Souvik Roy

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Assistant Professor,
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Educational Detail

- **Tata Institute of Fundamental Research,**
  Centre for Applicable Mathematics (TIFR-xCAM) — 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 Chandrashekhar.
- **Tata Institute of Fundamental Research, CAM** — Bangalore, India
  M.Sc. Mathematics — *2008 – 2010*
  - Graduated with 1$^{\text{st}}$ 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$^{\text{th}}$ 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 Sklodowska-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^{st} position in M.Sc exams at TIFR-CAM. 2008–2010
- Achieved 4^{th} position in B.Sc. exams at University of Calcutta. 2005–2008
- Achieved 71^{st} (out of more than 10000 participants) rank in the National Science Olympiad, India. 2004

Publications and Reports

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^{th} **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