Dr. Mahendra Kumar Gupta

Assistant Professor
Department of Mathematics
National Institute of Technology Jamshedpur
Jamshedpur, Jharkhand, India - 831014
✉ mahendra14389@gmail.com
✉ mkgupta.math@nitjsr.ac.in
📞 ✆ +91-9414333978
Date of joining: 15th June 2018

Research Interests

Control Theory, Linear Algebra & Matrix Theory, Linear and Nonlinear Systems, State Estimation, Observer design, Differential-Algebraic Equations (Descriptor Systems), Design of Output and Input Feedback, Fault Diagnosis

Research Project (On going)

Title: State Estimation and Fault Diagnosis for Differential-Algebraic Nonlinear Control Systems
Funding Agency: SERB, DST
Amount: 14,64,087/-
Duration: 16-12-2019 to 15-12-2021 (2 years)
Project No: SRG/2019/000451

Education

Degree	University/Board	Year	Specialization	% of Marks	% in Maths
PhD	IIT Patna	2016	Mathematics	NA %	NA %
M.Sc.	University of Rajasthan, Jaipur	2011	Mathematics	74.30 %	74.3 %
B.Sc.	University of Rajasthan, Jaipur	2009	Mathematics, Physics, Computer Application	67.41 %	71 %
Intermediate (Class 12th)	Board of Secondary Education, Rajasthan	2005	Mathematics, Physics, Chemistry	61.54 %	65 %
Secondary (Class 10th)	Board of Secondary Education, Rajasthan	2003	Hindi, English, Science Maths, SSC, Sanskrit	75.5 %	96 %

PhD details

Title of PhD thesis	Observer design for irregular descriptor systems
Department	Mathematics
Institute	Indian Institute of Technology Patna, India
Supervisors	Dr. Nutan Kumar Tomar and Dr. Shovan Bhaumik
Date of joining	24 July 2012
Date of thesis submission	23 April 2016
Date of defence	29 Nov 2016
Total CGPI in PhD course work	9.07 out of 10

Research Experience

Position	Affiliation	Period	Mentor/PI	Project
Post-Doctoral Fellow	Department of Chemical Engineering, IIT Madras	14 Sept 2016– 13 June 2018	Prof. Raghunathan Rengaswamy	Coauthoring a book "*Modern Control: Theory to practice*"
Post-Doctoral Fellow	Department of Chemical Engineering, IIT Gandhinagar	20 June 2016 – 22 August 2016	Dr. Pratyush Dayal	Non Linear Dynamics
Project Fellow	Department of Mathematics, IIT Patna	20 Aug 2011 – 1 July 2012	Dr. Nutan Kumar Tomar	Analysis and design of descriptor systems in infinite dimensional space

Awards

1. **GATE-2013 in Mathematics with All India Rank 6.**

2. GATE-2014 in Mathematics with All India Rank 42.

3. CSIR-JRF in Mathematical Science with All India Rank-33, June-2013.

4. UGC-JRF in Mathematical Science with All India Rank-90, June-2011.

5. International Travel Grant from DST & NBHM for "Summer School in Engineering & Sciences" in Technion-Israel Institute of Technology, Haifa, Israel, 29 July-28 August, 2015.

6. Full scholarship from Technion-Israel to attend the summer-school. (International Award)

7. Full scholarship and travel grant from IWR, University of Heidelberg, Germany to attend the workshop on Computational Mathematics, Chulalongkorn University, Thailand, March 20 – 24, 2017. (International Award)

8. Open Arms Grant from International Mathematical Union (IMU) to attend International Congress of Mathematicians (ICM), Rio De Generio, Brazil in August 2018 (International Award).

9. Full scholarship and travel grant to attend "7th Heidelberg Laureate Forum" Sept 22 -27, 2019 Heidelberg, Germany from Heidelberg Laureate Foundation (International Award).

10. IEEE student support for attending the conference "Indian Control Conference" in IIT Madras, Chennai, Jan 5-7, 2015.

Abroad Visits

1. "Summer School in Engineering & Sciences, Course: Non-Negative Matrices" in Technion International-Israel Institute of Technology, Haifa, **Israel**, July 29 – August 28, 2015 (acquired 95% of marks in mathematics).

2. Workshop on Computational Mathematics and Science, Chulalongkorn University, Bangkok, **Thailand**, March 20 – 24, 2017.

3. Young Researchers in Mathematics 2017, University of Kent, **England, UK**, 1–4 August, 2017.
   Delivered a contributed talk "Fault Diagnosis via nonlinear observers".

4. 2018 International Conference on Matrix Inequalities and Matrix Equations, Shanghai University, **China**, June 8–10, 2018.
   Delivered an invited talk "A simple proof for the existence of Jordan form".

5. International Congress of Mathematics, Rio de Janeiro, **Brazil**, August 1–9, 2018.
   Delivered a contributed talk "Causal detectability for descriptor systems".

6. 7th Heidelberg Laureate Forum, Heidelberg, **Germany**, Sept 22 – 27, 2019.
   Delivered a talk and presented a poster "On the necessary and sufficient condition for the existence of observer for descriptor system".

Publications in SCI/Scopus Journals

1. J. Jaiswal, **M.K. Gupta**, N.K. Tomar. Necessary and sufficient conditions for ODE observer design of descriptor systems, *Systems & Control Letters*, Elsevier, 151, pp. 104916, 2021. **(IF: 2.804)**

2. L. Moysis, **M.K. Gupta**, V.K. Mishra, M. Marwan, C. Volos. Observer design for rectangular descriptor systems with incremental quadratic constraints and nonlinear outputs - Application to secure communications, *Int. J. Robust Nonlinear Control*, Wiley, 30(18), 8139–8158, 2020 **(IF: 4.406)**

3. L. Moysis, A. Giakoumis, **M.K. Gupta**, C Volos, VK Mishra, VT Pham. Observers for Rectangular Descriptor Systems with Output Nonlinearities – Application to Secure Communications and Microcontroller Implementation, *Int. J. Dyn. Control*, Springer, 9(2), 530–540, 2021

4. **M.K. Gupta**, N.K. Tomar, M. Darouach. Unknown inputs observer design for descriptor systems with monotone nonlinearities, *Int. J. Robust Nonlinear Control*, Wiley, 28(17), 5481–5494, 2018 **(IF: 4.406)**

5. **M.K. Gupta**, N.K. Tomar, S. Bhaumik. Full- and reduced-order observer design for rectangular descriptor systems with unknown inputs, *J. Franklin Inst.*, Elsevier, 352(3), 1250–1264, 2015 **(IF: 4.504)**

6. V.K. Mishra, N.K. Tomar, **M.K. Gupta**. Regularization and index reduction for linear differential-algebraic systems, *Comput. Appl. Math.*, Springer, 37(4), 4587–4598, 2018 **(IF: 2.239)**

7. V.K. Mishra, N.K. Tomar, **M.K. Gupta**. Index reduction for rectangular descriptor systems via feedbacks, *Cogent Engineering,* Taylor & Francis, 4(1), pp. 1319786, 2017 (Scopus, WoS Indexed)

8. **M.K. Gupta**, N.K. Tomar, V. K. Mishra, S. Bhaumik. Observer design for semilinear descriptor systems with applications to chaos-based secure communication, *Int. J. Appl. Comput. Math.*, Springer, 3(1), 1313-1324, 2017

9. **M.K. Gupta**, N.K. Tomar, S. Bhaumik. On detectability and observer design for rectangular linear descriptor system, *Int. J. Dyn. Control*, Springer, 4(4), 438–446, 2016

10. V.K. Mishra, N.K. Tomar, **M.K. Gupta**. On controllability and normalizability for linear descriptor systems, *J. Control Autom. Electr. Syst.*, Springer, 27, 19–28, 2016. (Scopus, WoS Indexed)

11. **M.K. Gupta**, N.K. Tomar, S. Bhaumik. Observer Design for Descriptor Systems with Lipschitz Nonlinearities: an LMI Approach, *Nonlinear Dyn. Syst. Theory*, InforMath Publishing, 14(3), 292–302, 2014.

Conference Full Papers

1. J. Jaiswal, **M.K. Gupta**, N.K. Tomar. On Functional Observers for Descriptor Systems, *2021 American Control Conference*, May 25-28, 2021, LA, USA, pp. 4093–4098, IEEE

2. **M.K. Gupta***, N.K. Tomar, D. Sharma, J. Jaiswal. PD Observer Design for Descriptor Systems with Unknown Inputs: Application to Infinite Bus System, *5th IEEE Int. Conf. Recent Advances and Innovations in Engineering*, Dec 1–3, 2020, Jaipur, IEEE, DOI: 10.1109/icraie51050. 2020.9358352

3. E. Petavratzis, L Moysis, C Volos, **M.K. Gupta**, I. Stouboulos, S Goudos, Chaotic Motion Control of a Mobile Robot Using a Memory Technique, *24th Int. Conf. System Theory, Control and Computing*, Oct 8 – 10, 2020, Sinaia, Romania, pp. 506–511, IEEE

4. L Moysis, C Volos, VT Pham, S Goudos, I Stouboulos, **M.K. Gupta**. Synchronization of a Chaotic System with Line Equilibrium using a Descriptor Observer for Secure Communication, *8th Int. Conf. Modern Circuits and Systems Technologies* May 13–15, 2019, Thessaloniki, Greece, pp. 1–4, IEEE

5. S. Chandra, **M.K. Gupta***, N.K. Tomar. Synchronization of Rössler chaotic system for secure communication via descriptor observer design approach, *Int. Conf. on Signal Processing, Computing and Control*, Jaypee University, Solan, Sept. 24-26, 2015, pp. 120–124, IEEE

6. S. Chandra, **M.K. Gupta**, N.K. Tomar. Observer design approach to synchronize Lorenz chaotic systems for secure communication, *Int. Conf. on Computational Modeling & Simulation* University of Colombo, Sri Lanka, May 17-19, 2017, ISBN: 978-955703011-1

7. V.K. Mishra, N.K. Tomar, **M.K. Gupta**. Impulse controllability and impulse elimination in rectangular descriptor systems, *15th Int. Conf. on Control, Automation and Systems*, Busan, Korea, Oct 13-16, 2015, pp. 316–325, IEEE

8. **M.K. Gupta***, N.K. Tomar, S. Bhaumik. PD observer design for linear descriptor systems, *Int. Conf. on Mathematical Sciences*, Sathyabama University, Chennai, July 17-19, 2014, pp. 40–43, Elsevier.

9. **M.K. Gupta**, N.K. Tomar, S. Bhaumik. Detectability and observer design for linear descriptor system, *22nd Mediterranean Conf. on Control and Automation*, University of Palermo, Italy, June 16-19, 2014, pp. 1094–1098, IEEE.

10. **M.K. Gupta***, N.K. Tomar, S. Bhaumik. On observability of irregular descriptor systems, *Int. Conf. on Advances in Control and Optimization of Dynamical systems*, IIT Kanpur, March 13-15, 2014, 3(1), pp. 376–379, IFAC

* Presenting Author

Conference Presentations: 13

S. No.	Title	Conference	Date & place
1.	Index one generalized observer design for linear descriptor systems	Int. e-Conf. on Recent Advances in Computation, Communication, Internet of Things and Artificial Intelligence	M. Kumarasamy College Of Engineering March 31-April 01, 2021

2.	On the necessary and sufficient condition for the existence of observer for descriptor system	*7th Heidelberg Laureate Forum*	Heidelberg, Germany, Sept 22 – 27, 2019.
3.	Causal detectability for descriptor systems	*International Congress of Mathematics*	Rio de Janeiro, Brazil, August 1–9, 2018.
4.	A simple proof for the existence of Jordan form	*Int. Conference on Matrix Inequalities and Matrix Equations*	Shanghai University, China, June 8–10, 2018.
5.	Fault Diagnosis via nonlinear observers	*Young Researchers in Mathematics*	University of Kent, UK, Aug 1-4, 2017
6.	Observer design for rectangular descriptor systems with Lipschitz nonlinearities	*Conf. on Computational and Theoretical Partial Differential Equations*	NIT Goa, Oct 5-7, 2016
7.	Controllability and normalizability for LTI descriptor systems	*5th Research Scholar's day*	IIT Patna, Feb 28, 2016
8.	Observer design for descriptor systems with monotone nonlinearities	*Symposium on mathematical modeling and computation*	IIT Patna, April 9, 2016
9.	Observer design for descriptor systems with unknown inputs	*Int. Conf. on Frontiers of Mathematics*	Gauhati University, Guwahati, March 26-28, 2015
10.	Reduced-order observer design for rectangular linear descriptor systems	*Int. Conf. on Optimization, Computing and Business Analysis for Sustainable Development*	Central University of Rajasthan, Ajmer, Feb 20-22, 2015.
11.	PD observer design for descriptor systems with unknown inputs	*Int. Conf. on Linear Algebra & its Applications*	Manipal University, Manipal, Dec 18-20, 2014.
12.	Observer design for descriptor systems	*National Meeting of Research Scholars in Mathematical Sciences*	Jammu University, Jammu, Dec 8-12, 2014.
13.	Detectability and observer design for linear descriptor systems	*4th Research Scholar's day*	IIT Patna, March 8, 2014.

Courses Taught at NIT Jamshedpur

    M.Sc.: Functional Analysis, Probability & Statistics (3 times), Operations Research (2 times), Linear Algebra (2 times)

    MCA: Probability and Statistical Computing (2 times)

    B.Tech.: Engineering Mathematics-I (2 times), Engineering Mathematics-III

    Other Teaching interests: Abstract Algebra, Topology

Invited Talks

1. "How to prepare for NET, GATE, and other M.Sc./PhD entrance examinations" Winter Refresher Course in Mathematics, Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya, Kanchipuram, Tamil Nadu. 01 – 03 Feb 2018.

2. "Observer design for semi linear descriptor systems: Discussion on nonlinearities" Faculty Development Program on *Recent Trends in Control System Engineering*, Electronics and ICT Academy, NIT Patna, 22 – 28 June, 2020.

3. "Best Practices in PhD, Dos and Don'ts in Research" Shodh Aagaaz, **IIT Patna**, August 14 – 15, 2021.

Conference Chair

1. Chaired a Technical Session in The 3rd Int. Conf. on Frontiers in Industrial and Applied Mathematics (FIAM) 2020, NIT Jamshedpur, India, Dec 21-22.

2. Chaired a Technical Session in International Conference on Security & Privacy 2021, NIT Jamshedpur

Workshops/Conferences Organized

1. Applications of Algebra in Science and Engineering, Department of Mathematics, NIT Jamshedpur Oct 12-14, 2020 as **Co-ordinator**

2. 27th International Conference of International Academy of Physical Sciences (CONIAPS XXVII) on 'Recent Advances in Pure and Applied Algebra (RAPAA)', 26-28th Oct 2021, NIT Jamshedpur as **Organizing Secretary**

M.Sc. Thesis Supervision: 5

1. Mahendra Kumar Yadav, *Jordan form and its applications* 2019. End date: 14-05-2019

2. Shailesh Kumpawat, *Deep Neural Networks*, 2020. End date: 25-06-2020

3. Nistha Dewan, *Automated Detection Of Covid-19 Cases Using Deep Neural Networks With X-Ray Images*, 2020. End date: 25-06-2020

4. Madhusmita Chand, Qualitative Sign Stability of Matrix Pair, 2021

5. Samiksha Bhadoni, Sensitivity Analysis of Linear Programming Problem, 2021

Summer Schools/Workshops Attended: 11

1. Matrix Analysis and its Applications, Department of Mathematics, NIT Jalandhar, September 23-27, 2020 (online)

2. Workshop on Computational Mathematics and Science Chulalongkorn University, Bangkok, Thailand Mar 20-24, 2017

3. Advanced Instructional School: Matrix Analysis Shiv Nadar University, Noida May 2-21, 2016

4. Summer School in Engineering & Sciences Course: Non-Negative Matrices Technion Israel Institute of Technology, Haifa, Israel July 29-August 28, 2015

5. Indian Control Conference, IIT Madras, Chennai Jan 5-7, 2015

6. Scientific Computational Techniques Manipal University, Jaipur Nov 8-9, 2013

7. Advanced Workshop on Mathematical Epidemiology & Differential Equation IIT Patna July 8-13, 2013

8. Workshop on Cryptography, IIT Patna, April 06-07, 2013

9. Linear and Nonlinear Systems, Banasthali University, Dec 15-19, 2012

10. Third Science Conclave: A Congregation of Nobel Laureates, IIIT Allahabad, Dec 8-14, 2010

11. Summer Program in Mathematics, HRI, Allahabad June 21–July 10, 2010

Editorial Experience

1. Guest Editor for *Complexity*, Hindawi (SCIE Journal)
   Topical issue: Recent Advances in Modeling, Analysis, and Synchronization of Chaotic Systems 2019

Papers reviewed from

Journals: *Mathematical Reviews*-American Mathematical Society (4 papers); *Int. J. Robust Nonlinear Control*, Wiley (SCI); *Kybernetika*, Nakladatelstvi Academia (SCI); *International Frontier Science Letters*, SciPress Ltd.; *Applied Mathematics E-Notes,* (ESCI)
Conference: *Indian Control Conference 2017*, IEEE; *FIAM 2020*, NIT Jamshedpur.

Membership of professional bodies

- American Mathematical Society

Sports and Extra Curricular

1. Awarded several times for *Chess, Cycle race, Athletics, Marathon,* and *Skating* at University level.

2. Awarded several times for *Hindi typing competition, Hindi Gyan Pratiyogita, Essay writing Competitions,* and *Quiz competition*

3. Team Manager of NIT Jamshedpur chess team for Inter NIT Chess tournament held at MNIT Jaipur during 17–19 Oct 2019.

PhD Students (Ongoing)

- Abhinav Kumar
- Meenakshi Tripathi
- Mamoni Paitandi

Personal Details

Date of Birth: 14 March 1989
Father's Name: Sh. Suraj Mal Gupta (Retd. Teacher)
Hobbies: Swimming, Physical Exercise, Travelling
Permanent Address : 176/48, Pratap Nagar, Jaipur, Rajasthan, India, 302033.

References

Dr. Nutan Kumar Tomar (PhD Supervisor) Associate Professor Department of Mathematics IIT Patna, Bihta-801118 ✉ nktomar@iitp.ac.in ☎ +91-612-302 8021	**Dr. Shovan Bhaumik** (PhD Co-supervisor) Associate Professor Department of Electrical Engineering IIT Patna, Bihta-801118 ✉ shovan.bhaumik@iitp.ac.in ☎ +91-612-302 8049	**Prof. Raghunathan Rengaswamy** (Post Doc Mentor) Fellow- INAE Professor Department of Chemical Engineering IIT Madras-600036 ✉ raghur@iitm.ac.in ☎ 044-22574159