

# Sakil Ahamed

(Curriculum Vitae)

About Me	I am a Research Associate in the Department of Mathematics at the Indian Institute of Technology Bombay (IIT Bombay). My research interests lie in the field of Control theory.	
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Date of Birth	July 14, 1993	
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Academic Qualifications	Ph.D. in Mathematics, Indian Institute of Technology, Bombay (IIT Bombay). Thesis Submission Date : November 4, 2022. Doctoral Defence/Viva Voce Date : Awaited.	[July 14, 2016 - Present]
	M.Sc. in Mathematics, Indian Institute of Technology, Bombay (IIT Bombay). CPI : 8.13 out of 10.	[2014 - 2016]
	B.Sc. in Mathematics, Maulana Azad College, Kolkata (University of Calcutta). Aggregate : 83.12%	[2011 - 2014]
Academic Achievements	<ul style="list-style-type: none"><li>• Qualified National Eligibility Test (NET) in Mathematical Sciences for CSIR-UGC (JRF) Fellowship, December, 2016.</li><li>• Qualified Graduate Aptitude Test (GATE) 2016.</li><li>• DST-INSPIRE BS-MS fellowship 2011-2016.</li></ul>	
Internship	NNMCB Internship Organized by IISC Bangalore. Project Title : Studies on the Transport of Drug Eluted from Coronary Stent. Supervisor: Prof. Prashanta Kumar Mandal, Visva-Bharati. Project Duration : May 2015 – July 2015	
M.Sc. Project Details	Project Title : Reading Project on Laplace Equation. Supervisor: Prof. V. D. Sharma, IIT Bombay. Project Duration : July 2015 – December 2015	

Ph.D. Thesis  
Details

Thesis Title : Control Problems for Certain Linear Coupled Systems.

Doctoral Advisor : Prof. Debanjana Mitra, IIT Bombay.

Thesis Submission Date: November 4, 2022

Thesis Summary : We study control aspects of the following linear coupled systems:

- Linear coupled transport-parabolic system with variable coefficients.
- Compressible Navier-Stokes system with Maxwell's law with constant coefficients.

At first, we study the null controllability of linear coupled transport-parabolic systems with variable coefficients (depending on space and time) in the bounded domain  $(0, L)$ . The systems are considered with homogeneous Dirichlet boundary conditions and with localized interior controls acting on both transport and parabolic equations. We show that the coupled systems are not null controllable at a small time. Also, the system is null controllable at any time by parabolic control acting everywhere in the domain, under some assumptions on the coefficients and the initial data.

Next, we consider the compressible Navier-Stokes system with Maxwell's law, linearized around a constant steady state  $(\rho_s, 0, 0)$ , with  $\rho_s > 0$ . We study the controllability of this linearized system in the bounded domain  $(0, \pi)$ . The system is considered with Dirichlet boundary conditions and with interior controls. We prove the system is not null controllable at any time using localized controls in density and stress equations and even everywhere control in the velocity equation. However, we show that the system is null controllable at any time if the control acting in the density or stress equation is everywhere in the domain. This is the best possible null controllability result obtained for this system. We also show that the system is approximately controllable at a large time using localized controls.

We further study the exact controllability of the compressible Navier-Stokes system with Maxwell's law linearized around a constant steady state  $(\rho_s, u_s, 0)$ ,  $\rho_s > 0, u_s > 0$ . The system is considered in the bounded domain  $(0, 2\pi)$  with periodic boundary conditions. Using Ingham inequality, we prove that the system is exactly controllable at a large time using a localized control in any of the equations.

Publications

List of Published/Accepted Paper(s)

- Ahamed, Sakil and Maity, Debayan and Mitra, Debanjana. Lack of null controllability of one dimensional linear coupled transport-parabolic system with variable coefficients, Journal of Differential Equations (2022), Vol. 320, pp. 64–113. (available at <https://doi.org/10.1016/j.jde.2022.02.049>).

List of Preprint(s)

- Ahamed, Sakil and Mitra, Debanjana. Some controllability results for linearized compressible Navier-Stokes system with Maxwell's law, Submitted ( under minor revision) (2022). ( available at <https://doi.org/10.48550/arXiv.2210.11756>).

Workshops and  
Conferences  
Attended

- NCM workshop on Control Theory for Differential Equations, held at IISER Kolkata. [November 28- December 10, 2022]
- Mini conference on Differential equations, control and homogenization, held at IIT Bombay. [February 21- February 23, 2020]
- AIS Geometric Analysis Workshop, held at IIT Bombay. [December 09 - December 28, 2019]

- Multi-Scale Analysis and Theory of Homogenization Discussion-Meeting, held at ICTS Bangalore. [August 26- September 06, 2019]
- NCM AIS Geometric Measure Theory and PDE, held at IIT Madras. [June 03- June 15, 2019]
- Diamond Jubilee Symposium, Department of Mathematics, held at IIT Bombay. [Jan 04- Jan 06, 2019]
- ATMW New Directions in PDE Constrained Optimization, held at IIT Bombay. [March 12- March 16, 2018]
- NPDE-TCA Recent Advances in PDE: Theory, Computations and Applications, held at IIT Bombay. [June 08- June 10, 2017]
- Advanced Level Training Programme under the auspices of National Program on Differential Equations : Theory, Computation and Applications (NPDE-TCA), held at BITS Pilani, Hyderabad. [May 25 - June 14, 2016]

#### Talks and Poster Presentations

- Gave my Pre-Synopsis seminar titled Control Problems for Linear Coupled Systems at the Department of Mathematics, IIT Bombay. [August 10, 2022]

#### Teaching Experience

- All the following courses are undertaken as a Teaching Assistant (TA) at Department of Mathematics, IIT Bombay.
  - MA 105 : Calculus
  - MA 205 : Complex Analysis
  - MA 214 : Introduction to Numerical Analysis
  - MA 403 : Real Analysis (M.Sc)
  - MA 417 : Ordinary Differential Equations (M.Sc)
- Teaching Assistant at NCM workshop on Control Theory for Differential Equations held at IISER Kolkata.

#### Position of Responsibilities

- Member, Logistic and Registration team of 34th Mathematics Olympiad, 2015, Department of Mathematics, IIT, Bombay.

#### Programming Languages

- Matlab

#### Languages Known

- Bengali
- Hindi
- English

## References

1. Prof. Debanjana Mitra  
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2. Prof. Neela Nataraj  
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