

# Souvik Roy

Assistant Professor,  
University of Texas at Arlington, USA

March 21, 2019

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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 1<sup>st</sup> position and a 79.25% score.
- **Ramakrishna Mission Vidyamandira, Belur Math** West Bengal, India  
*University of Calcutta* 2005 – 2008  
*B.Sc. Mathematics*
  - Graduated with 4<sup>th</sup> 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 1<sup>st</sup> position in M.Sc exams at TIFR-CAM. 2008–2010
- Achieved 4<sup>th</sup> position in B.Sc. exams at University of Calcutta. 2005–2008
- Achieved 71<sup>st</sup> (out of more than 10000 participants) rank in the National Science Olympiad, India. 2004

### Publications in Preparation or Submitted

1. Madhu Gupta, Rohit Kumar Mishra and Souvik Roy. Sparse reconstruction of log-conductivity in current density impedance tomography. (*submitted*).
2. Jan Bartsch, Alfio Borzì, Francesco Fanelli and Souvik Roy. A theoretical investigation of Brockett's ensemble optimal control problems. (*submitted*).
3. Jan Bartsch, Alfio Borzì, Francesco Fanelli and Souvik Roy. A numerical investigation of Brockett's ensemble optimal control problems. (*under preparation*).
4. 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 MHC 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 Borzì. 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 Theses

1. Reconstruction of a class of fluid flows by variational methods and inversion of integral transforms in tomography. *Doctoral Dissertation*, Tata Institute of Fundamental Research, CAM, 2015.
2. Optical Flows – Determination of 2D velocities of a moving fluid. *M.Phil Dissertation*, Tata Institute of Fundamental Research, CAM, 2015.
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, 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, 32-55, 2011.

## Selected list of invited presentations

1. **A Fokker-Planck approach to control crowd motion**  
*Collaborative Conference on Math-Finance and Statistics, Hawaii, USA* *March 2019*
2. **Controlling pedestrian motion through a Nash games framework**  
*Guest Speaker, Mathematical Association of America, University of Texas at Arlington, USA* *March 2019*
3. **A fully non-linear optimization approach for acousto-electric tomography**  
*Computational Science Seminar, University of Texas, Dallas, USA* *February, 2019*
4. **Inverse problems and PDE-constrained optimization**  
*SIAM Student Chapter, University of Texas at Arlington, USA* *October 2018*
5. **Non-linear optimization methods for acousto-electric tomography**  
*Departmental Seminar, TIFR-CAM, India* *May, 2018*
6. **An introduction to linear ordinary differential equations and some numerical methods**  
*Mathematics Department Seminar, American University of Sharjah, UAE* *April, 2018*
7. **A Fokker-Planck Nash differential game to model crowd motion with avoidance**  
*Mathematics Department Colloquium, American University of Sharjah, UAE* *April 2018*
8. **A Fokker-Planck Nash differential game to model crowd motion with avoidance**  
*Mathematics Department Seminar, Denmark Technical University, Denmark* *August, 2017*
9. **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*

10. **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*
11. **Numerical investigation of a class of Liouville control problems**  
*Mathematics Department Seminar, University of Nice, France* *March, 2017*
12. **Inversion of a spherical Radon transform in a spherical shell**  
*Mathematics Department Seminar, Denmark Technical University, Denmark* *October, 2016*
13. **Numerical inversion of a broken ray transform arising in single scattering optical tomography**  
*Mathematics Department Seminar, ICTS, Bangalore, India* *July, 2016*
14. **Inversion of a spherical Radon transform in a spherical shell**  
*Mini-symposium talk at the conference “Inverse Problems: Modeling and Simulation”, Turkey* *May, 2016*
15. **A Fokker-Planck approach to control collective motion**  
*Mathematics Department Seminar, ICTS, Bangalore, India* *October, 2015*
16. **Inverse problems in imaging**  
*Inverse Problem Seminar Series, University of Texas at Arlington, USA* *March, 2015*
17. **A variational approach to flow estimation of unsteady incompressible flows**  
*Finite Element Meet, TIFR-CAM, Bangalore, India* *December, 2014*
18. **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*
19. **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. **8<sup>th</sup> 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 Borzì and Francesco Fanelli).  
Dissertation title: Optimal control problems governed by Liouville models- Theoretical analysis and implementation.  
Position after MS: Ph.D. student, University of Texas at Arlington, USA.

## Dissertation/Thesis Committee Membership

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