Arnab Roy

Curriculum Vitae

Basque Center for Applied Mathematics (BCAM)
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Personal Information

Nationality Indian.
Sex Male
Languages English, Hindi, Bengali.

Research Interests

- Fluid-Structure Interaction: Modelling and mathematical analysis of FSI problems, Existence, uniqueness, singular limits and long time behaviour of the solutions.
- Fluid Mechanics: Incompressible, Compressible Navier-Stokes, Hard sphere pressure model.
- Control of PDE : Controllability, Stabilizability and Optimal control problem for Fluids and Fluid-Structure interaction models.

Employment

Sept. 2024- **Ikerbasque Researcher and Ramón y Cajal Fellow**, *Basque center for applied mathematics (BCAM)*, Bilbao, Spain.
Team: Applied Analysis (AA).

Oct. 2022 - Aug. 2024 **Humboldt Fellow**, *TU Darmstadt*, Germany.
Host: Prof. Matthias Hieber.
Team: Applied Analysis (AA).

Nov. 2021 - Sept. 2022 **Post Doctoral Fellow**, *Basque center for applied mathematics (BCAM)*, Bilbao, Spain.
Advisor: Prof. Arghir Dani Zarnescu.
Team: Applied Analysis (AA).

Jan. 2020 - Oct. 2021 **Post Doctoral Fellow**, *Institute of Mathematics of the Czech Academy of Sciences*, Prague, Czech Republic.
Advisor: Prof. Šarka Nečasová.
Team: Evolution Differential Equations (EDE).

Sep. 2018 - Aug. 2019 **Post Doctoral Fellow**, *Institut Élie Cartan de Lorraine (IECL) and INRIA*, Nancy, France.
Advisor: Prof. Takéo Takahashi.
Team: EDP (IECL) and SPHINX (INRIA).

Education

2015–2018 **PhD**, *Tata Institute Of Fundamental Research-CAM*, Bangalore,India.
Title: *Existence, Controllability and Stabilization of fluid models.*
Thesis Advisor: Prof. Mythily Ramaswamy.
Date of Defense: 10 July 2018.

2014–2015 **Master Degree Dissertation**, *Tata Institute Of Fundamental Research-CAM*, Bangalore,India.
Title: *Existence and regularity of nonlinear Boussinesq system.*

Thesis Advisor: Prof. Mythily Ramaswamy.

2012–2014 **M.Sc in Mathematics**, *Tata Institute Of Fundamental Research-CAM*, Bangalore,India, *1st class with distinction*.

2009–2012 **B.Sc in Mathematics**, *University of Calcutta*, Kolkata, India, *1st class*.

Accepted Publications (Journal articles)

1. The Hydrostatic Lagrangian approach to the Compressible Primitive Equations, M. Hieber, Y. Iida, A. Roy and T. Zöchling, *Mathematische Annalen*, Pages 1–32, 2025.
2. Fluid-Structure Interaction with Porous Media: The Beaver-Joseph condition in the strong sense, T. Binz, M. Hieber and A. Roy, *J. Differential Equations, Volume 426, 660–689, 2025.*
3. Collision of a solid body with its container in a 3D compressible viscous fluid, B. J. Jin, Š. Nečasova, F. Oschmann and A. Roy, *J. Differential Equations, Volume 426, Pages 760–781 2025*.
4. Strong well-posedness and dynamics of a nematic liquid crystal-colloidal interaction model, T. Binz, F. Brandt, M. Hieber and A. Roy, *Trans. Amer. Math. Soc. 377, 8049–8090, 2024*.
5. Global existence of Weak Solutions for a model of nematic liquid crystal-colloidal interactions, Z. Geng, A. Roy and A. Zarnescu, *SIAM J. Math. Analysis, Volume 56, No. 4, Pages 4324–4355, 2024.*
6. On the motion of a nearly incompressible viscous fluid containing a small rigid body, E. Feireisl, A. Roy and A. Zarnescu, accepted in *Journal of Nonlinear Science, Volume 33, Article No. 9, 2023*.
7. On the motion of a small rigid body in a viscous compressible fluid, E. Feireisl, A. Roy and A. Zarnescu, *Communications in Partial Differential Equations, Volume 48, Issue 5, Pages 794–818, 2023*.
8. On the motion of several small rigid bodies in a viscous incompressible fluid, E. Feireisl, A. Roy and A. Zarnescu, *Journal de Mathématiques Pures et Appliqueés (JMPA), Volume 175, Pages 216–236, 2023*.
9. Motion of a Rigid body in a Compressible Fluid with Navier-slip boundary condition, Š. Nečasová, M. Ramaswamy, A. Roy and A. Schlömerkemper, *J. Differential Equations, Volume 338, Pages 256-320, 2022*.
10. Compressible Navier-Stokes system with the hard sphere pressure law in an exterior domain, Š. Nečasová, A. Novotný and A. Roy, *Z. Angew. Math. Phys. (ZAMP), Volume 73, Article No. 197, 2022*.
11. Existence of a weak solution to a nonlinear fluid-structure interaction problem with heat exchange, V. Mácha, B. Muha, Š. Nečasová, A. Roy and S. Trifunović, *Communications in Partial Differential Equations, Volume 47, Issue 8, 2022*.
12. Existence and uniqueness of maximal strong solution of a 1D Blood flow in a network of vessels, D. Maity, J. -P. Raymond and A. Roy, *Nonlinear Analysis: Real World Applications, Volume 63, February 2022, 103405.*
13. Approximate controllability and stabilizability of a linearized system for the interaction between a viscoelastic fluid and a rigid body, D. Mitra, A. Roy and T. Takahashi, *Mathematics of Control, Signals and Systems, 2021*.
14. Existence of strong solutions for a system of interaction between a compressible viscous fluid and a wave equation, D. Maity, A. Roy and T. Takahashi, *Nonlinearity 34 (4), 2021, 2659-2687.*
15. Measure-valued solutions and weak-strong uniqueness for the incompressible inviscid fluid-rigid body interaction, M. Caggio, O. Kreml, Š. Nečasová, A. Roy and T. Tang, *Journal of Mathematical Fluid Mechanics 23 (3), 2021.*
16. Self-propelled motion of a rigid body inside a density dependent incompressible fluid, Š. Nečasová, M. Ramaswamy, A. Roy and A. Schlömerkemper, *Math. Model. Nat. Phenom., 16 (2021) 9.*
17. Stabilization of a rigid body moving in a compressible viscous fluid, A. Roy and T. Takahashi, *J. Evol. Equ. 21 (2021), 167–200.*
18. Maximal-in-time existence and uniqueness of strong solution of a 3d fluid-structure interaction model, D. Maity, J. -P. Raymond and A. Roy, *SIAM J. Math. Anal., 52(6), 2020, 6338–6378.*
19. Remark on the global null controllability for a viscous Burgers-particle system with particle supported control, M. Ramaswamy, A. Roy and T. Takahashi, *Applied Mathematics Letters, September 2020, Volume 107.*
20. Local null controllability of a rigid body moving into a Boussinesq flow, A. Roy and T. Takahashi, *Math. Control Relat. Fields, December 2019, Volume 9, Issue 4, 793–836.*
21. Boundary feedback stabilization of the Boussinesq system with mixed boundary conditions, M. Ramaswamy, J.-P. Raymond and A.Roy, *J. Differential Equations 266 (2019), no. 7, 4268–4304, 2019.*

Accepted Publications (Book Chapters)

1. Wellposedness of Boussinesq system, A. Roy, to appear in *ENUMATH, 2025.*
2. Global Stabilization of a rigid body moving in a compressible viscous fluid, with D. Maity and T. Takahashi, to appear in *Lecture Notes in Mathematical Fluid Mechanics-Springer, 2023.*

3. Motion of several rigid bodies in a Compressible Fluid: mixed case, with Š. Nečasová, M. Ramaswamy and A. Schlömerkemper, *EMS Series in Industrial and Applied Mathematics (ESIAM), EMS press, Pages 135-174, 2022.*
4. Mathematical Advances in Geophysical Fluid Dynamics. *Oberwolfach Report 19 (2022), no. 4, pp. 2961-3003, EMS press*.

Submitted

1. Multilayered fluid-structure interactions: existence of weak solutions for time-periodic and initial-value problems, C. Mîndrilă and A. Roy, 2025.
2. Compressible fluids and elastic plates in 2D: a conditional no-contact theorem, D. Breit and A. Roy, 2024.
3. Dynamics of the general Q-tensor model interacting with a rigid body, F. Brandt, M. Hieber and A. Roy, 2024.
4. On the collective effect of a large system of heavy particles immersed in a Newtonian fluid, M. Bravin, E. Feireisl, A. Roy and A. Zarnescu, 2024.
5. On the effect of a large cloud of rigid particles on the motion of an incompressible non–Newtonian fluid, E. Feireisl, A. Roy and A. Zarnescu, 2024.

Research Visits

- Faculty of Mathematics, University of Seville, Spain. March 2025.
- Faculty of Mathematics, University of Warsaw, Poland. February 2025.
- Department of Mathematics, TU Clasthal, Germany. May 2024.
- Department of Mathematics, Universität Regensburg, Germany. November 2023.
- Basque Center for Applied Mathematics (BCAM), Spain. September 2023.
- Instituto Superior Técnico (IST), Lisbon, Portugal. August 2023.
- Hausdorff Research Institute for Mathematics (HIM), Bonn, Germany. March 2023.
- Tata Institute Of Fundamental Research, India. Nov.–Dec. 2019.
- Indian Institute Of Technology-Bombay, India. Oct.–Nov. 2019.
- Institute for Mathematics, University of Würzburg, Germany. May–June 2018.
- Institut de Mathématiques de Toulouse, Paul Sabatier University,Toulouse, France. April – May 2018, Sept. – Oct. 2017, Sept. – Oct. 2016.
- Institut Élie Cartan de Lorraine, Nancy, France. Oct. – Nov. 2017, Oct. – Nov. 2016.

Invited Talks

- *Mathematics with Applications 2025 on the occasion of the 60th birthday of Professor Sarka Necasova*, Funchal, Portugal, 2-6th June, 2025.
- *Spring workshop on fluid solid interactions and related problems*, CIRM-Marseille Luminy, France, 21-25 April, 2025.
- *Minisymposium in the "Young Researchers Congress of the RSME"*, Bilbao, 13-17th January, 2025.
- *Mathematics of fluids in motion: Recent results and trends*, CIRM-Marseille Luminy, France, 11-15 November, 2024.
- *Analysis and PDE Seminar, University of the Basque Country*, 19th September, 2024.
- *Minisymposium in Equadiff Conference 2024*, Karlstad University, Sweden, 10th-14th June, 2024.
- *Oberseminar AG Mathematische Modellierung, TU Clausthal*, 27th May, 2024.
- *Oberseminar Analysis, TU Darmstadt*, April, 2024.
- *Seminar in IISER Mohali*, India, February, 2024.
- *IntComSin Colloquium, FAU Erlangen-Nürnberg*, 24th November, 2023.
- *Oberwolfach Seminar: Recent Topics on the Navier-Stokes Equations*, 22nd-27th October 2023.
- *Minisymposium in ENUMATH Conference 2023*, Instituto Superior Técnico, Lisbon, 4th-8th September, 2023.
- *Oberwolfach Workshop: Mathematical Advances in Geophysical Fluid Dynamics*, 14th-18th November, 2022.

- *Oberseminar Analysis, TU Darmstadt*, 3rd November, 2022.
- *BCAM-UPV Analysis and PDE Seminar, University of the Basque Country*, 8th September, 2022.
- *Oberseminar Mathematik, University of Würzburg*, 2nd August, 2022.
- *Weekly Seminar in IISER Mohali*, India, 7th June, 2022.
- *National Institute of Science Education and Research (NISER)*, Odisha, India, 23th May, 2022.
- *Applied Mathematics and Numerical Analysis Seminar*, Instituto Superior Técnico (CEMAT, IST), Lisbon, Portugal, 5th May, 2022.
- *Minisymposium in French German Portuguese Conference on Optimization 2022*, University of Porto, Portugal, 3rd-4th May, 2022.
- *Analysis of Nematic Liquid Crystals Flows*, CIRM-Marseille Luminy, France, 25th-29th April, 2022.
- *NS-FSI Research Group Seminar*, Politecnico di Milano, Italy, 24th September, 2021.
- *SysConTalks, Department of Systems and Control*, IIT-Bombay, Mumbai, India, 9th August, 2021.
- *Minisymposium in 8th European Congress of Mathematics*, 20th–26th June 2021.
- *Nečas Seminar on Continuum Mechanics*, Charles University, Dec 07, 2020.
- *Seminar on PDEs*, Czech Academy of Sciences, June 23, 2020.
- *IIT-Bombay*, Mumbai, India, Nov 13, 2019.
- *IFSMACS Réunion*, Institut Élie Cartan de Lorraine, Nancy, France, Jan 21–22, 2019.
- *Institute of Mathematics,* Czech Academy of Sciences, Dec 18, 2018.
- *Institute for Mathematics,* University of Würzburg, June 08, 2018.
- *AIRBUS Investigators' Meeting,* TIFR - CAM, Bangalore, August 21, 2017.

Contributory Presentations

- *12th Forum of Partial Differential Equations*, Bedlewo, Poland 19th–25th September, 2021.
- Brijuni Applied Mathematics Workshop, Croatia, 4th–10th July, 2021.
- *Poster presentation*, Institut de Mathmatiqués de Bordeaux, France, Analysis and Control of Fluid-Structure Interaction Systems, Oct 02–05, 2017.

Academic Achievements

- Awarded **Spanish National Project PID2023-146764NB-I00** (2024-2028) funded by the Spanish Ministry of Science.
- Awarded **Ikerbasque Research Fellowship** (2024-2029) funded by the Ikerbasque Foundation, Spain.
- Awarded **Ramón y Cajal Fellowship** (2024-2029) funded by the Spanish Ministry of Science.
- Awarded **INSPIRE Faculty Fellowship** for 5 years by Dept. of Science and Technology (DST), Govt. of India.
- Awarded **HUMBOLDT Research Fellowship** (2022-2024) funded by the Alexander Von Humboldt Foundation.
- Postdoctoral fellowship supported by Grant Agency of the Czech Republic (GAČR).
- Postdoctoral fellowship supported by ANR research project IFSMACS.
- Senior Research Scholar fellowship from TIFR CAM (2015–2018).
- Junior Research Scholar fellowship from TIFR CAM (2012–2015).
- Secured 15th rank (JRF,CSIR) in NET (National Eligibility Test), JUNE, 2013.
- M C Nag award for First class first in Mathematics in B.Sc.
- Recipient of the SWAMI LOKESWARANANDA AWARD, 2012 for all-round performance at the Graduate level.
- Awarded INSPIRE Scholarship (2009-2012) by Govt. of India.
- Awarded WBCHSE Scholarship by State Govt. (2007-2009).

Teaching Experience

- Spring 2025: *Introduction to Compressible fluids Part I and II* (Lecturer), BCAM, Spain.
- Spring 2024: *Fourier Analysis and application to PDEs* (Lecturer), TU Darmstadt.
- Fall 2023: *Advance topics in Fluid Mechanics* (Lecturer), TU Darmstadt.
- Spring 2022: Short course on *Control of Fluid Flows*, BCAM.
- Fall 2017 : *Linear Partial Differential Equations*, Master level (Teaching Assistant), TIFR- CAM.
- Spring 2017 : *PDE III*, Master level (Teaching Assistant), TIFR- CAM.
- Spring 2016 : *PDE III*, Master level (Teaching Assistant), TIFR- CAM.
- Fall 2015 : *Real Analysis*, Master level (Teaching Assistant), TIFR- CAM.
- Fall 2014 : *Complex Analysis*, Master level (Teaching Assistant), TIFR- CAM.

Organizational Skills

- Special session "Fluid-structure interaction and free boundary problems", 15th AIMS Conference in Athens, Greece, 6–10th July, 2026.
- "2nd Bilbao Workshop on Fluid Dynamics", Basque Center for Applied Mathematics (BCAM), 3rd-5th November, 2025.
- Analysis and PDE seminar, Bilbao for 2024/25 (Weekly Seminar in BCAM and University of Basque Country).
- Minisymposium in the "Young Researchers Congress of the RSME", Bilbao, 13-17th January, 2025.
- Minisymposium in the "XXVIII Congress of differential equations and applications" CEDYA, Bilbao, 2024.
- Long night of Mathematics (Die Lange Nacht der Mathematik), TU Darmstadt 2024.
- Oberseminar in TU Darmstadt, 2023/24.
- Long night of Mathematics (Die Lange Nacht der Mathematik), TU Darmstadt 2023.
- Local Coordinator in "Fluids under control" workshop, Prague, 2021.

Supervision

- Claudiu Mîndrilă, Basque Center for Applied Mathematics. PostDoctoral Fellow, 2024-2026.)
- Meriem Essadik, L'Aquilla University, Italy. Master thesis, 2025.
- Eder Garcia Martinez, University of Basque Country. Internship, 2025.

Computer skills

- Markup Language: Latex
- Operating Systems: Unix/Linux, Windows.

References

- **Prof. Eduard Feireisl**
  Institute of Mathematics of the Czech Academy of Sciences,
  Žitná 25, CZ - 115 67,
  Praha 1, Czech Republic.
  feireisl@math.cas.cz
- **Prof. Matthias Hieber**
  Technische Universität Darmstadt,
  Schloßgartenstraße 7, 64289 Darmstadt, Germany.
  hieber@mathematik.tu-darmstadt.de
- **Prof. Šarka Nečasová**
  Institute of Mathematics of the Czech Academy of Sciences,
  Žitná 25, CZ - 115 67,
  Praha 1, Czech Republic.

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- **Prof. Mythily Ramaswamy**
  ICTS-TIFR,
  Bangalore - 560065,
  Karnataka, India.
  mythily@tifrbng.res.in
- **Prof. Jean Pierre Raymond**
  Institut de Mathmatiques de Toulouse,
  Université Paul Sabatier & CNRS,
  31062 Toulouse Cedex, France.
  raymond@math.univ-toulouse.fr
- **Prof. Takéo Takahashi**
  Institut Élie Cartan de Lorraine,
  BP 239, 54506 Vandœuvre-lés-Nancy,
  Nancy, France.
  takeo.takahashi@inria.fr
- **Prof. Arghir Dani Zarnescu**
  Basque Center for Applied Mathematics,
  14 Mazarredo, 48009 Bilbao, Basque Country, Spain.
  adzarnescu@gmail.com