

Curriculum Vitae

Dr. Shelly Arora



Official Address

Department of Mathematics,
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Contact Information

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Title of Ph.D. Thesis

Solutions of Partial Differential Equations Involving Diffusion Dispersion Phenomenon Using Weighted Residual Methods

Research Interest

Mathematical Modelling; Numerical Analysis; PDEs and ODEs.

Projects

- Awarded major research project funded by SERB-POWER. Project title “Study of non linear singularly perturbed partial differential equations using Hermite spline collocation with radial basis functions”. Sanction number SPG/202/001269. (Amount: Rs. 16,72,858/-)
- Major UGC research project entitled “Modelling of Rotary Vacuum Washer Using Collocation Technique”. Sanction No. F. No. 41-786/2012(SR). (Amount: Rs. 12,23,800/-)

- Awarded Raman Post-doctoral fellowship by University Grants Commission at University of South Florida, Tampa, FL, USA. (Amount: Rs. 23,01,716/-)

List of Ph.D. Students Guided

- **Happy Kumar:** Solution of axial dispersion model for washing zone of a rotary vacuum washer by hermite collocation.
- **Dereje Alemu Alemar:** Modelling of displacement washing of porous structure of particles involving intraparticle diffusion and longitudinal dispersion coefficients.
- **Inderpreet Kaur:** Solution of two point boundary value problems using quintic hermite spline collocation.
- **Nisu Jain:** Solutions of boundary value problems using analytic and collocation techniques.
- **Rajiv Jain:** Study of non-linear singularly perturbed differential equations using collocation method with Hermite splines.

Research and Teaching Experience:

- ✓ Worked as Raman Post-doctoral fellow in CIIM, University of South Florida, Tampa, FL, USA under the supervision of Professor A.Z. Grinshpan..
- ✓ Working as Lecturer in Department of Mathematics, Punjabi University, Patiala from 23rdOctober, 2006 to till date.
- ✓ Worked as Lecturer in Department of Mathematics, G.N.D. University, Amritsar from 03rdJuly, 2006 to 19th October, 2006.
- ✓ Worked as SRF (NET) in Department of Mathematics, SLIET, Longowal from Jan. 1, 2005 to June 30, 2006.

- ✓ Worked as JRF (NET) in Department of Mathematics, SLIET, Longowal from Dec. 18, 2002 to Dec. 31, 2004.

Membership

- ✓ Life membership Indian Mathematical Society
- ✓ Life member Punjab Academy of Sciences. L – 415 (Membership No.)
- ✓ Life member Indian Society of Industrial and Applied Mathematics. A38 (Membership No.)
- ✓ Annual member of Society of Industrial and Applied Mathematics, USA

List of Invited Talks

- Delivered an invited talk at DSCW, Ferozpur City.(2008)
- Delivered an invited talk at KMN college, Phagwara. (2010)
- Examiner of M.Phil. viva –voce at MM University Mullana. (2011)
- Delivered an invited talk at Rayat Bahra College. (2014)
- Examiner of Master viva- voce at GGSW University, Fathehgarh Sahib. (2016)
- Delivered an invited talk at GNKC, Budhladha.(2016)
- Delivered an invited talk at PEC Chandigarh.(2016)
- Delivered an invited talk at Krishna College, Budhladha.(2016)
- Delivered an invited talk at South Asian University, New Delhi.(2018)
- Chaired a session in FIAM-2018 at NIT Hamirpur. (2018)

Awards and Honors

- Awarded honourarium of \$1219.54 by Department of Mathematics, University of South Florida, Tampa, FL, USA.
- Awarded Best paper award at International Conference on Engineering and Technology, BGIET, Sangrur, INDIA.
- Awarded SRF by UGC, New Delhi, INDIA.
- Awarded JRF by UGC, New Delhi, INDIA.

List of Publications

- 1) **Shelly Arora**, S.S. Dhaliwal & V.K. Kukreja (2005). “Solution of Two Point Boundary Value Problems Using Orthogonal Collocation on Finite Elements.” *Applied Mathematics & Computation*. 171 (1), 358-370. **(IF: 4)**
- 2) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2006). “Simulation of Washing of Packed Bed of Porous Particles by Orthogonal Collocation on Finite Elements.” *Computers and Chemical Engineering*. 30 (6-7), 1054-1060. **(IF: 4.3)**
- 3) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2006). “Application of Orthogonal Collocation on Finite Elements for Solving Non Linear Boundary Value Problems.” *Applied Mathematics & Computation*. 180, 516-523. **(IF: 4)**
- 4) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2006). “A Computationally Efficient Technique for Solving Two Point Boundary Value Problems in Porous Media.” *Applied Mathematics & Computation* 183(2), 1170-1180. **(IF: 4)**

- 5) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2006). Modelling of the Displacement Washing of Pulp Fibre Bed. *Indian J. Chem. Tech.* 13, 433-439. (IF: 0.76)
- 6) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2007). “Computationally Efficient Technique For Weight Functions and Effect of Orthogonal Polynomials on the Average.” *Applied Mathematics & Computation*.186 (1), 623-631.(IF: 4)
- 7) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2007). “Modelling of Displacement Washing of Pulp Fibers Using Orthogonal Collocation on Finite Elements”. *PAMM, Proc. Appl. Math. Mech.* 7, 2150027-2150028.
- 8) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2008). Mathematical Modelling of the Washing Zone of an Industrial Rotary Vacuum Washer. *Indian J. Chem. Tech.* 15, 332-340. (IF: 0.76)
- 9) **Shelly Arora**, F. Potucek (2009). “Modelling of Displacement Washing of Packed Bed of Fibers” *Brazilian Journal of Chemical Engineering.* 26(2), 385-393. (IF: 1.2)
- 10) **Shelly Arora**, F. Potucek (2009).“Modelling of Displacement Washing of Pulp:Comparison Between Model and Experimental Data” *Cellulose Chemistry & Technology.* 43(7-8), 305-313. (IF: 1.3)
- 11) **Shelly Arora**, František Potůček, S.S. Dhaliwal and V.K. Kukreja (2009). “Modelling of Displacement Washing of Pulp Bed Using Orthogonal Collocation on Finite Elements”. Conference proceedings of *American Institute of Physics.* 1146(1), 169-176.
- 12) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2009). Convergence of Orthogonal Collocation on Finite Elements For Parabolic Partial Differential Equations. *Indian J. Ind. App. Math.* 1 (2), 63-72.
- 13) **Arora, S., Potůček, F.**, (2010). Modelling of Displacement Washing of Pulp Bed. *Pap. Celul.*, 65(9), 255. ISSN 0031-1421.

- 14) Potůček, F., **Arora, S.**, Miklík, J (2010). Vytěšňovacípranísulfátovébuničiny. *Chem. Listy*, vol. 104, no. 6, 506. ISSN 0009-2770.(**IF: 0.311**)
- 15) **Shelly Arora**, F. Potucek (2012). Verification of Mathematical Model For Displacement Washing of Kraft Pulp Fibers. *Indian J. Chem. Tech.* 19, 140-148. (**IF: 0.76**)
- 16) **Shelly Arora.**, Frantisek Potucek. (2013).Verification of Mathematical Model For Displacement Washing of Unbleached Kraft Pulp. Proceedings of 40th International Conference of SSCHE, Tatransk'eMatliare, Slovakia.
- 17) Amandeep Kaur, **Shelly**, Kukreja VK (2013). Analytic Solution of Axial Dispersion Model Using Laplace Transform. *Indian J. Ind. App. Math.* 4 (2), 1-9.
- 18) I. A. Ganaie, **Shelly Arora**and V.K. Kukreja (2013). "Modelling and Simulation of a Packed Bed of Pulp Fibers Using Mixed Collocation Method". *Int. J. Diff. Eqs.*,2013, 1-7.(**IF: 1.6**)
- 19) Happy Kumar, **Shelly Arora** and R.K. Nagaich (2013). "Solution of Non Linear Singular Perturbation Equation Using Hermite Collocation Method". *App. Math. Sci.*, 7(109), 5397-5408.
- 20) Pardeep Kaur, **Shelly**, Frantisek Potucek (2014). Numerical Solution of Axial Dispersion Model Using Orthogonal Collocation Method. *Indian J. Ind. App. Math.*5(1), 35-41.
- 21) **Shelly Arora.**, Indrepreet Kaur, Amandeep Kaur (2014). Study of 1D reaction diffusion problem using Hermite collocation method. *Indian J. Ind. App. Math.* 5(2), 105-110.
- 22) Inderpreet Kaur, **Shelly**. (2014). Numerical Solutions of Two Point Boundary Value Problems Using Collocation Techniques. *Int. J. Sci. Engg. Res.*, 5(1), 718-726.

- 23) Ishfaq Ahmad Ganaie, **Shelly Arora**, VK Kukreja (2014). Cubic Hermite Collocation Method for Solving Boundary Value Problems with Dirichlet, Neumann and Robin Conditions. *Int. J. Engg. Math.* 2014, 1-8.
- 24) **Shelly Arora.**, VK Kukreja, Frantisek Potucek. (2014).Analytic solution of biparameter axial dispersion model. *Comm. App. Ind. Math.* 5, DOI: 10.1685/journal.caim.458. 1-11.
- 25) Ishfaq Ahmad Ganaie, **Shelly Arora**, VK Kukreja (2015). Cubic Hermite Collocation Solution of Kuramoto Sivansiki Equation. *Int. J. Comp. Math.* 2015, 1-13.(**IF: 1.8**)
- 26) **Shelly Arora.**, Inderpreet Kaur, Frantisek Potucek. (2015).Modelling of displacement washing of pulp fibers using Hermite collocation method. *Brazilian Journal of Chemical Engineering.* 32(2), 563-575. (**IF: 1.2**)
- 27) **Shelly Arora.**, Indrepreet Kaur. (2015). Numerical solution of heat conduction problems using orthogonal collocation on finite elements. *J. Nigerian Mathematical Society.* 34(3), 286-302.
- 28) **Shelly Arora**, Happy Kumar (2016). Solution of Time Dependent Linear Singular Perturbation Problems Using Collocation Techniques with Hermite Basis. *Indian J. Ind. App. Math.* 7(2). 220-243
- 29) **Shelly Arora**, Dereje Alemu Alemar, Amandeep Kaur (2016). Approximation of Burger equation by Orthogonal Collocation Method with base shifted Jacobi Polynomials $P_n^{(\alpha,\beta)}$ for different values of α and β . *Indian J. Ind. App. Math.* 7(2). 148-164.
- 30) **Shelly Arora.**, Indrepreet Kaur. (2016). An efficient scheme for numerical solution of Burgers' equation using quintic Hermite interpolating polynomials. *Arabian Journal of Mathematics.* 5, 23-34.(**IF:1.2**)
- 31) **Shelly Arora.**, Indrepreet Kaur, Happy Kumar, VK Kukreja. (2017). A robust technique of cubic Hermite collocation for solution of two phase non linear model. *JKSU-ES.* 29, 159-165

- 32) **Shelly Arora.**, Indrepreet Kaur. (2018). Applications of quintic Hermite collocation with time discretization to singularly perturbed problems. *Applied Mathematics & Computation*. 316, 409-421. (IF: 4)
- 33) **Shelly Arora.**, Frantisek Potucek., Inderpreet Kaur. (2019). Simulation of washing of packed bed of porous particles using quintic Hermite splines. *JKSU-ES*.31(2), 114-121.
- 34) **Shelly Arora.**, Indrepreet Kaur., Wudneh Tilahun. (2020). An exploration of quintic Hermite splines to solve Burgers' equation. *Arabian Journal of Mathematics*. 9, 19-36. (IF: 1.2)
- 35) **Shelly Arora.**, Dereje Alemu Alemar., Frantisek Potucek. (2020). Study of Two-Phase Nonlinear Advection Dispersion Model for Displacement Washing of Porous Particles Using OCFE with Lagrangian Basis. *Arabian Journal for Science and Engineering*. 45, 531-542.(IF: 2.9).
- 36) **Shelly Arora**, Rajiv Jain and V.K. Kukreja (2020). Solution of Benjamin-Bona-Mahony-Burgers equation using collocation method with quintic Hermite splines. *Applied Numerical Mathematics*. 154, 1-16. (IF: 2.8)
- 37) **Shelly Arora**, Rajiv Jain and V.K. Kukreja (2023).A robust Hermite spline collocation technique to study generalized Burgers-Huxley equation, generalized Burgers-Fisher equation and Modified Burgers' equation. *Journal of Ocean Engineering and Science*. (In Press)(IF: 7.1)
- 38) Inderpreet Kaur, **Shelly Arora** and Indu Bala (2023). An Improved Technique of Quintic Hermite Splines to Discretize Generalized Burger Huxley type Equations. *Iranian Journal of Numerical Analysis and Optimization*.13 (1), 59–79.
- 39) **Shelly Arora**, Atul Pasrija (2023).A novel integral transform operator and its applications.*Iranian Journal of Numerical Analysis and Optimization*. 13(3), 553-575.

- 40) **Shelly Arora**, Indu Bala(2023). Numerical study of the coupled Burger and Burger Huxley equations using Bessel collocation scheme. *MESA*, 14(2),323-346.
- 41) **Shelly Arora**, Indu Bala(2023).Numerical Study of sine-Gordon Equations using Bessel Collocation Method. *Iranian Journal of Numerical Analysis and Optimization*. (In press)
- 42) Priyanka, **Shelly Arora**, F.M-Oudina, Saroj Sahani(2023). Super convergence analysis of fully discrete Hermite splines to simulate wave behavior of Kuramoto-Sivashinsky equation.*Wave Motion*, 121, 103187. (IF: 2.4)
- 43) **Shelly Arora**, VK Kukreja, Happy Kumar (2020). Study of Two Phase Non-Linear Model of Advection Dispersion For Displacement Washing of Porous Particles. *Advances and Applications in Mathematical Sciences*. 19(9). 859-865

Chapters in Edited Books

- 1) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2005). Numerical Solution of a Packed Bed Model Using Orthogonal Collocation. *Mathematical Biology-Recent Trends*, Anamaya Publishers, Eds. Peeyush Chandra & B.V. Rathish Kumar.
- 2) **Shelly Arora**, Indu Bala (2023). Orthogonal Collocation Approach for Solving Astrophysics Equations using Bessel Polynomials. *Advance Numerical Techniques to solve linear and nonlinear differential Equations*, River Publishers. Eds. Geeta Arora & Mangey Ram.
- 3) **Shelly Arora**, Indu Bala (2023). Bessel Collocation Method to Study Reaction Diffusion Equations. *Recent Advances in Mathematical Sciences*, Ideal Publishers. Eds. J.S. Dhiman. Khem Chand & Jyoti Prakash.

Conferences

- 1) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2006). “On The Convergence Behavior of the Method of Orthogonal Collocation on Finite Elements.” International Congress of Mathematicians, Madrid (Spain).
- 2) **Shelly Arora**, S.S. Dhaliwal and V.K. Kukreja (2007).“Modelling of Washing of Packed Bed of Porous Particles”. International Congress in Industrial and Applied Mathematics, Jammu University, Jammu (India).
- 3) **Shelly Arora**, F. Potucek (2010). “Modelling of Displacement Washing of Pulp Bed” Int. Conf. SPPC. Pardubice (Czech Republic).
- 4) **Shelly Arora**, Happy Kumar and R.K. Nagaich (2010). “Modelling of washing of a pulp bed using axial dispersion model” Satellite Conference of International Congress of Mathematicians, New Delhi (India).
- 5) **Shelly Arora**, V.K. Kukreja (2010).“Numerical Solution of Axial Dispersion Model Using Orthogonal Collocation on Finite Elements”. International Conference: Computational Methods in Applied Mathematics, Bedlewo, Poland.
- 6) **Shelly Arora**, V.K. Kukreja (2010). “Modelling of washing zone of brown stock washer” International Congress of Mathematicians, Hyderabad, India.
- 7) Kaur Amandeep., **Shelly** (2013). “Analytic Solution of One Dimensional Axial Dispersion Model Using Laplace Transforms”. National conference on Recent Advances in Continuum Mechanics. HP University, Shimla.
- 8) Pardeep Kaur., **Shelly**(2013).“Numerical Solution of Non Linear Axial Dispersion Model Using Orthogonal Collocation Method”. National conference on Recent Advances in Continuum Mechanics. HP University, Shimla. March 29-30, 2013.
- 9) Inderpreet Kaur., **Shelly**(2013). “Numerical Solution of Axial Dispersion Model Involving Two Parameters Using Orthogonal Collocation on Finite

- Elements”. National conference on Recent Advances in Continuum Mechanics. HP University, Shimla. March 29-30, 2013.
- 10) **Shelly Arora.**, Arcadii Z Grinshpann (2015). “Applications of Weighted convolution inequalities to PDEs” 13th international symposium on orthogonal polynomials, special functions and applications, NIST, Gaithersburg, Maryland, USA.
 - 11) **Shelly Arora** (2016). “Applications of Hypergeometric Techniques to Analysis of Singular Perturbation Problems” 32nd Southeastern Analysis Meeting (SEAM 2016), USF, Tampa, Florida, USA.
 - 12) **Shelly Arora.**, Arcadii Z Grinshpann (2016). “Convolutions in Time Dependent Heat Conduction Equations” International Conference in Mathematical Analysis and Applications (ICMAA), IIT Roorkee, Roorkee.
 - 13) Sergei Abramovich., **Shelly Arora.**, Arcadii Z Grinshpann (2017). “Action learning breaks out mindset in mathematics” Indo-US global Expo Summit, Indus Foundation, Hyderabad, Telangana, INDIA.
 - 14) **Shelly Arora** (2017). Regional Workshop on Indian Women Mathematics Research and Career Opportunities. Punjabi University, Patiala, INDIA.
 - 15) **Shelly Arora** (2018). “Numerical solution of Burger equation using quintic Hermite splines with collocation technique”. International Conference on Mathematical Modelling and Computations. South Asian University, New Delhi, INDIA
 - 16) **Shelly Arora**, Inderpreet Kaur, VK Kukreja (2018). “Numerical analysis of singularly perturbed problems using quintic Hermite splines” International Conference on Engineering and Technology, BGIET, Sangrur, INDIA.
 - 17) **Shelly Arora** (2018). “Study of singular perturbation equations using quintic Hermite collocation method with time discretization method”. International Conference & 14th Biennial conference of ISIAM. GND University, Amritsar, INDIA.

- 18) **Shelly Arora** (2018). Recent Development in Mathematical Modelling & Fuzziology, Chandigarh University, Mohali, INDIA.
- 19) **Shelly Arora** (2018). "Solution of Burgers' equations by quintic Hermite splines". international conference on Frontiers in Industrial & Applied Mathematics (FIAM), National Institute of Technology (NIT) Hamirpur, INDIA. (April 26-27, 2018).
- 20) Indu Bala, **Shelly Arora**(2019). "A note on Bessel collocation approach to solve Lane-Emden Equation using shifted Legendre collocation points". 2nd International Conference on Mathematical Modelling, Applied Analysis and Computational, JECRC University, Jaipur, INDIA. August 8-10, 2019.
- 21) **Shelly Arora**, Indu Bala (2020). "Bessel Collocation Approach to Solve Ordinary Differential Equations of Lane Emden type". International conference on Integrated Interdisciplinary Innovations in Engineering (ICIIIE-2020), UIET, Punjab University, Chandigarh and Government College of Engineering and Technology, Jammu, INDIA. August 28-30, 2020.
- 22) **Shelly Arora**, Rajiv Jain, V. K. Kukreja (2021). "Stability analysis of numerical solutions of Burgers' equation using Hermite Splines". 9th International Conference on Advancement in Engineering and Technology, BGIET, Sangrur, INDIA. June 25 -26, 2021.
- 23) **Shelly Arora**, Rajiv Jain, V. K. Kukreja (2021). "Analysis of Quintic Hermite Collocation method for Generalized Benjamin-Bona-Mahony-Burgers equation". 4th International Conference on Frontiers in Industrial and Applied Mathematics, SLIET, Sangrur, INDIA. Dec 21 -22, 2021.
- 24) **Shelly Arora**, Indu Bala (2021). "Bessel Collocation Approach to Solve Ordinary Differential Equations of Astrophysics". 9th International Conference on Advancement in Engineering and Technology, BGIET, Sangrur, INDIA. June 25 -26, 2021.

List of Referees

Professor Arcadii Z Grinshpan Center for industrial and Interdisciplinary Mathematics Department of Mathematics & Statistics University of South Florida Tampa, Florida USA Email: agrinshp@mail.usf.edu	Professor F.M. Oudina Department of Physics Faculty of Sciences University of 20 Aout 1955-Skikda Skikda 21000 Algeria Email: f.mebarek_oudina@univ-skikda.dz ; oudina2003@yahoo.fr
Professor S.K. Tomar Vice Chancellor JC Bose University of Science and Technology Faridabad, Haryana INDIA Email: sktomar66@gmail.com	Professor R.C. Mittal Department of Mathematics Jaypee University Noida, Uttar Pradesh INDIA Email: mittalrc@gmail.com