

Souvik Roy

Assistant Professor,
University of Texas at Arlington, USA

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Educational Detail

- **Tata Institute of Fundamental Research,
Centre for Applicable Mathematics (TIFR-CAM)** Bangalore, India
Ph.D. Mathematics 2011 – 2015
 - Thesis title: Reconstruction of a class of fluid flows by variational methods and inversion of integral transforms in tomography.
 - Advisors: A. S. Vasudeva Murthy, Praveen Chandrashekar and Venkateswaran P. Krishnan.
- **Tata Institute of Fundamental Research, CAM** Bangalore, India
M.Phil. Mathematics 2010 – 2011
 - Thesis title: Optical Flows – Determination of 2D velocities of a moving fluid.
 - Advisors: A. S. Vasudeva Murthy and Praveen Chandrashekar.
- **Tata Institute of Fundamental Research, CAM** Bangalore, India
M.Sc. Mathematics 2008 – 2010
 - Graduated with 1st position and a 79.25% score.
- **Ramakrishna Mission Vidyamandira, Belur Math** West Bengal, India
University of Calcutta 2005 – 2008
B.Sc. Mathematics
 - Graduated with 4th position and a 82.5% score.

Professional Experience

- **University of Texas at Arlington (UTA)** Arlington, Texas, USA
Assistant Professor August 2018 – present
- **Tata Institute of Fundamental Research, CAM** Bangalore, India
Visiting fellow March 2018 – July 2018
- **University of Würzburg** Würzburg, Germany
Postdoctoral fellow Sep 2016 – Sep 2017
- **International Centre for Theoretical Sciences (ICTS)** Bangalore, India
Postdoctoral fellow Jan 2016 – August 2016
- **University of Würzburg** Würzburg, Germany
Postdoctoral fellow July 2015 – Dec 2015
- **University of Texas at Arlington** Texas, USA
Postdoctoral fellow Jan 2015 – May 2015
- **University of Würzburg** Würzburg, Germany
Deutscher Akademischer Austauschdienst (DAAD) visiting scientist Oct 2014 – Dec 2014

Current Research Interests

- Inverse problems in medical imaging and fluid flows.
- Optimal control framework for stochastic processes, health sciences and medical imaging.
- QSP modeling and control for treatment of cancer.
- Numerical analysis and numerical linear algebra.
- Numerical methods for fluid flows.
- Shape optimization.

Awards, Grants & Honours

- H.C. Ørsted COFUND fellowship (under Marie Skłodowska-Curie Actions grant no. 609405 (FP7) and 713683 (H2020)) for postdoctoral studies at Denmark Technical University (S. Roy declined the offer due to accepting the UTA assistant professor position). 2017
- Deutsche Forschungsgemeinschaft (DFG) grant for postdoctoral studies at University of Würzburg, Germany. Sep 2016–Sep 2017
- Indo-French Centre for Applied Mathematics (IFCAM) visiting scientist fellowship for postdoctoral studies at University of Nice, France. April 2016–June 2016
- ICTS postdoctoral fellowship. Jan 2016–August 2016
- Postdoctoral fellowship under the project “Multi-ITN Strike” at University of Würzburg, Germany. July 2015–Dec 2015
- University of Texas, Arlington and AIRBUS fellowship for postdoctoral studies at University of Texas, Arlington, USA Jan 2015–May 2015
- Deutscher Akademischer Austauschdienst (DAAD) visiting scholar fellowship for research visit to University of Würzburg, Germany. Oct 2014–Dec 2014
- TIFR-CAM doctoral fellowship. 2010–2015
- TIFR-CAM masters fellowship. 2008–2010
- Achieved 1st position in M.Sc exams at TIFR-CAM. 2008–2010
- Achieved 4th position in B.Sc. exams at University of Calcutta. 2005–2008
- Achieved 71st (out of more than 10000 participants) rank in the National Science Olympiad, India. 2004

Publications and Reports

Publications in Preparation or Submitted

1. Suvra Pal and Souvik Roy. A new estimation algorithm for Box-Cox transformation cure rate model and comparison with EM algorithm (*submitted*).
2. Madhu Gupta, Rohit Kumar Mishra and Souvik Roy. Sparse reconstruction of log-conductivity in current density impedance tomography. (*submitted*).
3. Jan Bartsch, Alfio Borzì, Francesco Fanelli and Souvik Roy. A theoretical investigation of Brockett's ensemble optimal control problems. (*submitted*).
4. Jan Bartsch, Alfio Borzì, Francesco Fanelli and Souvik Roy. A numerical investigation of Brockett's ensemble optimal control problems. (*under preparation*).
5. Amit Apte, Didier Auroux, Mythily Ramaswamy, Souvik Roy and Vishal Vasan. Observers for tracking an image driven by compressible Navier-Stokes equations. (*under preparation*).

Peer-reviewed Publications

1. Anisa M.H. Chorwadwala and Souvik Roy. How to place an obstacle having a dihedral symmetry centered at a given point inside a disk so as to optimize the fundamental Dirichlet eigenvalue. *Journal of Optimization Theory and Applications*, <https://doi.org/10.1007/s10957-019-01483-1>, 2019.
2. Souvik Roy, Mario Annunziato, Alfio Borzì and Christian Klingenberg. A Fokker-Planck approach to control collective motion. *Computational Optimization and Applications*, 69(2):423–459, 2018.
3. Gaik Ambartsoumian, Rim-Gouia-Zarrad, Venkateswaran P. Krishnan and Souvik Roy. Image reconstruction from radially incomplete spherical Radon data. *European Journal of Applied Mathematics*, 29(3): 470–493, 2018.
4. Souvik Roy and Alfio Borzì. A new optimisation approach to sparse reconstruction of log-conductivity in acousto-electric tomography. *SIAM Journal of Imaging Sciences*, 11(2):1759–1784, 2018.
5. Bolaji Adesokan, Kim Knudsen, Venkateswaran P. Krishnan and Souvik Roy. A fully non-linear optimization approach to acousto-electric tomography. *Inverse Problems*, 34:104004, 2018.
6. Souvik Roy, Alfio Borzì and Abderrahmane Habbal. Pedestrian motion constrained by FP-constrained Nash games. *Royal Society Open Science*, 4(9):170648, 2017.
7. Praveen Chandrashekar, Souvik Roy and A. S. Vasudeva Murthy. A variational approach to estimate incompressible fluid flows. *Proceedings of Mathematical Sciences, Springer*, 127(1):175–201, 2017.
8. Souvik Roy and Alfio Borzì. Numerical investigation of a class of Liouville control problems. *Journal of Scientific Computing*, 73(1):178–202, 2017.
9. Gaik Ambartsoumian and Souvik Roy. Numerical inversion of a broken ray transform arising in single scattering optical tomography. *IEEE Transactions on Computational Imaging*, 2(2): 166–173, 2016.

10. Souvik Roy, Mario Annunziato and Alfio Borzi. A Fokker–Planck feedback control-constrained approach for modelling crowd motion. *Journal of Computational and Theoretical Transport*, 45(6): 452–458, 2016.
11. Souvik Roy, Venkateswaran P. Krishnan, Praveen Chandrasekhar and A. S. Vasudeva Murthy. An efficient numerical algorithm for Radon transform inversion with applications in ultrasound imaging. *Journal of Mathematical Imaging and Vision, Springer*, 53:78–91, 2015.
12. Souvik Roy, Praveen Chandrashekar and A. S. Vasudeva Murthy. A variational approach to optical flow estimation of unsteady incompressible flows. *International Journal of Advances in Engineering Sciences and Applied Mathematics, Springer*, 7(3):149–167, 2015.

Technical Reports and Dissertations

1. Reconstruction of a class of fluid flows by variational methods and inversion of integral transforms in tomography. *Doctoral Dissertation*, TIFR-CAM, 2015.
2. Optical Flows – Determination of 2D velocities of a moving fluid. *M.Phil Dissertation*, TIFR-CAM, 2011.
3. Gaurav Sharma and Souvik Roy. Bubble drag coefficient formulation and stability analysis for multiphase-turbomachinery problems (Shear flow/breakup GE2), *Modeling week and study group meeting on industrial problems*, Supercomputer Education Research Center, Indian Institute of Science, Bangalore, India, 58-73, 2011.
4. Andrew A. Lacey, A. S. Vasudeva Murthy and Souvik Roy. Fish feeding. *Modeling week and study group meeting on industrial problems*, Supercomputer Education Research Center, Indian Institute of Science, Bangalore, India, 32-55, 2011.

Selected list of invited presentations

1. **A new non-linear optimization framework for acousto-electric tomography**
Mini-symposium talk at the conference Applied Inverse Problems, Grenoble, France *July, 2019*
2. **A Fokker-Planck approach to control crowd motion**
Collaborative Conference on Math-Finance and Statistics, Hawaii, USA *March, 2019*
3. **Controlling pedestrian motion through a Nash games framework**
Guest Speaker, Mathematical Association of America, University of Texas at Arlington, USA *March 2019*
4. **A fully non-linear optimization approach for acousto-electric tomography**
Computational Science Seminar, University of Texas, Dallas, USA *February, 2019*
5. **Math: A boon or a curse**
Guest Speaker at a faculty program for student residents, University of Texas at Arlington, USA *November, 2018*
6. **Inverse problems and PDE-constrained optimization**
SIAM Student Chapter, University of Texas at Arlington, USA *October, 2018*
7. **Non-linear optimization methods for acousto-electric tomography**
Departmental Seminar, TIFR-CAM, India *May, 2018*

8. **An introduction to linear ordinary differential equations and some numerical methods**
Mathematics Department Seminar, American University of Sharjah, UAE *April, 2018*
9. **A Fokker-Planck Nash differential game to model crowd motion with avoidance**
Mathematics Department Colloquium, American University of Sharjah, UAE *April 2018*
10. **A Fokker-Planck Nash differential game to model crowd motion with avoidance**
Mathematics Department Seminar, Denmark Technical University, Denmark *August, 2017*
11. **A novel numerical method for a class of Liouville control problems**
Workshop on Numerical Methods for Optimal Control and Inverse Problems, Technical University of Munich, Germany *April, 2017*
12. **Numerical inversion of a broken ray transform arising in single scattering optical tomography**
Mini-symposium talk at the conference "100 Years of the Radon Transform", The Radon Institute of Computational and Applied Mathematics, Linz, Austria *March, 2017*
13. **Numerical investigation of a class of Liouville control problems**
Mathematics Department Seminar, University of Nice, France *March, 2017*
14. **Inversion of a spherical Radon transform in a spherical shell**
Mathematics Department Seminar, Denmark Technical University, Denmark *October, 2016*
15. **Numerical inversion of a broken ray transform arising in single scattering optical tomography**
Mathematics Department Seminar, ICTS, Bangalore, India *July, 2016*
16. **Inversion of a spherical Radon transform in a spherical shell**
Mini-symposium talk at the conference "Inverse Problems: Modeling and Simulation", Turkey *May, 2016*
17. **A Fokker-Planck approach to control collective motion**
Mathematics Department Seminar, ICTS, Bangalore, India *October, 2015*
18. **Inverse problems in imaging**
Inverse Problem Seminar Series, University of Texas at Arlington, USA *March, 2015*
19. **A variational approach to flow estimation of unsteady incompressible flows**
Finite Element Meet, TIFR-CAM, Bangalore, India *December, 2014*
20. **A discontinuous Galerkin vorticity-velocity formulation for incompressible 2D Euler flow.**
Mathematics Department Seminar, Indian Institute of Science Education and Research, Pune, India *June, 2014*
21. **Optimal control approach for estimation of incompressible fluid flows**
28th Annual Conference Of Ramanujam Mathematical Society, Ramaiah Institute of Technology, Bangalore, India *June, 2013*

Workshops and Conferences

1. **Numerical Methods for Optimal Control and Inverse Problems**
Technical University of Munich, Germany *April, 2017*

2. **100 Years of the Radon Transform**
The Radon Institute of Computational and Applied Mathematics, Linz, Austria *March, 2017*
3. **8th International Conference on Inverse Problems: Modeling and Simulation**
Turkey *May, 2016*
4. **Conference on Computational Partial Differential Equations, Finite Element Meet**
TIFR-CAM, Bangalore, India *December, 2014*
5. **Gene Golub SIAM Summer School**
The Radon Institute of Computational and Applied Mathematics, Linz, Austria *August, 2014*
6. **Advanced Instructional School on Theoretical and Numerical Aspects of Inverse Problems**
TIFR-CAM, Bangalore, India *June, 2014*
7. **Workshop on Optimization with PDE Constraints**
TIFR-CAM, Bangalore, India *November, 2013*
8. **Summer School on Numerics and Control of PDEs**
Indian Institute of Science, Bangalore, India *July-August, 2013*
9. **Compact Course on Discontinuous Galerkin Methods by Chi-Wang Shu**
TIFR-CAM, Bangalore, India *July, 2013*
10. **International Conference on Conservation Laws and Applications**
TIFR-CAM, Bangalore, India *July, 2013*
11. **Theoretical and Computational Aspects of Nonlinear Waves**
Indian Institute of Technology, Bombay, India *May, 2013*
12. **Advanced Workshop on Non-Standard Finite Element Methods**
Indian Institute of Technology, Bombay, India *February, 2013*
13. **Instructional Workshop on Finite Element Methods**
TIFR-CAM, Bangalore, India *July, 2012*
14. **School on Cocompact Embeddings and Profile Decompositions**
TIFR-CAM, Bangalore, India *July, 2011*
15. **Workshop on Computational Science**
Supercomputer Education Research Centre , Bangalore, India *March, 2011*
16. **Mesh-Free Conference**
Indian Institute of Science, Bangalore, India *March, 2011*
17. **Monsoon School on Data Assimilation Research Programme**
TIFR-CAM, Bangalore, India *February, 2011*
18. **Workshop on Scientific Discovery through Intensive Data Exploration**
Jawaharlal Nehru Centre For Advanced Scientific Research, Bangalore, India *January, 2011*
19. **Conference on Recent Trends in Non-Linear Elliptic PDEs** *TIFR-CAM, Bangalore, India*
January, 2011
20. **Indian Institute of Science Mathematics Initiative (IMI) Workshop and Symposium on Mathematical Ecology**
Indian Institute of Science Education and Research, Kolkata, India *November, 2010*

21. **International Conference of Mathematicians-Satellite Conference on Partial Differential Equations**
TIFR-CAM, Bangalore, India *August, 2010*
22. **IMI Workshop and International Conference on Homogenization**
Indian Institute of Science, Bangalore, India *May, 2013*
23. **Symposium on “Perspectives in Mathematics”**
TIFR, Mumbai, India *November, 2009*

Students Supervised

Supervised Ph.D. Students

1. **John Montalbo**, current, University of Texas at Arlington, USA (co-supervised with Gaik Ambartsoumian).

Supervised Master Students

1. **Jan Bartsch**, MS 2017, University of Würzburg, Germany (co-supervised with Alfio Borzi and Francesco Fanelli).
 Dissertation title: Optimal control problems governed by Liouville models- Theoretical analysis and implementation.
 Position after MS: Ph.D. student, University of Würzburg, Germany.

Dissertation/Thesis Committee

1. Rawan Joudeh, MS committee (chair Gaik Ambartsoumian), Mathematics, UTA.

Teaching

Teaching at UTA

1. **MATH 3319- Differential Equations and Linear Algebra (undergraduate)**, University of Texas at Arlington.
Instructor, Class size - about 60 students. Responsibilities: lectures, office hours, 3 exams per semester.
2. **MATH 1426-Calculus 1 (undergraduate)**, University of Texas at Arlington.
Instructor, Class size - about 80 students. Responsibilities: lectures, office hours, 3 exams per semester.
3. **MATH 2425- Calculus 2 (undergraduate)**, University of Texas at Arlington.
Instructor, Class size - about 70 students. Responsibilities: lectures, office hours, 3 exams per semester.

Teaching outside of UTA

1. *Mechanics (graduate)*, TIFR-CAM, Bangalore, India.
Teaching assistant, Class size - about 18 students. Responsibilities: assignment and examination evaluations, supplementary lectures.
2. *Computational Partial Differential Equations (graduate)*, TIFR-CAM, Bangalore, India.
Teaching assistant, Class size - about 10 students. Responsibilities: assignment and examination evaluations, supplementary lectures.

Professional Service

1. Co-organizer of the *Calculus Bowl*, UTA, Spring, 2019.
2. Member of the *Mathematical Association of America*, 2018-present.
3. Life member of the *Indian Society of Industrial and Applied Mathematics*, 2016-present.
4. Journal reviewer for
 - Inverse Problems
 - Inverse Problems in Science and Engineering
 - Applied Mathematics
 - Applied Mathematical Modeling
 - Journal of Ramanujan Mathematical Society
 - SIAM book reviews.
5. Organizer of the *Inverse Problems Seminar Series*, UTA, Spring, 2015.

Articles in the Media (hyperlinks)

1. February 2018 - [Science Trends: Solving mass transportation problems using Liouville equations](#)
2. September 2017- [Eureka Alert: On a collision course with game theory](#)
3. September 2017 - [PhysOrg: On a collision course with game theory](#)
4. September 2017 - [Science Daily: On a collision course with game theory](#)
5. September 2017 - [N+1: Pedestrian traffic described using game theory](#)
6. September 2017- [Jura Forum: On a collision course with game theory](#)

Additional Information

Programming skills

- C++, PYTHON, MATLAB
- FENICS, COMSOL, DEAL.II
- PARAVIEW, VISIT
- GITHUB

Languages

Fluent in English, Bengali and Hindi