

Manish Kumar

Curriculum Vitae

Cubicle-6, DMS, IISER Kolkata, Nadia-741246, India

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Education

- August 2019-present **Integrated Ph.D.**, Indian Institute of Science Education and Research (IISER), Kolkata, West Bengal, India.
- August 2016-May 2019 **B.Sc. (Hons.) in Mathematics**, CGPA: 9.54, Rajdhani College, University of Delhi, Delhi, India.
- 2014-2016 **Higher Secondary in Science**, Percentage: 91.67%, D.A.V Public School, BSEB Colony Road, Patna, Bihar, India.
- 2014 **Matriculation**, CGPA: 10.0, R.P.S Public School, Pahari, Patna, Bihar, India.

Research Interests

Partial Differential Equations, Fluid Mechanics, Control Theory, Numerical Analysis.

Linear and Nonlinear Partial Differential Equations, Fluid Mechanics, Compressible Navier-Stokes equations, Kuramoto-Sivashinsky Equation, Parabolic systems, Dispersive equations, Control of PDE (In particular, Controllability, Stabilizability, and Optimal control problem).

PhD Thesis

Null Controllability of Certain Continuous and Discrete PDE Control Systems, Submitted in the Institute for the review on March 24, 2025.

This thesis work is based on the study of two types of controllability problems. The first type of problems deals with the study of null controllability for two distinct control systems described by coupled partial differential equations (PDEs), one coupling KS-KdV eq. with heat eq. and the other one coupling linear KS-KdV eq. with transport eq. using the method of moments. While the second type of problems deals with the study of a suitable analogous notion of null controllability (ϕ -null controllability) for a time-discrete coupled parabolic system and a fully-discrete linear KdV equation, using the duality approach in discrete framework, where we derive discrete Carleman estimates for the underlying differential operator.

Publications

- March, 2025 **Carleman estimate and controllability of a time-discrete coupled parabolic system**, Joint work with Kuntal Bhandari and Rajib Dutta. Mathematical Control and Related Fields, [article](#).
- February, 2025 **Insensitizing control problem for the Kawahara Equation**, Joint work with Subrata Majumdar. Nonlinear Differential Equations and Applications, [article](#).
- June, 2024 **On the controllability of a system coupling Kuramoto-Sivashinsky-Korteweg-de Vries and transport equations**, Joint work with Subrata Majumdar. Mathematics of Control, Signals, and Systems, [article](#).
- March/April, 2024 **Local null controllability of the stabilized Kuramoto-Sivashinsky system using moment method**, Joint work with Subrata Mazumdar. Advances in Differential Equations, [article](#).

Preprints and Submitted works

- **Stackelberg-Nash Exact Controllability for the Benney–Lin Equation with Mixed Boundary Conditions**, Joint work with Subrata Majumdar.
In communication, [preprint](#).
- **Boundary controllability of fully-discretized Korteweg-De-Vries equation using Carleman type estimates**.
In communication, [preprint](#).

Ongoing Works

- **Interior controllability of semi-discretized Korteweg-De-Vries equation using Carleman type estimates**, Joint work with Rajib Dutta.
- **Null controllability of linearized compressible Navier-Stokes equation under nonnegative constraint**, Joint work with Shirshendu Chowdhury and Rajib Dutta.

Awards & Achievements

- May, 2021 **PMRF**, Received the prestigious Prime Minister's Research Fellowship, Govt. of India.
- June, 2023 **NET**, Qualified the Joint CSIR-UGC NET exam for Lectureship/Assistant Professor.
- June, 2022 **NET**, Qualified the Joint CSIR-UGC NET exam for Lectureship/Assistant Professor.
- 2019 **Interviews**, Cracked IPhD interviews of IISER-TVM and IISER-Kolkata.
- 2019 **IIT-JAM**, Cracked IIT Joint Admission Test for Masters in Mathematics.
- 2018 **SRFP**, Was selected for Summer Research Fellowship Programme by Indian Academy of Sciences.

Master's Thesis

Controllability of a hyperbolic and a parabolic system in one dimensional periodic domain, Submitted to IISER Kolkata in 2022.

In the thesis, I have studied controllability aspect of transport equation and Kuramoto-Sivashinsky-Korteweg-De-Vries equation using Carleman estimates and method of moments, respectively.

Projects

- **Summer Project**, 2021.
Project Title: *Semigroup Theory For Operators And Control Of PDEs*.
Project Advisor: *Dr. Rajib Dutta*.
- **IPhd Project II**, 2021.
Project Title: *Controllability and Stability of ODEs*.
Project Advisor: *Dr. Rajib Dutta*.
- **IPhd Project I**, 2020.
Project Title: *Distribution theory and Sobolev Space*.
Project Advisor: *Dr. Rajib Dutta*.
- **Summer Project**, 2020.
Project Title: *Partial differential equations*.
Project Advisor: *Dr. Rajib Dutta*.
- **Summer Research Fellowship Program (Indain Academy of Scineces)**, 2018.
Project Title: *Completion of incomplete metric space and basic topology*.
Project Advisor: *Dr. Shrihari Sridharan*.

Institute Teaching Assistantships

- Spring 2025 **Mathematics II**, 1st year undergraduate, IISER Kolkata.
◦ **Instructor:** Dr. Shibananda Biswas.
- Autumn 2024 **Mathematics I**, 1st year undergraduate, IISER Kolkata.
◦ **Instructor:** Dr. Somnath Basu.
- Spring 2024 **Analysis II**, 2nd year undergraduate, IISER Kolkata.
◦ **Instructor:** Dr. Rajib Dutta.
- Autumn 2023 **Mathematics I**, 1st year undergraduate, IISER Kolkata.
◦ **Instructor:** Dr. Saugata Bandyopadhyay.
- Spring 2023 **Mathematics II**, 1st year undergraduate, IISER Kolkata.
◦ **Instructor:** Dr. Anirban Banerjee.
- Spring 2022 **Mathematical Methods I**, 1st year undergraduate, IISER Kolkata.
◦ **Instructor:** Dr. Anandamohan Ghosh.
- Spring 2022 **Analysis II**, 2nd year undergraduate, IISER Kolkata.
◦ **Instructor:** Dr. Rajib Dutta.
- Autumn 2021 **Linear Algebra I**, 2nd year undergraduate, IISER Kolkata.
◦ **Instructor:** Dr. Somnath Basu.

NPTEL Teaching Assistantships

- Spring 2025 **Basic Real Analysis**.
◦ **Instructor:** Prof. I. K. Rana.
- Autumn 2024 **Introductory Course in Real Analysis**.
◦ **Instructor:** Prof. P. D. Srivastava.
- Spring 2024 **Dynamical System and Control**.
◦ **Instructors:** Prof. N. Sukavanam, Prof. D. N. Pandey.
- Autumn 2023 **Measure and Integration**.
◦ **Instructor:** Prof. S. Kesavan.
- Spring 2023 **Ordinary and Partial Differential Equations and Applications**.
◦ **Instructors:** Prof. P.N. Agarwal, Prof. D.N. Pandey.
- Autumn 2022 **Sobolev Space and Partial Differential Equations**.
◦ **Instructor:** Prof. S. Kesavan.

ATM Schools Teaching Assistantships

- NCMW 2025 (upcoming) **Theoretical aspects of Incompressible Navier-Stokes equations**, IISER Kolkata,
Organized by Dr. Shirshendu Chowdhury and Dr. Rajib Dutta.
Instructors: Dr. Rajib Dutta, Dr. Ujjwal Koley, Dr. Debayan Maity.
- NCMW 2023 **Control theory for partial differential equation**, IISER Thiruvananthapuram,
Organized by Dr. Shirshendu Chowdhury and Dr. Dharmatti Sheetal.
Instructors: Dr. Mrinmay Biswas, Dr. Debayan Maity.
- NCMW 2022 **Control theory for differential equations**, IISER Kolkata, *Organized by Dr. Shirshendu Chowdhury and Dr. Rajib Dutta.*
Instructors: Dr. Mrinmay Biswas, Dr. Rajib Dutta, Dr. Debayan Maity.
- AFS 2022 **AFS-II : Analysis II (Measure and Integration)**, IISER Kolkata, *Organized by Dr. Somnath Basu and Dr. Shirshendu Chowdhury.*
Instructors: Dr. Shirshendu Chowdhury, Dr. Rajib Dutta, Dr. Arnab J. D. Gupta.

Workshops & Webinars attended

- **X Partial differential equations, optimal design and numerics**, Benasque Science Center.
Organizers: G. Buttazzo, O. Glass, G. Leugering, E. Zuazua.
Date: August 19 - August 23, 2024.
- **Mathematical Analysis of Fluid Flow Models**, TIFR-CAM.
Organizers: Ujjwal Koley, Debayan Maity.
Date: June 10 - June 22, 2024.
- **Recent advances on control theory of PDE systems**, ICTS Bengaluru.
Organizers: Shirshendu Chowdhury, Debayan Maity, Debanjana Mitra.
Date: Feb 12 - Feb 23, 2024.
- **Advanced topics in PDEs**, JUIT Solan
Organizers: Ujjwal Koley, Rakesh Kumar Bajaj, Bidhan Chandra Sardar.
Date: May 15 - May 27, 2023.
- **Control Theory meets the Theory of Homogenization**, IIT Bombay.
Organizers: Debanjana Mitra, Harsha Hutridurga.
Date: February 28 - March 04, 2023.
- **Webinar on PDE and related areas**.
Organizers: IIT Kanpur in collaboration with TIFR-CAM, IISER-Pune and IISER-Kolkata.
Date: September 3 - December 15, 2020.

Talks & Poster Presentations

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| Talk | X Partial differential equations, optimal design and numerics , August, 2024, Benasque Science Center, slides .
Organizers: G. Buttazzo, O. Glass, G. Leugering, E. Zuazua. |
| Poster | Control Theory meets the Theory of Homogenization , March, 2023, IIT Bombay.
Organizers: Debanjana Mitra, Harsha Hutridurga. |
| Talk | Graduate Student Seminar , August, 2022, IISER Kolkata.
Organizers: Joydip Singh, Jebasingh. |

Additional responsibilities

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| 2023-present | Member of Departmental Grievance Redressal Committee , <i>Department of Mathematics and Statistics</i> , IISER Kolkata. |
| 2021-2024 | Member of Departmental Library Committee , <i>Department of Mathematics and Statistics</i> , IISER Kolkata. |
| 2021-2022 | Representative of Department of Mathematics and Statistics in the Institute Outreach Committee , IISER Kolkata. |

References

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| ◦ PhD Advisor: Dr. Rajib Dutta
Associate Professor
Department of Mathematics,
IISER Kolkata,
Mohanpur, West Bengal, India.
Email: rajib.dutta@iiserkol.ac.in | ◦ Dr. Shirshendu Chowdhury
Associate Professor
Department of Mathematics,
IISER Kolkata,
Mohanpur, West Bengal, India.
Email: shirshendu@iiserkol.ac.in |
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Declaration: I hereby declare that all the statements made herein are true to my best of knowledge and belief.

Place: Kolkata

Manish Kumar