada equations via adaptive operator splitting*; Fall 2016.

2. **Graduate School Travel Award**; Baylor University; *Using an adaptive Crank-Nicolson scheme to solve the degenerate stochastic Kawarada equation on nonuniform grids*; Fall 2016.

1. **Graduate School Travel Award**; Baylor University; *A semi-adaptive LOD method for solving three-dimensional degenerate Kawarada equations*; Spring 2016.

Courses Taught

Spring 2021	**Linear Algebra**, *University of Arkansas*.	
Spring 2021	**Calculus III**, *University of Arkansas*.	
Fall 2020	**Calculus III**, *University of Arkansas*.	
Summer 2020	**Computer Literacy and Programming II**, *Texas Tech University*.	
Summer 2020	**Numerical Methods for Fractional-Order nonlinear PDEs, Part II**, *Texas Tech University*.	
Summer 2020	**Computer Literacy and Programming I**, *Texas Tech University*.	
Summer 2020	**Numerical Methods for Fractional-Order nonlinear PDEs, Part I**, *Texas Tech University*.	
Sprint 2020	**Abstract Algebra Applied II**, *Texas Tech University*.	
Spring 2020	**Numerical Methods for Singular and Nonlinear Differential Equations II**, *Texas Tech University*.	
Spring 2020	**Machine Learning**, *Texas Tech University*.	
Spring 2020	**Computational Techniques for Science and Mathematics**, *Texas Tech University*.	
Fall 2019	**Abstract Algebra Applied I**, *Texas Tech University*.	
Fall 2019	**Numerical Methods for Singular and Nonlinear Differential Equations I**, *Texas Tech University*.	
Fall 2019	**Mathematical Computing**, *Texas Tech University*.	
Summer 2019	**Mathematical Computing**, *Texas Tech University*.	
Summer 2019	**Linear Algebra**, *Texas Tech University*.	
Spring 2019	**Abstract Algebra Applied II**, *Texas Tech University*.	

Fall 2018	**Abstract Algebra Applied I**, *Texas Tech University*.
Summer 2018	**Mathematical Computing**, *Texas Tech University*.
Summer 2018	**Foundations of Algebra I**, *Texas Tech University*.
Spring 2018	**Computational Techniques for Science and Mathematics**, *Texas Tech University*.
Fall 2017	**Calculus III with Applications**, *Texas Tech University*, (two sections).
Spring 2017	**Partial Differential Equations**, *Baylor University*.
Spring 2017	**Discrete Structures**, *Baylor University*.
Fall 2016	**Calculus III**, *Baylor University*.
Spring 2016	**Calculus II**, *Baylor University*.
Fall 2015	**Calculus I**, *Baylor University*.
Spring 2015	**Calculus I**, *Baylor University*.
Fall 2014	**Business Precalculus**, *Baylor University*.
Spring 2014	**Precalculus**, *Baylor University*.
Fall 2013	**Precalculus**, *Baylor University*.

Honors and Awards

Fall 2015	**Outstanding Graduate School Teacher**, *Baylor University*.
2014–2015	**Department of Mathematics Outstanding Teaching Award**, *Baylor University*.
2012–2017	**Graduate School Fellowship**, *Baylor University*.
2011–2012	**Christenberry Award**, *Big South Conference (NCAA Division I)*.
2010–2012	**Track and Field Scholarship**, *Gardner-Webb University*.
2010–2011	**Undergraduate Research Award**, *Gardner-Webb University*.
2008-2009	**Outstanding Mathematics Award**, *Gardner-Webb University*.
2008–2012	**Presidential Fellow**, *Gardner-Webb University*.
2008-2011	**Robert C. Byrd Award**, *North Carolina Department of Education*.

Professional Travel

July 2019	**Isaac Newton Institute**, *Cambridge University*, *Geometry, Compatibility, and Structure-Preserving Workshop*.
July 2015	**Mathematical Sciences Research Institute**, *University of California at Berkeley*, *Incompressible Fluid Flows at High Reynolds Number*.

Service

2020	**Co-Organizer**, *Special Session*, Joint Mathematics Meeting, Denver, Colorado.
2019-2021	**Advisory Committee member**, *M3HPCST*.
2016–Present	**Reviewer**, *Numerical Methods in Partial Differential Equations*.
2017–Present	**Reviewer**, *Computers and Mathematics with Applications*.
2018–Present	**Reviewer**, *Mathematical Review/MathSciNet*.
2018–Present	**Reviewer**, *Journal of Computational Physics*.
2018–Present	**Reviewer**, *Journal of Computational Physics*.
2019–Present	**Reviewer**, *Discontinuity, Nonlinearity, and Complexity*.
2019–Present	**Reviewer**, *Applied Numerical Mathematics*.

2019–Present	**Reviewer**, *Computational and Mathematical Methods*.
2016-2017	**Vice President**, *Baylor AMS Chapter*, (co-founder).
November 2016	**Job Interview Panel**, *Organized and moderated the panel on job interviews for graduate students*.
September 2016	**Special Session Chair**, *SIAM Central States Section Meeting*.
September 2016	**Academic and Industry Job Panel**, *Organized and moderated panel on application materials regarding academic and industry jobs for graduate students*.
January 2015	**Special Session Chair**, *Joint Mathematics Meeting*.

Computer skills

Language	Matlab, Mathematica, LaTeX, Python, GoLang, C++, parallel programming
Operating System	UNIX, Windows