Arghya Samanta

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Degrees and Academic Positions

- **Indian Institute of Technology, Delhi**
  Associate Professor – Department of Applied Mechanics *2020 –Present*
- **Indian Institute of Technology, Delhi**
  Assistant Professor – Department of Applied Mechanics *2016 – 2020*
- **Indian Institute of Technology, Delhi**
  Visiting Faculty – Department of Applied Mechanics *2015 – 2016*
- **KTH Royal Institute of Technology, Stockholm**
  Postdoctoral Fellow – Department of Mechanics *2014 – 2015*
- **Indian Institute of Science, Bangalore**
  Inspire Faculty – Department of Chemical Engineering *2013 – 2014*
- **Indian Statistical Institute, Kolkata**
  Visiting Scientist– Department of Physics and Applied Mathematics *2012 – 2012*
- **University of Pierre and Marie Curie, Lab. FAST, Paris**
  PhD – Mechanical Engineering *2009 – 2012*
  - Advisers: Prof. Christian Ruyer-Quil and Prof. Benoît Goyeau
  - Thesis: Falling film over a porous medium
  - Graduated with très honorable
  - Date: 1st June 2012
- **Indian Statistical Institute, Kolkata**
  Research Fellow – Department of Physics and Applied Mathematics *2006 – 2009*
- **University of Calcutta, Kolkata**
  MSc – Applied Mathematics *2003 – 2005*
- **University of Calcutta, Kolkata**
  BSc – Mathematics (Hons.) *2000 – 2003*

Awards, Grants and Honours

Sixth Position in BSc (Mathematics Hons.) 2003
First Position (joint) in MSc (Applied Mathematics) 2005
National Eligibility Test (Research Fellowship), NET CSIR, India 2005
Graduate Aptitude Test (GATE), IIT, India 2006
Junior Research Fellowship JRF (Entrance exam.), Indian Statistical Institute 2006
Senior Research Fellowship, Indian Statistical Institute 2008

Marie Curie Fellow (ESR), France *2009*
Inspire Faculty Award, DST, India *2013*
Wenner-Gren Foundation Postdoctoral Fellowship, Stockholm, Sweden *2013*
Postdoctoral Fellowship, Linné FLOW Centre, KTH, Stockholm, Sweden *2013*
Early Career Research Award, SERB, DST, India *2017*
Teaching Excellence Award, IIT Delhi, India *2019*

Teaching Experience

- *Advanced Fluid Mechanics (APL711)*
- *Applied Computational Methods (AML702)*
- *Engineering Mechanics (APL100)*
- *Engineering Mathematics and Computation (APL703)*
- *Mechanics of Fluids (APL107)*
- *Mechanics and Mathematics (APL701)*

Research Publications: Peer-Reviewed International Journal Articles

25. **A. Samanta,** Effect of surfactant on the linear stability of a shear-imposed fluid flowing down a compliant substrate. ***Journal of Fluid Mechanics***, 920, 2021, A23. pdf

24. S. Pal and **A. Samanta,** Linear stability of a surfactant-laden viscoelastic liquid flowing down a slippery inclined plane. ***Physics of Fluids***, 33, 2021, 054101. pdf

23. **A. Samanta,** Instability of a shear-imposed flow down a vibrating inclined plane. ***Journal of Fluid Mechanics***, 915, 2021, A93. pdf

22. **A. Samanta,** Effect of porous layer on the Faraday instability in viscous liquid. ***Proceedings of the Royal Society A***, 476, 2020, 20200208. pdf

21. **A. Samanta,** Non-modal stability analysis in viscous fluid flows with slippery walls. ***Physics of Fluids***, 32, 2020, 064105. pdf

20. F. A. Bhat and **A. Samanta,** Linear stability for surfactant-laden two-layer film flows down a slippery inclined plane. ***Chemical Engineering Science***, 220, 2020, 115611. pdf

19. **A. Samanta,** Optimal disturbance growth in shear-imposed falling film. ***AIChE Journal***, 66, 2020, e16906. pdf

18. **A. Samanta,** Linear stability of a plane Couette-Poiseuille flow overlying a porous layer. ***International Journal of Multiphase Flow***, 123, 2020, 103160. pdf

17. F. A. Bhat and **A. Samanta,** Linear stability analysis of a surfactant-laden shear-imposed falling film. ***Physics of Fluids***, 31, 2019, 054103. pdf

16. **A. Samanta,** Effect of electric field on an oscillatory film flow. ***Physics of Fluids***, 31, 2019, 034109. pdf
15. F. A. Bhat and **A. Samanta,** Linear stability of a contaminated fluid flow down a slippery inclined plane. ***Physical Review E***, 98, 2018, 033108. pdf
14. **A. Samanta,** Role of slip on the linear stability of a liquid flow through a porous channel. ***Physics of Fluids***, 29, 2017, 094103. pdf
13. **A. Samanta,** Linear stability of a viscoelastic liquid flow on an oscillating plane. ***Journal of Fluid Mechanics***, 822, 2017, 170-185. pdf
12. **A. Samanta,** Spatiotemporal instability of an electrified falling film. ***Physical Review E***, 93, 2016, 013125. pdf
11. **A. Samanta**, R. Vinuesa, I. Lashgari, P. Schlatter and L. Brandt, Enhanced secondary motion of the turbulent flow through a porous square duct. ***Journal of Fluid Mechanics***, 784, 2015, 681-693. pdf
10. **A. Samanta,** Effect of surfactants on the instability of a two-layer film flow down an inclined plane. ***Physics of Fluids***, 26, 2014, 094105. pdf
9. **A. Samanta,** Shear imposed falling film. ***Journal of Fluid Mechanics***, 753, 2014, 131-149. pdf
8. **A. Samanta,** Shear wave instability for electrified falling film. ***Physical Review E***, 88, 2013, 053002. pdf
7. **A. Samanta,** Effect of surfactant on two-layer channel flow. ***Journal of Fluid Mechanics***, 735, 2013, 519-552. pdf
6. **A. Samanta**, B. Goyeau and C. Ruyer-Quil, A falling film on a porous medium. ***Journal of Fluid Mechanics***, 716, 2013, 414-444. pdf
5. **A. Samanta**, C. Ruyer-Quil and B. Goyeau, A falling film down a slippery inclined plane. ***Journal of Fluid Mechanics***, 684, 2011, 353-383. pdf
4. **A. Samanta,** Effect of electric field on the stability of an oscillatory contaminated film flow. ***Physics of Fluids***, 21, 2009, 114101. pdf
3. **A. Samanta,** Stability of inertialess liquid film flowing down a heated inclined plane. ***Physics Letters A***, 372, 2008, 6653-6657. pdf
2. **A. Samanta,** Stability of liquid film flowing down a vertical non-uniformly heated wall. ***Physica D: Nonlinear Phenomena***, 237, 2008, 2587-2598. pdf
1. B. S. Dandapat and **A. Samanta,** Bifurcation analysis of first and second order Benney equations for viscoelastic fluid flowing down a vertical plane. ***Journal of Physics D: Applied Physics***, 41, 2008, 095501. pdf

Research Interest

- **Falling film instability**
  Studies of wave dynamics on the surface of a falling film are of special interest because of the prevalence of such films in chemical and technological processes. For instance, the formation of wave on the surface of a coating film degrades the quality of a final product and, indeed, plays a crucial role in the coating technology. An interesting characteristic of a falling liquid film is the appearance of instability in the form of a surface wave whose typical wavelength is much larger than the depth of the film. This surface wave propagates downstream with increasing speed and amplitude through a sequence of nonlinear events including solitary waves, transverse secondary instability and complex disordered pattern. Due to the convective nature of instability, disturbances are induced by an external forcing at the inlet. High frequency disturbances lead to saturated periodic waves, whereas low frequency disturbances evolve directly to a large amplitude solitary wave. In general, the surface wave amplifies due to the competition between kinematic and dynamic waves, and an instability appears when the kinematic wave speed exceeds the speed of dynamic waves.

- **Flow transport through porous media**
  In general, a porous medium characterized by porosity and permeability is defined as a medium interconnected with pores through which liquid flows. In the microscopic sense, flow is possible only through pores, and thereby, Navier-Stokes equations can be employed only in the liquid phase. Therefore, it is essential to develop a modified form of the governing equations that are valid not only in the liquid phase but also in the solid phase. The derivation of the macroscopic equations is performed by the method of volume averaging. Various types of models can be formed based on the governing equations. The derivations of accurate governing equations and associated boundary conditions valid in all possible flows are still challenging problems in this field. Recently, this field is extended to the poroelastic media because of its several applications in the biomedical field, such as, flow through the blood vessels which can be considered as poroelastic media. The transport of blood through the vessels plays an important role in maintaining the metabolism of the human body. In addition, the elastic behaviour of the solid phase makes the problem cumbersome even numerically.

- **Surfactant transport on single layer or double-layer fluid flows**
  Over the last few decades, extensive theoretical and experimental studies have been devoted to the development of two-layer channel flow because of its industrial and biomedical applications. These types of problems are often encountered in many applied and physical situations, for instance, oil recovery, lubricated pipelining, and the obstruction to air flow in the small airways of the lungs. Due to the viscosity contrast, or varying flow rate, instability may appear at the liquid-liquid interface and evolves slowly downstream through a sequence of nonlinear events. This surface instability is strongly influenced by the insoluble surfactants.

- **Oscillatory free surface flow**
  The studies of liquid film flow on an oscillating plane are of special interest in the biomedical field and industrial processes. For example, a detailed understanding of blood flow in the cardiovascular system plays an essential role in the treatment of the vascular diseases. Further, investigations of such problems are more relevant in aiding the development of lab on a chip microfluidic devices. Besides, a few studies were performed in this context due to the unsteady base flow that makes the problem cumbersome to tackle even numerically. The interesting fact is that such flows exhibit instability on account of an oscillation of the plane. In the long-wave regime, the U-shaped unstable regions appear only in the separated bandwidths of the imposed frequency. However, the finite wavelength neutral curves appear through the branch points detected on the long-wave U- shaped

neutral curves. Therefore, the long-wavelength analysis is not sufficient to predict unstable frequency ranges in the parameter space.

- **Non-modal stability analysis**
  Non-modal stability analysis is performed when the matrix operator associated with the governing equations is non-normal, which generally observed for a wall-bounded Poiseuille flow. This fact ensues a set of non-orthogonal eigenfunctions and their superposition leads to a transient amplification. As a result, the threshold of instability for the shear mode may occur before than that predicted from the modal stability analysis.

- **Fluid flows over compliant substrate**
  Studies of fluid flows over compliant substrate are very relevant in exploring the drag-reducing capabilities of compliant substrates since the experimental work of Kramer. Further, such studies have immense biological applications. Because of the existence of compliant substrate, the wall mode emerges along with the surface mode, and makes the flow system unstable even at the zero value of Reynolds number and confirms the existence of inertialess instability. Moreover, there exists a critical value of spring stiffness below which the flow configuration becomes unstable to surface mode despite the zero value of Reynolds number.

Externally sponsored research projects

- Two-layer film flows down an inclined plane (ECR Scheme)
  Principal Investigator
  Funding Agency: SERB, DST
  Duration: 08/06/2017–07/06/2020

- Non-modal Stability of Free Surface Fluid Flows (MATRICS Scheme)
  Principal Investigator
  Funding Agency: SERB, DST
  Duration: 08/01/2020–07/01/2023

PhD and MTech Students guided

- PhD Student (Current):
  - Subham Pal (2019-)
  - Arnab Choudhary (2020-)
- MTech Student (Current):
  - Pankaj Kumar Singh (2020-)
  - Abhishek Mauriya (2020-)
- Completed:
  - Farooq Ahmad Bhat (PhD)
  - Satish Kumar (MTech)
  - Deepak Raj (MTech)

- Gaurav Joshi (MTech)
- Sankalp Lodhi (MTech) [with Dr. S Hegde]
- Rizwan Khan (MTech) [with Dr. S Hegde]

Academic Service

- Service as a reviewer of the following international journals:
  - Applied Mathematical Modelling
  - Applied Thermal Engineering
  - Archives of Mechanics
  - Chinese Physics Letters
  - European Journal of Mechanics B Fluids
  - Heat Transfer
  - Journal of Fluid Mechanics
  - Journal of Engineering Mathematics
  - International Journal of Heat and Mass Transfer
  - International Journal of Nonlinear Mechanics
  - International Journal for Numerical Methods in Fluids
  - International Journal of Thermal Science
  - Meccanica
  - Physics of Fluids
  - Sadhana
  - ZAMP