Manish Kumar

Curriculum Vitae

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

August 2019- **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,Control of PDE (In particular Controllability, Stabilizability, Optimal control problem for coupled parabolic-parabolic and paraboli-hyperbolic mixed class of PDEs)

Awards & Achievements

PMRF Fellow, Selected for Prime Minister Research Fellowship for May, 2021 cycle

Interviews, Cracked IPhD interviews of IISER, TVM and IISER, Kolkata in 2019

JAM, Got 491 rank in JAM exam in Mathematics in 2019

Topper, In bachelors at college level

Projects

- **Summer Project**
  Project Title: *Semigroup Theory For Operators And Control Of PDEs*
  I did this project in the last summer under the supervision of my PhD supervisor where I learned the controllability and stability concepts in case of PDEs, for which I needed the semigroup theory as a tool.
- **IPhd Project II**
  Project Title: *Controllability and Stability of ODEs*
  I did this project in my 4th semester of MS under the supervision of my PhD supervisor where I got introduced to my research field,i.e., Control of PDEs. In this project because of ODE setup, everything was in finite dimension.
- **IPhd Project I**
  Project Title: *Distribution theory and Sobolev Space*
  I did this project in my 3rd semester of MS under the supervision of my PhD supervisor where I get to know about the generalisation of classical theories and about new spaces, using which we work in research.

- **Summer Project**
  Project Title: *Partial differential equations*
  I did this project in 2020 under the supervision of my present PhD supervisor Dr. Rajib Dutta and it was a sort of intrductory study in pde where I learned about Characteristic method of solving 1st order pde and also studied about the four important linear PDEs.
- **Summer Project**
  Project Title: *Completion of incomplete metric space and basic topology*
  I did this project in 2018 in IISER,TVM under the supervision of Dr. Srihari Sridharan and it was mainly about how the number system evolved from counting numbers to complex numbers and few approximation results of real analysis.

Master's Thesis

Controllability of a hyperbolic and a parabolic system in one dimensional periodic domain.
In the thesis, I have studied controllability aspect of tranpsport equation and Kuramoto-Sivashinsky-Korteweg-De-Vries equation using Carleman estimates and method of moments, respectively.

Publications

March/April, 2024 ***Local null controllability of the stabilized Kuramoto-Sivashinsky system using moment method***, Joint work with Subrata Mazumdar.
Advances in Differential Equations: 10.57262/ade029-0304-223

Preprints/Submitted works

- ***Examining local exact controllability to trajectories of the fifth-order Korteweg-De-Vries equation while seeking a Nash equilibrium***, Joint work with Subrata Majumdar.
- ***Insensitizing control problem for the Kawahara equation***, Joint work with Subrata Majumdar.
- ***Study of controllability of a time-discrete 1-D parabolic system via Carleman estimates***, Joint work with Kuntal Bhandari and Rajib Dutta.
- ***Null controllability of a system coupling Kuramoto-Sivashinsky-Korteweg-De-Vries and transport equations.***, Joint work with Subrata Majumdar.
  HAL link: https://hal.science/hal-03695906v1/document

Ongoing Works

- ***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.

Institute Teaching Assistantships

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.

ATM Schools Teaching Assistantships

NCMW 2023 **Control theory for partial differential equation**, IISER Thiruvananthapuram.

- **Instructors:** Dr. Mrinmay Biswas, Dr. Debayan Maity.

NCMW 2022 **Control theory for differential equations**, IISER Kolkata.

- **Instructors:** Dr. Rajib Dutta, Dr. Mrinmay Biswas, Dr. Debayan Maity.

AFS 2022 **AFS-II AFS-II : Analysis II (Measure and Integration)**, IISER Kolkata.

- **Instructors:** Dr. Rajib Dutta, Dr. Arnab Jyoti Das Gupta, Dr. Shirshendu Chowdhury.

NPTEL Live sessions

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 Diffrential Equations and Applications**

- **Instructors:** Prof. P.N. Agarwal, Prof. D.N. Pandey.

Autumn 2022 **Sobolev Space and Partial Differential Equations**

- **Instructor:** Prof. S. Kesavan.

Workshops and webinars attended

- **Title:** Recent advances on control theory of PDE systems.
  Organizers: Shirshendu Chowdhury, Debayan Maity, Debanjana Mitra.
  Date: 12 Feb - 23 Feb, 2024.
- **Title:** Advanced topics in PDEs.
  Organizers: Ujjwal Koley, Rakesh Kumar Bajaj, Bidhan Chandra Sardar.
  Date: 15 May - 27 May, 2023.
- **Title:** Control Theory meets the Theory of Homogenization.
  Organizers: Debanjana Mitra, Harsha Hutridurga.
  Date: 28 Feb - 04 March, 2023.
- **Title:** NdAM Workshop - Analysis and Numerics of Design, Control and Inverse Problems.
  Organiser: Giuseppe Floridia and Enrique Zuazua.
  Date: 01 Jul - 07 Jul, 2021.
- **Title:** Convex integration solutions for the transport equation.
  Speaker: Ujjwal Koley, TIFR CAM.
  Date: November, 2021.

- **Title:** NdAM Workshop - Analysis and Numerics of Design, Control and Inverse Problems.
  Organiser: Giuseppe Floridia and Enrique Zuazua.
  Date: 01 Jul - 07 Jul, 2021.
- **Title:** Webinar on PDE and related areas.
  Organiser: IIT Kanpur in collaboration with TIFR-CAM, IISER-Pune and IISER-Kolkata.
  Date: 3 September -15 December, 2020.

Posters and Talks

Poster presentation — **Control Theory meets the Theory of Homogenization**, March, 2023.
Indian Institute of Technology, Bombay.

- **Organizers:** Debanjana Mitra, Harsha Hutridurga.

Talk — **Graduate Student Seminar**, August, 2022.
Indian Institute of Science Education and Research, Kolkata.

References

- **PhD Supervisor: Dr. Rajib Dutta**
  Department of Mathematics
  Faculty
  IISER Kolkata
  West Bengal, India.
  Email: rajib.dutta@iiserkol.ac.in

- **Dr. Shirshendu Chowdhury**
  Department of Mathematics
  Faculty
  IISER Kolkata
  West Bengal, India.
  Email: shirshendu@iiserkol.ac.in

Additional responsibilities

- As a current member of Library committee of my department.
- As a current member of Outreach committee in my institute.

Webpage Link

manishgnu.github.io

Declaration: I hereby declare that all the statements made herein are true to my best of knowledge and belief.

Place: Kolkata — Manish Kumar