Dr. Sudarshan Santra

Post-Doctoral Fellow
Axis Bank Centre for Mathematics and Computing
Department of Computational and Data Sciences
Indian Institute of Science, Bangalore, India
sudarshans@iisc.ac.in, sudsantra@gmail.com
https://sites.google.com/view/sudarshans/home
+91 9874249522, +91 9123316375

Research Fields

Broad Area of Research

- Numerical Methods, Analysis & Scientific Computing, Wavelets.
- Fractional-Order ODEs, PDEs, and Integro-PDEs.

Research Interest

- Machine Learning, Physics Informed Neural Networks (PINNs).

Work Experience

Sep, 2023 – Till Date
Post-Doctoral Fellow: I am working as a Post-Doctoral Research Fellow in the *Department of Computational and Data Sciences* at *Indian Institute of Science* (*IISc*), *Bangalore* under Prof. Ratikanta Behera in assistance with the Post-Doctoral Fellowship, Axis Bank Centre for Mathematics and Computing, IISc Bangalore.

Oct, 2022 – Aug, 2023
Project Associate: I worked as a Project Associate in the *Department of Computational and Data Sciences* at *Indian Institute of Science* (*IISc*), *Bangalore* under Prof. Ratikanta Behera.

Jul, 2019 – Dec, 2019
Teaching Assistant: I have worked as a teaching assistant in the *Department of Mathematics* at *National Institute of Technology Rourkela* (*NIT-R*).
Topics covered: Differential Equations.

Jul, 2015 – Jul, 2018
Assistant Professor: I worked as a lecturer of mathematics in the *Department of Basic Science & Humanities* at *Future Institute of Technology* (*FIT*), Kolkata, affiliated to *Maulana Abul Kalam Azad University of Technology* (*MAKAUT*), West Bengal (Topics covered: Real analysis, Linear Algebra, Differential Equation, Numerical Analysis).

Education

Ph.D. (2018-2023)
Doctor of Philosophy (Ph.D.) in Mathematics, *Department of Mathematics, National Institute of Technology Rourkela*. **First Class** (Marks: 8.74 CGPA out of 10 (87.4%)).
Title of the thesis: *"Numerical solutions and their convergence analysis for fractional differential and integro-differential equations involving weak singularities"*.
Supervisor: Prof. Jugal Mohapatra.

M.Sc. (2013-2015)
M.Sc. in Mathematics and Computing, *Department of Mathematics, Indian Institute of Technology Guwahati*. **First Class** (Marks: 8.25 CGPA out of 10 (82.5%)).

B.Sc. (2009-2012)
B.Sc. in Mathematics (Honours), *Department of Mathematics, Raja Peary Mohan College, University of Calcutta*. **First Class** (Marks: 60% out of 800).

12th (2007-2009)
Higher Secondary Education, Science, *Singur Mahamaya High School, WBCHSE*. **First Class** (Marks: 77.6% out of 500).

10th (2005-2007)
Secondary Education, *Paltagarh Radharani Sikshamandir, WBBSE*. **First Class** (Marks: 83.625% out of 800).

Research Publications

Journal Articles (SCI/SCIE/SCOPUS Indexed)

1. Mohapatra, J., **Santra**, **S.**, & Ramos, H. (2023). Analytical and numerical solution for the time fractional Black-Scholes model under jump-diffusion. ***Comput. Econom.*** doi:10.1007/s10614-023-10386-3

2. **Santra**, **S.**, & Mohapatra, J. (2023a). Numerical simulation and convergence analysis for Riemann-Liouville fractional initial value problem involving weak singularity. ***Int. J. Comput. Sci. Math.***, *18*(4), 340–349. doi:10.1504/IJCSM.2023.135045

3. **Santra**, **S.**, & Mohapatra, J. (2023b). Numerical treatment of multi-term time fractional nonlinear KdV equations with weakly singular solutions. ***Int. J. Model. Simul.***, *43*(1), 23–33. doi:10.1080/02286203.2022.2030629

4. **Santra**, **S.**, Mohapatra, J., Das, P., & Choudhuri, D. (2023). Higher order approximations for fractional order integro-parabolic partial differential equations on an adaptive mesh with error analysis. ***Comput. Math. Appl.***, 87–101. doi:10.1016/j.camwa.2023.09.008

5. Panda, A., **Santra**, **S.**, & Mohapatra, J. (2022). Adomian decomposition and homotopy perturbation method for the solution of time fractional partial integro-differential equations. ***J. Appl. Math. Comput.***, *68*(3), 2065–2082. doi:10.1007/s12190-021-01613-x

6. **Santra**, **S.**, & Mohapatra, J. (2022a). A novel finite difference technique with error estimate for time fractional partial integro-differential equation of Volterra type. ***J. Comput. Appl. Math.***, *400*. doi:10.1016/j.cam.2021.113746

7. **Santra**, **S.**, & Mohapatra, J. (2022b). An efficient computational approach for the solution of time-space fractional diffusion equation. ***Int. J. Model. Simul.*** doi:10.1080/02286203.2022.2085976

8. **Santra**, **S.**, & Mohapatra, J. (2022c). Analysis of a finite difference method based on L1 discretization for solving multi-term fractional differential equation involving weak singularity. ***Math. Methods Appl. Sci.***, *45*(11), 6677–6690. doi:10.1002/mma.8199

9. **Santra**, **S.**, Panda, A., & Mohapatra, J. (2022). A novel approach for solving multi-term time fractional Volterra-Fredholm partial integro-differential equations. ***J. Appl. Math. Comput.***, *68*(5), 3545–3563. doi:10.1007/s12190-021-01675-x

10. **Santra**, **S.**, & Mohapatra, J. (2021a). Analysis of the L1 scheme for a time fractional parabolic-elliptic problem involving weak singularity. ***Math. Methods Appl. Sci.***, *44*(2), 1529–1541. doi:10.1002/mma.6850

11. **Santra**, **S.**, & Mohapatra, J. (2021b). Numerical analysis of Volterra integro-differential equations with Caputo fractional derivative. ***Iran. J. Sci. Technol. Trans. A Sci.***, *45*(5), 1815–1824. doi:10.1007/s40995-021-01180-7

Articles Communicated/Under Preparation

1. Mohapatra, J., **Santra**, **S.**, & Kanaujiya, A. (Communicated). *A computational approach to the option price and their Greeks in time fractional Black-Scholes framework*.

2. **Santra**, **S.**, & Behera, R. (Communicated[a]). *A novel higher-order numerical method for parabolic integro-fractional differential equations based on wavelets and $L2$-1_σ scheme*. doi:10.48550/arXiv.2304.08009

3. **Santra**, **S.**, & Behera, R. (Communicated[b]). *Simultaneous space-time hermite wavelet method for time-fractional nonlinear weakly singular integro-partial differential equations*.

4. **Santra**, **S.**, & Behera, R. (Communicated[c]). *Wavelet-based $L2$-1_σ approach for time-fractional option pricing model under jump-diffusion*.

5. **Santra**, **S.**, & Behera, R. (Communicated). *Wavelet-based numerical methods for higher-order integro-fractional differential equations*.

Books and Chapters

1. Mohapatra, J., & **Santra**, **S.** (2023). Numerical simulation for time fractional integro partial differential equations arising in viscoelastic dynamical system. In ***Mathematical Methods in Dynamical Systems***, *CRC Press, Taylor & Francis Group*. doi:10.1201/9781003328032-8

Research IDs

- **Google Scholar**: https://scholar.google.co.in/citations?user=eMIbSdoAAAAJ&hl=en
- **Research Gate**: https://www.researchgate.net/profile/Sudarshan-Santra
- **MathScinet**: https://mathscinet.ams.org/mathscinet/search/author.html?mrauthid=1412031&edit=true
- **Orcid**: https://orcid.org/0000-0002-9937-1957

Conferences Workshops (International/National)

2023 **Workshop on Mathematics and Computing of Uncertainty Quantification in Model-Based Simulation for Risk-Informed Decision Making**. Participated in the workshop on "Mathematics and Computing of Uncertainty Quantification in Model-Based Simulation for Risk-Informed Decision Making". Organized by **Axis Bank Centre for Mathematics and Computing, Indian Institute of Science, Bangalore** on December 14 – 15, 2023.

Workshop on Tensor Computation and Machine Learning (TCML). Participated in the workshop on "Tensor Computation and Machine Learning (**TCML**)". Organized by **Department of Computational and Data Sciences, Indian Institute of Science, Bangalore** on November 17 – 18, 2023.

2022 **Short Term Training Program (STTP)**. Participated in the Program "Emerging Applications of Mathematics and Statistics in Engineering Science and Technology (**EAMSEST**)". Organized by **Department of Mathematics, National Institute of Technology Rourkela** on May 9 – 15, 2022.

2021 **International Conference on Mathematical Sciences (ICMS)**. Participated and presented a paper entitled "***A finite difference method for the numerical solution of Caputo fractional Volterra integro-differential equation***". Organized by **Department of Mathematics, Sardar Vallabhbhai National Institute of Technology Surat** on Oct. 7 – 9, 2021.

National Conference On Recent Trends in Mathematical Modeling and its Applications (NCRTMMA). Participated and presented a paper entitled "***A fully discrete finite difference scheme for time fractional partial integro differential equation***". Organized by **Department of Mathematics, The ICFAI University, Tripura** on Aug. 23 – 27, 2021.

2020 **International Conference On Advances in Differential Equations and Numerical Analysis (ADENA)**. Attended and presented a paper entitled "***Numerical solution of a time fractional mixed reaction convection diffusion problem involving weak singularity***". Organized by **Department of Mathematics, Indian Institute of Technology Guwahati** on Oct. 12 – 15, 2020.

International Conference On Advances in Mathematics, Science and Technology (ICAMST). Participated and presented a paper entitled "***Numerical solution of a time fractional parabolic-elliptic problem involving weak singularity***". Organized by **Department of Mathematics, Rajiv Gandhi University, Arunachal Pradesh** on Sept. 1–3, 2020.

Miscellaneous Experience

Awards and Achievements

2023 **Axis Bank Postdoctoral Fellowship**, I have been selected for the Axis Bank postdoctoral fellowship associated with the Axis Bank Centre for Mathematics and Computing, IISc Bangalore.

2018 **GATE**, Qualified GATE, organized by Indian Institute of Technology Guwahati with **AIR – 782**.

2014 **MCM Scholarship**, Awarded Merit Cum Means scholarship by Indian Institute of Technology Guwahati.

2013 **JAM**, Qualified JAM, organized by Indian Institute of Technology Delhi with **AIR – 196**.

2010 **MCM Scholarship**, Awarded Merit Cum Means scholarship by the Government of West Bengal.

Miscellaneous Experience (continued)

Reviewer in International Journals

- *Numerical Algorithms* (Springer)
- *International Journal of Applied and Computational Mathematics* (Springer)
- *Mathematical Modelling and Analysis* (VGTU)
- *International Journal of Mathematical Modelling and Numerical Optimisation* (Inderscience)
- *Mathematics* (MDPI)
- *The Journal of Supercomputing* (Springer)
- *International Journal of Dynamical Systems and Differential Equations* (Inderscience)
- *The European Physical Journal Special Topics* (Springer)
- *Studies in Applied Mathematics* (Wiley–Blackwell)
- *Computational and Applied Mathematics* (Springer)

Skills

Languages	English, Hindi, Bengali.
Computer proficiency	Matlab, C, C++, LaTeX, MS Office, Windows, Linux.

Personal Details

Place and Date of Birth	Singur, Hooghly, West Bengal, India, 24th November, 1990.
Father/Mother/Spouse	Narayan Santra/Malati Santra/Rina Paul Santra.
Current Address	Department of Computational and Data Sciences, Indian Institute of Science, Bangalore, PIN 560012.
Permanent Address	Paltagarh, Singur, Hooghly, West Bengal, PIN 712409.

References

Prof. Jugal Mohapatra
Professor & Head
Department of Mathematics,
National Institute of Technology Rourkela,
Rourkela, Odisha, India, 769008.
☎ 0661 246 2711
✉ jugal@nitrkl.ac.in
✉ jugal.math@gmail.com

Prof. Ratikanta Behera
Assistant Professor
Department of Computational and Data Sciences,
Indian Institute of Science, Bangalore,
Karnataka, India, 560012.
☎ +91 9310192034
✉ ratikanta@iisc.ac.in

Prof. Debajyoti Choudhuri
Associate Professor
School of Basic Sciences (Mathematics),
Indian Institute of Technology Bhubaneswar,
Bhubaneswar, Odisha, India, 752050.
☎ +91 7682991867
✉ dchoudhuri@iitbbs.ac.in

Prof. Pratibhamoy Das
Assistant Professor
Department of Mathematics,
Indian Institute of Technology Patna,
Patna, Bihar, India, 801106.
☎ +91 612 302 8055
✉ pratibhamoy@iitp.ac.in

Declaration

I hereby declare that the information furnished above is true to the best of my knowledge.

Sudarshan Santra