

# Deepanshu Verma

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## Curriculum Vitae

Department of Mathematics, MS 3F2  
George Mason University  
Fairfax, 22030 VA, USA

E-Mail: [dverma2@gmu.edu](mailto:dverma2@gmu.edu)  
Office: Room 4310, Exploratory Hall  
Web: <https://dpnshvrm.github.io/>

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## Education

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- 2018 - Present    **Ph.D. in Mathematics** | George Mason University, Fairfax, Virginia  
Advisor: Prof. Harbir Antil  
GPA: 4.0  
Expected Graduation: 2021
- 2015 - 2018    **M.Sc. in Mathematics** | Indian Institute of Technology (IIT) Bombay, Mumbai, India  
CPI: 9.65/10
- 2012 - 2015    **B.Sc.(Hons.) in Mathematics** | Shri Guru Teg Bahadur Khalsa College, Delhi University, India.  
Percentage: 95%

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## Research Interests

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PDE Constrained Optimization | Fractional PDEs | Inverse Problems |  
Numerical Analysis | Machine Learning

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## Research Experience

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- 2018 - Present    **Graduate Research Assistant**  
George Mason University, Fairfax, VA  
Advisor: Dr. Harbir Antil
- Summer 2019    **Summer Research Intern**  
George Mason University, Fairfax, VA  
Advisor: Dr. Harbir Antil

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## Teaching Experience

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- Fall 2020    **Speaker, PDE Control and Learning from Data Seminar**  
George Mason University, Fairfax, VA  
Topics: • A Mathematical Introduction to Deep Learning  
• Stochastic Gradient Descent Method  
• Back-propagation and Gradient updates

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\*For the complete list of topics, visit <http://math.gmu.edu/pde-control-seminar.php>.

- Spring 2020 **Speaker, PDE Control and Learning from Data Seminar**  
George Mason University, Fairfax, VA  
Topics\*: • Newton's Method for Optimization  
• Globally Convergent Methods for Optimization
- Feb 2020 **TA for Dr. Harbir Antil**  
Workshop on Finite Elements for Nonlinear and Multiscale Problems  
Indian Institute of Sciences (IISc), Bangalore, India  
Duties: Helped Dr. Antil in setting up the slides for his course  
Topics: • Introduction to Finite Elements and Theory  
• PDE Constrained Optimization  
• Fractional Operators: Analysis, Control, and Applications  
• Introduction to Deep learning
- Fall 2019 **Speaker, PDE Control Seminar**  
George Mason University, Fairfax, VA  
Topics\* : • Low Rank and Compressed Sensing  
• Basics of Optimization
- Spring 2019 **Moderator, Deep Learning and Optimization Discussion Group**  
George Mason University, Fairfax, VA  
Duties: Held weekly review and discussion sessions for a graduate course on Deep Learning and Optimization
- Fall 2018 **Speaker, PDE Control Seminar**  
George Mason University (GMU), Fairfax, VA  
Topics\*: • Introduction to Augmented Lagrangian Methods  
• Exact Penalty Methods  
• Sequential Quadratic Programming
- 2017 - 2018 **Graduate Teaching Assistant**  
Indian Institute of Technology Bombay, India  
Duties: Grading and proctoring for Linear Algebra

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## Preprints and Publications

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### • Journal Articles In Preparation

- (1) H. Antil, T.S. Brown, R. Löhner, F. Togashi and **D. Verma**. DNNs for Chemically Reacting Flows.
- (2) H. Antil, H.C. Elman, A. Onwunta and **D. Verma**. A Fractional DNN Based Solver for Bayesian Inverse Problems.
- (3) H. Antil, R. Arndt, C. N. Rautenberg, and **D. Verma**. Variational Problems with Distributional and Weak Gradient Constraints: Analysis, Algorithms, and Applications.

### • Submitted Articles

- (1) H. Antil, T.S. Brown, **D. Verma** and M. Warma. Optimal Control of Fractional Parabolic PDEs with State Constraints. arXiv: <https://arxiv.org/pdf/2004.09595.pdf>.
- (2) H. Antil, T.S. Brown, and **D. Verma**. Moreau-Yosida Regularization for Optimal Control of Fractional Elliptic Problems with State Constraints. arXiv: <https://arxiv.org/pdf/1912.05033.pdf>.

• **Published/Accepted**

- (1) H. Antil, R. Khatri, R. Löhner and **D. Verma**. Fractional Deep Neural Network via Constrained Optimization. *Machine Learning: Science and Technology 2020*. DOI: <https://doi.org/10.1088/2632-2153/aba8e7>.
- (2) H. Antil, **D. Verma** and M. Warma. Optimal Control of Fractional Elliptic PDEs with State Constraints and Characterization of the dual of Fractional Order Sobolev Spaces. *J Optim Theory Appl (2020)*. DOI: <https://doi.org/10.1007/s10957-020-01684-z>.
- (3) H. Antil, **D. Verma** and M. Warma. External Optimal Control of Space-Time Fractional Parabolic PDEs. *ESAIM: COCV 26 (2020) 20*. DOI: <https://doi.org/10.1051/cocv/2020005>.

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## Honors and Awards

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- George Mason University, **Presidential Merit Fellowship**, 2018 - 2022.
- George Mason University, **Dean's Graduate Award for Excellence**, 2019-2020.
- George Mason University, **Presidential Scholar Summer Research Fellowship**, Summer 2020.
- Travel support from SIAM as Student Chapter Representative for SIAM Annual Meeting 2020 Student Days Program, Toronto, Canada, July 2020.
- Travel support from SIAM Southeastern Atlantic Section (SIAM-SEAS) to present at SIAM-SEAS Conference at Auburn University, Auburn, March 2020.
- Local support from conference organizing committee to attend Workshop on Finite Elements for Nonlinear and Multiscale Problems, Indian Institute of Sciences (IISc), Bangalore, India, February 2020.
- Local support from conference organizing committee to present at Special Semester on Optimization, Johann Radon Institut (RICAM), Linz, Austria, October 2019.
- Office of the Provost, George Mason University, **Graduate Student Travel Fund (GSTF)** to present at Sixth International Conference on Continuous Optimization at TU Berlin, Germany, August 2019.

- Financial Support Grant from conference organizing committee to present at Sixth International Conference on Continuous Optimization (ICCOPT) at TU Berlin, Germany, August 2019.
- Department of Mathematics, George Mason University, **Achievements in Analysis Award**, May 2019.
- Travel Award from conference organizing committee to attend Workshop on Dynamics, Control and Numerics for Fractional PDEs, San Juan, Puerto Rico, December 2018.
- 2017 - 2018: Indian Institute of Technology, Bombay, **Ph.D. Scholarship**.
- 2017: M.Sc. Mathematics, Indian Institute of Technology, Bombay, **Institute Silver Medal** for academic excellence.
- 2017: M.Sc. Mathematics, Indian Institute of Technology, Bombay, **Mrs. Rama Mathur Award** for securing highest CPI (GPA).
- 2017: M.Sc. Mathematics, Indian Institute of Technology, Bombay, **Prof. P.V. Sukhatme Memorial Prize Award** for securing highest CPI (GPA).
- 2017: **Graduate Aptitude test in Engineering in Mathematics**, All India Rank: 70.
- 2016: **Junior Research Fellowship Awardee**, All India Rank: 09.
- 2015: B.Sc.(H) Mathematics, Shri Guru Teg Bahadur Khalsa College, Delhi University, India, **1<sup>st</sup> rank holder**.

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## Presentations

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- August 2020: Sayas Numerics Seminar (virtual). Link to video: [zoom](#)
- September 2020<sup>†</sup>: **Minisymposium speaker**. Optimal Control and Optimization for nonlocal and fractional problem. IFIP TC7 Conference on System Modelling and Optimization, Quito, Ecuador.
- September 2020<sup>†</sup>: **Minisymposium speaker**. Nonlocal PDEs and Calculus of Variations. IFIP TC7 Conference on System Modelling and Optimization, Quito, Ecuador.
- July 2020<sup>†</sup>: **Minisymposium speaker**. Modelling with Fractional PDEs: Numerical Analysis and Applications. The Second Joint SIAM/CAIMS Annual Meeting 2020, Toronto, Canada.
- May 2020<sup>†</sup>: Sayas Numerics Day, University of Maryland, Baltimore County.

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<sup>†</sup>Did not take place due to COVID

- May 2020<sup>†</sup>: **Minisymposium speaker**. Numerical Methods for Optimization Problems with PDE Constraints. Second International Conference on Computational Methods and Applications in Engineering (ICCMAE), Mississippi State University.
- April 2020<sup>†</sup>: East Coast Optimization Meeting 2020, George Mason University, Fairfax, VA.
- March 2020<sup>†</sup>: 16th Copper Mountain Conference on Iterative Methods, Copper Mountain, CO.
- March 2020<sup>†</sup>: **Minisymposium speaker**. Recent Developments in Nonlocal Continuum Modeling. 44th SIAM Southeastern Atlantic Section Conference, Auburn University, Auburn.
- November 2019: Finite Element Circus, Virginia Tech, Blacksburg, VA.
- October 2019: **Invited talk** at Special Semester on Optimization, Johann Radon Institut (RICAM), Linz, Austria.
- October 2019: Student Research Talks (StReeTs), George Mason University.
- August 2019: **Minisymposium speaker**. Fractional/Nonlocal PDEs: applications, control, and beyond. Sixth International Conference on Continuous Optimization, TU Berlin, Germany.
- May 2019: DelMar Numerics Day 2019, University of Maryland, College Park.
- April 2019: East Coast Optimization Meeting 2019, George Mason University, Fairfax, VA.

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### Professional Services

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- Fall 2019 - Present: **Executive Board Member**, SIAM, Student Chapter GMU.
- April 2020: **Support Team Member and SIAM Representative**, Annual East Coast Optimization Meeting, George Mason University. April 2-3, 2020, <http://math.gmu.edu/~hantil/ECOM/2020/>.
- March 2020: **Reviewer**, Spring 2020 Mason Core assessment.
- November 2019: **Co-Organizer**, SIAM Symposium, SIAM Student Chapter GMU.
- September 2019: **Volunteer**, Departmental Tea/Coffee time organized by Department of Mathematics in Fall 2019.
- Fall 2019 - : **Student Coordinator**, PDE-Control Seminar, George Mason University.

- April 2019: **Support Team Member**, Annual East Coast Optimization Meeting, George Mason University. April 4-5, 2019, <http://math.gmu.edu/~hantil/ECOM/2019/>.
- 2018: **Volunteer Grader**, Northern VA Regional MATHCOUNTS Competition, George Mason University, Fairfax, VA.
- Fall 2018: **Volunteer**, Mason Experimental Geometry Lab (MEGL) Outreach for middle school students.
- March 2018: **Student Volunteer**, New Directions in PDE Constrained Optimization, Indian Institute of Technology, Bombay.
- July 2016 - 2017: Core team member of Public Relation team in Mathematics Olympiad, conducted by Mathematics Association of IIT Bombay.
- May 2016 - 2017: Member of the Institute Student Companion Programme (ISCP), a programme within the IIT Bombay with the primary objective of aiding in the overall development of the new entrants.

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### Professional Memberships

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- 2018 - Present: Member of the American Mathematical Society (AMS).
- 2018 - Present: Member of the Association for Women in Mathematics (AWM), Student Chapter GMU.
- 2018 - Present: Member of the Society for Industrial and Applied Mathematics (SIAM).

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### Programming

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C++ | Matlab | Python |  $\text{\TeX}$  | Mathematica

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### Other Interests

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Hiking | Traveling