JAN MUHAMMAD
Date of Birth: 10th March 1986 | **Nationality:** Pakistani
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Postdoctoral Researcher in Nonlinear PDEs & Mathematical Physics

Professional Summary

A highly accomplished mathematician and postdoctoral researcher with a Ph.D. in Mathematics and an exceptional publication record of over 50 peer-reviewed articles in leading journals, specializing in nonlinear partial differential equations, soliton theory, and mathematical physics. Currently a Postdoctoral Research Fellow at Shanghai University, China, with a strong international academic profile encompassing research collaboration, scholarly dissemination, and university-level teaching. Committed to advancing theoretical and applied mathematical research while contributing to academic excellence through rigorous scholarship, mentorship, and innovative pedagogy.

Career Objective

Aspiring to contribute to advanced mathematical research in nonlinear partial differential equations and related fields. My goal is to thrive in a dynamic academic or research environment, driving innovation and knowledge expansion while achieving personal and organizational excellence.

Key Research Interests

• Nonlinear Partial Differential Equations

• Soliton Theory & Optical Wave Propagation

• Analytical & Semi-Analytical Methods

• Fractional Calculus & Mathematical Physics

• Applied Mathematics in Engineering & Optics

Education

Postdoctoral Fellowship (March 2023 –)
School of Mathematics, Shanghai University, Shanghai, China
Research work: Analytical solutions of nonlinear PDEs
Advisor: Prof. Wancheng Sheng (盛万成)

Ph.D. in Mathematics (September 2017 – December 2020)
School of Mathematics, CNS, Northwest University, Xi'an, China
Thesis: Large-time behavior and existence of weak solutions to a class of compressible non-Newtonian fluids
Advisor: Prof. Zhenhua Guo (郭真华)

M.Phil. in Mathematics (April 2011 – September 2014)
Abdul Wali Khan University, Mardan, Pakistan
Thesis: New sufficiency criteria for functions to be in a class of alpha convex functions
Advisor: Prof. Muhammad Arif

M.Sc. in Mathematics (October 2007 – January 2010)
University of Peshawar, Pakistan

Bachelor of Science (September 2004 – May 2007)
University of Peshawar, Pakistan

Academic Experience

Lecturer, Department of Mathematics
Shaheed Benazir Bhutto University (March 2021 – December 2022)

- Courses Taught: Numerical Analysis, Algebra, Differential Equations, Real Analysis

Subject Teacher, Mathematics
Government High School Gandheri (April 2016 – September 2017)

- Focused on high school mathematics curriculum.

Lecturer, Mathematics
Peace College Nowshera (December 2014 – March 2016)
Lecturer, Abdul Wali Khan University
(March 2011 – October 2011)

- Courses: Differential Equations, Complex Analysis, Mathematical Techniques

Teaching Philosophy

My teaching philosophy is grounded in the belief that mathematics should be taught as both a logical discipline and a creative tool for problem-solving in the real world. I aim to cultivate a learning environment that encourages curiosity, analytical thinking, and academic independence. I focus on connecting abstract mathematical theories to practical applications, particularly in physics, engineering, and computer science, to spark student interest and deepen understanding.

In my classrooms, I use a balanced mix of theoretical explanation, problem-solving sessions, and technology-enhanced instruction. I also promote collaborative learning through group assignments and research projects. My goal is not only to teach students how to solve equations but also to empower them to apply mathematical thinking in research, innovation, and interdisciplinary contexts.

Publications

1. **J. Muhammad**, L. Fang, Z. Guo, Global weak solutions to a class of compressible non-Newtonian fluids with vacuum. Math Meth Appl Sci. 2020; 43:5234–5249.

2. H. Zhu, L. Fang, **J. Muhammad**, Z. Guo. Global weak solutions to a Vlasov Fokker Planck/compressible non-Newtonian fluid system of equations. Z Angew Math Mech. 2020; 100:e201900091.

3. A. Samad, **J**. **Muhammad** Mesh free Collocation Method for the Numerical Solution of Higher Order KdV Equation. Journal of Applied and Computational Mechanics (2020).

4. **J. Muhammad**, A. Samad, On integrability up to the boundary of the weak solutions to a class of non-Newtonian compressible fluids with vacuum. Journal of Applied and Computational Mechanics (2021).

5. I. Hussain, **J. Muhammad**, Efficient convex region-based segmentation for noising and inhomogeneous patterns. Inverse Problems and Imaging. 2023 Jun 1;17(3):708-25.

6. I. Hussain, **J. Muhammad**, R. Ali, Enhanced global image segmentation: Addressing pixel inhomogeneity and noise with average convolution and entropy-based local factor. Int J. Knowl. Innov Stud. 2023;1(2):116-26.

7. M. Li, **J. Muhammad**, U. Younas, H. Rezazadeh, M.A. Hosseinzadeh, S. Salahshour, On the optical wave structures to the fractional nonlinear integrable coupled Kuralay equation. Modern Physics Letters B. 2024 Apr 9:2450354.

8. **J. Muhammad**, Q. Ali, U. Younas, Three component coupled fractional nonlinear Schrodinger equations: Diversity of exact optical solitonic structures. Modern Physics Letters B. 2024 Apr 16:2450373.

9. **J. Muhammad**, M.B. Riaz, U. Younas, N. Nasreen, A. Jhangeer, D. Lu, Extraction of optical wave structures to the coupled fractional system in magneto-optic waveguides. Arab Journal of Basic and Applied Sciences, 31(1) (2024) 242-254.

10. **J. Muhammad**, U. Younas, H. Rezazadeh, M. Ali Hosseinzadeh, S. Salahshour, On the investigation of fractional coupled nonlinear integrable dynamical system: Dynamics of soliton solutions. Modern Physics Letters B. 2024 May 7:2450380.

11. U. Younas, **J. Muhammad**, H.F. Ismael, M.A. Murad, T.A. Sulaiman, Optical fractional solitonic structures to decoupled nonlinear Schrödinger equation arising in dual-core optical fibers. Modern Physics Letters B. 2024 May 10:2450378.

12. **J. Muhammad**, Q. Ali, U. Younas,On the analysis of optical pulses to the fractional extended nonlinear system with mechanism of third-order dispersion arising in fiber optics. Optical and Quantum Electronics. 2024 Jun 7;56(7):1168.

13. **J. Muhammad**, On the Global Existence for a Class of Compressible Non-Newtonian Fluids with Inhomogeneous Boundary Data. Russ. J. Math. Phys. 31, 276–298 (2024).

14. **J. Muhammad**, U. Younas, N. Nasreen, et al., Multicomponent nonlinear fractional Schrödinger equation: On the study of optical wave propagation in the fiber optics, Partial Differential Equations in Applied Mathematics, 11 (2024) 100805.

15. U. Younas, **J. Muhammad**, H. Rezazadeh, M.A. Hosseinzadeh, S. Salahshour, Dynamics of novel soliton and periodic solutions to the coupled fractional nonlinear model. Partial Differential Equations in Applied Mathematics. 2024 Jul 8:100804.

16. N. Nasreen, **J. Muhammad**, A. Jhangeer et al., Dynamics of fractional optical solitary waves to the cubic-quintic coupled nonlinear Helmholtz equation, Partial Differential Equations in Applied Mathematics (2024).

17. U. Younas**, J. Muhammad**, N. Nasreen, A. Khan, T. Abdeljawad, On the comparative analysis for the fractional solitary wave profiles to the recently developed nonlinear system, Ain Shams Engineering Journal, 2024.

18. **J. Muhammad**, S.U. Rehman, N. Nasreen, M. Bilal, U. Younas, Exploring the fractional effect to the optical wave propagation for the extended Kairat-II equation, Nonlinear Dynamics, 113 (2025) 1501–1512.

19. **J. Muhammad**, U. Younas, E. Hussain, Q. Ali, M. Sediqmal, K. Kedzia, A.Z. Jan, Analysis of fractional solitary wave propagation with parametric effects and qualitative analysis of the modified Korteweg-de Vries-Kadomtsev-Petviashvili equation, Scientific Reports, 14(1) (2024) 19736.

20. **J. Muhammad**, U. Younas, A. Khan et al., On the study of double dispersive equation in the Murnaghan's rod: Dynamics of diversity wave structures, Partial Differential Equations in Applied Mathematics (2024).

21. U. Younas, **J. Muhammad**, H. Rezazadeh, et al. Propagation of Optical Solitons to the Fractional Resonant Davey-Stewartson Equations. Int. J. Theor. Phys. 63, 239 (2024).

22. **J. Muhammad,** M. Bilal, S. Ur Rehman, Analyzing the decoupled nonlinear Schrödinger equation: fractional optical wave patterns in the dual-core fibers. J. Opt. (2024).

23. **J. Muhammad,** N. Nasreen, E. Hussain, U. Younas, A Saad Alsubaie, On the study of analytical soliton solutions and interaction aspects to the Estevez-Mansfield-Clarkson equation arising in diversity of fields, Physica Scripta, 99 (2024)115221.

24. **J. Muhammad**, Bounded absorbing sets for compressible non-Newtonian fluids, Journal of engineering mathematics, 149(3) (2024) 1-15.

25. U. Younas, **J. Muhammad**, Q. Ali, M. Sediqmal, K. Kedzia, A.Z. Jan, On the study of solitary wave dynamics and interaction phenomena in the ultrasound imaging modelled by the fractional nonlinear system, Scientific Reports, 14(1) (2024) 26080.

26. **J. Muhammad**, U. Younas, E. Hussain, Q. Ali, M. Sediqmal, K. Kedzia, A.Z. Jan, Solitary wave solutions and sensitivity analysis to the space-time β-fractional Pochhammer–Chree equation in elastic medium, Scientific Reports, 14(1) (2024) 1-13.

27. **J. Muhammad,** U. Younas, D.K. Almutairi et al., Optical wave features and sensitivity analysis of a coupled fractional integrable system, Results in Physics (2024).

28. U. Younas, E. Hussain, **J. Muhammad**, M. Garayev, M. El-Meligy, Bifurcation analysis, chaotic behavior, sensitivity demonstration and dynamics of fractional solitary waves to nonlinear dynamical system, Ain Shams Engineering Journal (2024).

29. **J. Muhammad**, Global compact attractors and complete bounded trajectories for compressible magnetohydrodynamic system of equations, Theoretical and Applied Mechanics, 51(2) (2024) 165–188.

30. U. Younas, E. Hussain, **J. Muhammad**, M. Sharaf, M.E. Meligy, Chaotic Structure, Sensitivity Analysis and Dynamics of Solitons to the Nonlinear Fractional Longitudinal Wave Equation, International Journal of Theoretical Physics, 64(2) (2025) 42.

31. U. Younas, **J. Muhammad**, M.A. Murad, D.K. Almutairi, A. Khan, T. Abdeljawad, Investigating the truncated fractional telegraph equation in engineering: Solitary wave solutions, chaotic and sensitivity analysis, Results in Engineering, (2025) 104489.
32. U. Younas, **J. Muhammad**, D.K. Almutairi, A. Khan, T. Abdeljawad, Analyzing the neural wave structures in the field of neuroscience, Scientific Reports, 15(1) (2025) 1-14.
33. M. Ajmal, **J. Muhammad**, U. Younas, E. Hussian, M. El-Meligy, M. Sharaf, Exploring the Gross-Pitaevskii Model in Bose-Einstein Condensates and Communication Systems: Features of Solitary Waves and Dynamical Analysis. International Journal of Theoretical Physics, 64(3) (2025) 1-26.
34. **J. Muhammad,** On the Existence of Two-Dimensional Solutions to the Magnetohydrodynamic Equations of a Compressible Flow in Orlicz Spaces, Bulletin of the Iranian Mathematical Society, 51, 29 (2025) https://doi.org/10.1007/s41980-024-00953-1
35. L. Ming, **J. Muhammad**, D. Yaro, U. Younas, Exploring the multistability, sensitivity, and wave profiles to the fractional Sharma–Tasso–Olver equation in the mathematical physics, AIP Advances, 15(4) (2025) https://doi.org/10.1063/5.0264311
36. **J. Muhammad**, U. Younas, A.Z. Jan, Investigating the fractional integrable Calogero-Bogoyavlenskii-Schiff equation: Exploring the solitary wave solutions, Fractals, 33(9) (2025) 2550083.
37. **J. Muhammad**, U. Younas, Wave propagation and multistability analysis to the modified fractional KDV-KP equation in diversity of fields, Modeling Earth Systems and Environment, (2025) 1-17.
38. **J. Muhammad**, U. Younas, A.Z. Jan, Exploring the fractional wave profiles to the generalized truncated Bogoyavlensky-Konopelchenko equation, Fractals, (2025).
39. **J. Muhammad**, G.H. Tipu, Y. Alrashedi, M. Alhazmi, U. Younas, Analytical study of the nonlinear dynamical systems: Application of the neural networks method, AIMS Mathematics, 10(6) (2025) 14596-616.
40. L. Ming, **J. Muhammad**, D. Yaro, G.H. Tipu, U. Younas, Investigation of the exact solutions via sub-equation neural network method to the nonlinear systems in fluid and nuclear physics, AIP Advances, 15(7) (2025).
41. U. Younas, **J. Muhammad**, A. Khan, T. Abdeljawad, M.A. Alqudah, I. Ahmad, Exploring the β-fractional telegraph equation: Investigating the optical solitary waves, interaction solutions and multistability analysis, Fractals, (2025).
42. **J. Muhammad**, A.H. Tedjani, E. Hussain, U. Younas, Investigating Chaotic Techniques and Wave Profiles with Parametric Effects in a Fourth-Order Nonlinear Fractional Dynamical Equation, Fractal and Fractional, 9(8) (2025) 487.
43. U. Younas, **J. Muhammad**, T.A. Sulaiman, H.F. Ismael, H. Emadifar, W.W. Mohammed, K.K. Ahmed, Estevez-Mansfield-Clarkson equation: Investigation of Breathers, two waves, and solitary wave solutions in shallow water phenomena and engineering fluid dynamics, Case Studies in Thermal Engineering, (2025) 106723.
44. A. Khan, **J. Muhammad**, U. Younas, R. Thinakaran, T. Abdeljawad, M.A. Alqudah, Investigating the stochastic higher dimensional nonlinear Schrodinger equation to telecommunication engineering, Scientific Reports, 15(1) (2025) 27309.
45. U. Younas, **J. Muhammad**, H.F. Ismael, T.A. Sulaiman, M.R. Ali, F. Aymen, Investigating the wave profiles to the linear quadratic model in mathematical biology, Scientific Reports, 15(1) (2025) 27899.

46. **J. Muhammad**, G.H. Tipu, U. Younas, Analytical solutions of the eighth-order (3+ 1)-dimensional Kac–Wakimoto equation modeling waves in ocean engineering, Modeling Earth Systems and Environment, 11(5) (2025) 381.
47. U. Younas **J. Muhammad**, H.F. Ismael, T. A. Sulaiman, Homan Emadifar, Karim K. Ahmed, The New Combined Kairat-II-X Differential Equation: Diversity of Solitary Wave Structures via New Techniques, Journal of Nonlinear Mathematical Physics, 32(55) (2025).
48. **J. Muhammad**, U. Younas, M. Yar, Exploring the chaotic, sensitivity and wave patterns to the dual-mode resonant Schrödinger equation: application in optical engineering, Scientific Reports, 15 (2025) 30972.
49. **J. Muhammad**, U. Younas,Y. Alrashedi, M. Alhazmi, Analyzing the diversity of wave profiles to the stochastic Davey-Stewartson equation: Application in the hydrodynamics engineering, Ain Shams Engineering Journal, 16(11) (2025) 103701.
50. U. Younas, **J. Muhammad,** E. Hussain, Higher dimensional nonlinear model arising to the diversity of fields: Dynamics of wave structures with M-fractional derivative, Partial Differential Equations in Applied Mathematics, 15 (2025) 101284.
51. **J. Muhammad**, U. Younas, K.K. Ahmed, Investigating higher-dimensional nonlinear evolution equation: dynamics of waves and multistability in fluid mediums, Modeling Earth Systems and Environment, 11(6) (2025) 442.
52. **J. Muhammad**, A.H. Tedjani, E. Hussain, U. Younas, Exploring the exact solutions to the nonlinear systems with neural networks method, Scientific Reports, 15(1) (2025) 36818.
53. **J. Muhammad**, A.R. Abdullah, F. Yao, U. Younas, Dynamics of Soliton Solutions to Nonlinear Dynamical Equations in Mathematical Physics: Application of Neural Network-Based Symbolic Methods, Mathematics, 13(21) (2025) 3546.
54. U. Younas, **J. Muhammad**, H.F. Ismael, T.A. Sulaiman, H. Emadifar, K.K. Ahmed, Diversity of solitary wave structures in Kerr media: Analyzing the complex paraxial wave equation in fiber optic communication systems, Ain Shams Engineering Journal, 16(12) (2025) 103763.
55. **J. Muhammad,** U. Younas, Haroon, H. Mukalazi, M.E. Meligy, K.A. Alnowibet, On the Study of Nonlinear Murray Equation in Non-Newtonian Fluids: Fractional Solitary Wave Structures, Chaos, and Sensitivity Demonstration, Advances in Mathematical Physics, 2025(1) (2025) 3604476.
56. **J. Muhammad**, F. Yao, U. Younas, Neural network assisted symbolic analysis and simulation of nonlinear dynamical equation, Modeling Earth Systems and Environment, 12(41) (2026) 1-12.
57. **J. Muhammad**, A.H. Tedjani, U. Younas, F. Yao, Dynamics of Soliton Solutions to Nonlinear Coupled System with Neural Network and Chaotic Insights, Mathematics, 13(23) (2025)3801.
58. **J. Muhammad**, U. Younas, A.Z. Jan, On the study of unidirectional wave propagation: Exploring the fractional wave structures, High Energy Density Physics, (2025) 101252.

Honors and Awards

1. Full Ph.D. Scholarship by Chinese Government (2017–2020)

2. Prime Minister's Youth Training Scheme Internship at Abdul Wali Khan University
3. Travelling Grant by Higher Education Commission (Pakistan) for International Fellowship