

# ANUBHAB ROY

Assistant Professor,  
Department of Applied Mechanics,  
Indian Institute of Technology Madras,  
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Date of Birth - 5<sup>th</sup> January, 1985.

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## RESEARCH INTERESTS

Particle-laden flows, Waves and instabilities

## PROFESSIONAL EXPERIENCE

May 2016–Present: Assistant Professor,  
Department of Applied Mechanics, Indian Institute of Technology, Chennai

August 2012–May 2016: Postdoctoral Associate,  
School of Chemical and Biomolecular Engineering, Cornell University, Ithaca.  
Mentor: Prof. Donald L. Koch

## ACADEMIC QUALIFICATIONS

August 2006–July 2012: PhD Student  
Defended thesis in March 2013,  
Engineering Mechanics Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.  
Thesis: Singular eigenfunctions in hydrodynamic stability: the roles of rotation, stratification and elasticity  
Advisor: Prof. Ganesh Subramanian  
Co-Advisor: Prof. Rama Govindarajan

2002–2006: Bachelor of Technology (B.Tech.)  
Indian Institute of Technology (IIT) Varanasi (formerly Institute of Technology, Banaras Hindu University - IT-BHU).  
Area of specialisation: Civil Engineering.

## AWARDS/FELLOWSHIPS

- ***Srimathi Marti Annapurna Gurunath Award for Excellence in Teaching 2022*** (IIT Madras).
- ***INSA Young Scientist Medal 2020*** (Indian National Science Academy).
- ***Young Faculty Recognition Award 2020*** (IIT Madras).
- ***Prakash Faculty Externship 2019*** (Class of '78 IIT Madras).
- Science and Engineering Research Board (SERB India) ***Early Career Research Award*** 2018.
- ***Travel Grant: American Physical Society - Division of Fluid Dynamics Travel grant*** (2011).
- ***Geophysical Fluid Dynamics Summer Program Fellowship***, Woods Hole Institute of Oceanography, 2010.

## PUBLICATIONS

### (I) Under Review

1. “Wavy regime of a colloidal falling film”, Darish Jeswin Dhas S and **Anubhab Roy** submitted to *Phys. Rev. Fluids*
2. “The Brownian coagulation of like-charged aerosol particles”, Pijush Patra and **Anubhab Roy** submitted to *Phys. Rev. Fluids*
3. “Instability of a dusty vortex”, Shuai Shuai, Darish Jeswin Dhas, **Anubhab Roy** and M.Houssem Kasbaoui submitted to *J. Fluid Mech.*
4. “Collision efficiency of non-Brownian spheres in a simple shear flow - the role of non-continuum hydrodynamic interactions”, Pijush Patra, Donald L. Koch and **Anubhab Roy** submitted to *J. Fluid Mech.*
5. “Instability of a thin film of chemotactic active suspension”, Nishanth Murugan and **Anubhab Roy** submitted to *J. Fluid Mech.*

### (II) Published Papers

1. “A multiscale approach to predict the effective conductivity of a suspension using the asymptotic homogenization method”, Easwar M K, A Arockiarajan, and **Anubhab Roy**. accepted in *Phys. Fluids*, <https://doi.org/10.1063/5.0091451>.
2. “Stability of gravity-driven particle-laden flows - Roles of shear-induced migration and normal stresses”, Darish Jeswin Dhas S and **Anubhab Roy**. *J. Fluid Mech.*, **938**, A29, 2022.
3. “Transport of condensing droplets in Taylor-Green vortex flow in the presence of thermal noise”, Anu V. S. Nath, **Anubhab Roy**, Rama Govindarajan, and S. Ravichandran. *Phy. Rev. E*, **105**, 3, 2022.
4. “Inertio-elastic instability of a vortex column”, **Anubhab Roy**, Piyush Garg, Jumpal Shashikiran Reddy and Ganesh Subramanian. *J. Fluid Mech.*, **937**, A27, 2022.
5. “Instability of an auto-chemotactic active suspension”, Nishanth Murugan and **Anubhab Roy**. *J. Fluid Mech.*, **934**, A21, 2022.
6. “Linear stability of a rotating liquid column revisited”, Pulkit Dubey, **Anubhab Roy** and Ganesh Subramanian. *J. Fluid Mech.*, **933**, A55, 2022.
7. “Triadic resonances in internal wave modes with background shear”, Ramana Patibandla, Manikandan Mathur and **Anubhab Roy**. *J. Fluid Mech.*, **929**, A10, 2021.
8. “Stability of two-layer flows past slippery surfaces. Part II: Inclined channels”, Himanshu Mishra, S. Vengadesan and **Anubhab Roy**. *Phys. Fluids*, **33**, 8, 2021.
9. “Stability of two-layer flows past slippery surfaces. Part I: Horizontal channels”, Vignesh Ramakrishnan, Remil Mushthaq, S. Vengadesan and **Anubhab Roy**. *Phys. Fluids*, **33**, 8, 2021.
10. “Inertial effects on the flow near a moving contact line”, Akhil Varma, **Anubhab Roy** and Baburaj A. Puthenveetil. *J. Fluid Mech.*, **924**, A36, 2021.
11. “Collision rate of bidisperse, hydrodynamically interacting spheres settling in a turbulent flow”, Johnson Dhanasekaran, **Anubhab Roy** and Donald L. Koch. *J. Fluid Mech.*, **912**, A5, 2021.

12. “Collision rate of bidisperse spheres settling in a compressional non-continuum gas flow”, Johnson Dhanasekaran, **Anubhab Roy** and Donald L. Koch. *J. Fluid Mech.*, **910**, A10, 2021.
13. “A Lattice Boltzmann Method for Electromagnetic Wave Propagation in Medium”, Jamal Hussain, Ratul Dasgupta, Harish N Dixit, Sumesh P. Thampi and **Anubhab Roy**. *IEEE ICCEM*, 299, 2020.
14. “Azimuthal capillary waves on a hollow filament - the discrete and the continuous spectrum”, Palas . K. Farsoiya, **Anubhab Roy** and Ratul Dasgupta. *J. Fluid Mech.*, **883**, A21, 2020.
15. “Inertial torques and a symmetry breaking orientational transition in the sedimentation of slender fibers”, **Anubhab Roy**, Rami J. Hamati, Lydia Tierney, Donald L. Koch and Greg A. Voth, *J. Fluid Mech.*, **875**, 576–596, 2019.
16. “Optimal energy growth in a stably stratified shear flow”, Sharath Jose, **Anubhab Roy**, Rahul Bale, Krithika Iyer and Rama Govindarajan, *Fluid Dynamics Research*, **50**, 1, 011421 (2018).
17. “Analytical solutions for algebraic growth of disturbances in a stably stratified shear flow”, Sharath Jose, **Anubhab Roy**, Rahul Bale and Rama Govindarajan, *Proc. Roy. Soc. A*, 471, 20150267 (2015).
18. “Emergence of upstream swimming through a hydrodynamic transition”, Chih-kuan Tung, Florencia Ardon, **Anubhab Roy**, Donald L. Koch, Susan S. Suarez & Mingming Wu, *Phys. Rev. Lett.*, **114**, 108102 (2015).
19. “A modal interpretation of the ‘lift-up’ effect”, **Anubhab Roy** & Ganesh Subramanian, *J. Fluid Mech.*, **757**, 82–113 (2014).
20. “Linearized oscillations of a vortex column: the singular eigenfunctions”, **Anubhab Roy** & Ganesh Subramanian, *J. Fluid Mech.*, **741**, 404–460 (2014).
21. “Dynamics of vorticity defects in stratified shear”, N. J. Balmforth, **A. Roy** & C. P. Caulfield, *J. Fluid Mech.*, **694**, 292–331 (2012). Cover page article.
22. “An adaptation of Adomian decomposition for numeric-analytic integration of strongly non-linear and chaotic oscillators”, Susanta Ghosh, **Anubhab Roy** & Debasish Roy, *Computer Methods in Applied Mechanics and Engineering*, **196 (4-6)**, 1133–1153 (2007).
23. “Seismic evaluation of multi-storey RC frame using modal pushover analysis”, **Anubhab Roy** & Srinivas Chandrasekaran, *Nonlinear Dynamics*, **43(4)**, 329–342 (2006).

### (III) Others

1. **Video publication:** Jets formed from fluid flow through a non-circular orifice, Palas Kumar Farsoiya, Sagar Patankar, **Anubhab Roy** and Ratul Dasgupta, *Gallery of Fluid Motion*, American Physical Society - Division of Fluid Dynamics, Seattle, Washington, U.S.A, November 2019.

### REPRESENTATIVE TALKS

1. “Shallow gravity driven particle-laden flows-Role of normal stresses”, *73rd Annual Meeting of the Division of Fluid Dynamics, American Physical Society (APS-DFD)*, 2020.
2. “Inertial Slender Body Theory”, *ME-EM Virtual Graduate Seminar*, Michigan Technological University, USA, Nov 12, 2020.

3. "Collision efficiency of rapidly settling particles in a turbulent flow", *72nd Annual Meeting of the Division of Fluid Dynamics, American Physical Society (APS-DFD)*, Seattle, USA, Nov 23, 2019.
4. "A finite Re slender body theory", *IUTAM Symposium on Dynamics of Complex Fluids and Interfaces*, IIT Kanpur, Kanpur, Dec 17-20, 2018.
5. "Introduction to hydrodynamic instability", *QIP/CEP short-term course on "Introduction to hydrodynamic instability"*, IIT Madras, Chennai, Mar 26-31, 2018.
6. "Inertial microfluidics", *QIP/CEP short-term course on "Microfluidics based Healthcare Diagnostics and Interfacial Phenomena"*, IIT Madras, Chennai, Nov 7, 2017.
7. "The collision efficiency of cloud droplets in a non-continuum gas", *CompFlu, Complex Fluid Conference*, Hyderabad, Nov 12-13, 2016.
8. "Living Fluids' - Dynamics of swimming cells", National Institute of Technology Karnataka, Surathkal, Oct 17-18, 2016.
9. "The collision efficiency of cloud droplets in a non-continuum gas", *68th Annual Meeting of the Division of Fluid Dynamics, American Physical Society (APS-DFD)*, Boston, USA, Nov 23, 2015.
10. "Predicting the yield stress of solvent-free nanoparticle fluids resulting from configurational entropy of tethered space-filling oligomers", *AIChE Annual Meeting*, San Francisco, USA, Nov 6, 2013.
11. "Shear rheology of nanoparticle organic hybrid materials", *KAUST-CU Thrust Meeting - Carbon Dioxide Capture and Conversion, Cornell University*, May 3, 2013.
12. "Shear rheology of nanoparticle organic hybrid materials", *Rheology meeting, School of Chemical & Biomolecular Engineering, Cornell University*, April 15, 2013.
13. "Linear response of a vortex column - singular eigenfunctions and growth mechanisms", *64th Annual Meeting of the Division of Fluid Dynamics, American Physical Society (APS-DFD)*, Baltimore, USA, Nov 21, 2011.
14. "Non-modal growth of disturbances in stably stratified shear flow", Anubhab Roy, Krithika Iyer and Rama Govindarajan, *Instabilities in Shear Flows, Indo-European Network on Advanced Instability Methods*, Bangalore, India, Jan 15, 2010.
15. "Modal and non-modal dynamics of a vortex column", *Instabilities in Shear Flows, Indo-European Network on Advanced Instability Methods*, Bangalore, India, Jan 14, 2010.
16. "Linear response of a columnar vortex: The continuous spectrum and the inviscid resonances", *Waves and Instabilities in Geophysical and Astrophysical Flows*, Porquerolles, France, May 9, 2009.

## RESEARCH GRANTS

1. *Explosive resonant interactions with singular eigenfunctions*, MATRICS scheme (SERB), 2022-2025, INR 6 Lakhs.
2. *Mathematical modelling of aerosolized transmission of pathogens via turbulent expiratory events*, MATRICS Short-term special call on COVID-19 (SERB), 2020-2021, INR 5 Lakhs.

3. Droplet interactions and trajectories in expectorate flow from coughing, sneezing or loud talking, TIFR. 2020-2021, Co-PI.
4. *Resonant Triad Interactions in Stratified Shear Flows*, SPARC Scheme MHRD, 2019-2021, INR 41.4 Lakhs. Co-PI.
5. *The Role of Particle Flow Interactions in Cloud Microphysics*, New Faculty Seed Grant ICSR-IITM, 2018-2021, INR 26 Lakhs.
6. *Confined Living Fluids - Bacterial Motility on Surfaces*, Early Career Research Award SERB, 2018-2021, INR 31.5 Lakhs.
7. *Diffusion of Macromolecules Across Mammalian Cellular Clusters*, Exploratory Research Project ICSR-IITM, 2019-2020, INR 6.5 Lakhs.
8. *Instabilities in bacterial suspensions*, New Faculty Initiation Grant ICSR-IITM, 2016-2019, INR 5 Lakhs.

## STUDENT SUPERVISION

### Lab alumni

- Remil Mushthaq, M.Tech/B.Tech, (2017) - *Stability of stratified two-layer flows down an incline: Role of wall slip*. PhD student at Department of Mechanical Engineering, University of New Hampshire, USA.
- Praneet Shaw, M.Tech/B.Tech, (2018) - *Electrokinetics in non-Newtonian fluids..* Analyst at Bank of America.
- K K Prasoon, MS, (2020) - *Particle dynamics in natural convection boundary layer over horizontal plate*. Main supervisor - A P Baburaj (AM IITM). PhD student at Department of Aerospace Engineering, IIT Madras.
- Nishanth Murugan MS, (2021) - *Confined living fluids - The effects of active stresses, auto-chemotaxis and convective transport*. PhD Student at Sibley School of Mechanical and Aerospace Engineering, Cornell University, USA.
- Jamal Hussain MS, (2022) - *Rainfall estimation from electromagnetic wave scattering by raindrops*. Co-supervisor - Sumesh Thampi (CH IITM), Engineer at Detect Technologies

### Ongoing

- Darish Jeswin Dhas S, PhD, (2017-) - *Instabilities in particle laden free surface flows*.
- Pijush Patra PhD, (2017-) - *A stochastic theory of particles settling in a turbulent flow*. **Prime Minister's Research Fellow**
- Patibandla B L V Ramana PhD, (2018-) - *Resonant interactions of waves in stratified vortices*.
- Anu V S Nath PhD, (2018-) - *Evolution of particle clouds*. **Prime Minister's Research Fellow**
- Prabhaskar Kumar PhD, (2018-) - *The role of Basset-Bousinesq forces on clustering of inertial particles*. Co-supervisor - Mahesh Panchagnula (AM IITM).
- Mohd Meraj Khan PhD, (2020 -) - *A lattice Boltzmann method for simulating electromagnetic wave propagation in atmosphere*. Co-supervisor - Sumesh Thampi (CH IITM)
- Himanshu Mishra, PhD, (2020-) - *Particle transport due to upper ocean circulation*.

- Easwar M K MS, (2020-) - *Soft composite solids*. Main supervisor - A Arockiarajan (AM IITM)