

Personal Information

Name Ranjan Kumar Das
Citizenship INDIAN
Date of Birth 15th May 1989
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Languages English, Hindi, Odia (Native)



Research Interests

Broadly I am working in Linear Algebra, Numerical Linear Algebra and Matrix Theory. I am primarily interested in Linear and Nonlinear Eigenvalue Problems, Distance Problems for Polynomial and Rational Matrices, Perturbation Theory for Rational Eigenvalue Problems, Matrix Inverse Problems. I am also open to explore other possible related research areas in Numerical Linear Algebra.

Currently, I am working on parameter dependent quadratic eigenvalue problem arising from vibration analysis of mechanical systems and model order reduction.

Current Affiliation

Post-Doctoral Fellow
DEPARTMENT OF MATHEMATICS, UNIVERSITY OF OSIJEK, CROATIA

January 2022 - present

Previous postdoctoral positions

Post-Doctoral Fellow
DEPARTMENT OF ELECTRICAL ENGINEERING, IIT BOMBAY, INDIA

October 2020 - October 2021

Education

Ph.D. in MATHEMATICS
DEPARTMENT OF MATHEMATICS, INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

2013-2019

Master in MATHEMATICS
DEPARTMENT OF MATHEMATICS, INDIAN INSTITUTE OF TECHNOLOGY KANPUR, INDIA

2012

Bachelor of Science (MATHEMATICS HONOURS)
GANGADHAR MEHER COLLEGE, SAMBALPUR UNIVERSITY, INDIA

2009

Higher Secondary Examination in SCIENCE
(COUNCIL OF HIGHER SECONDARY EDUCATION, ODISHA) DEOGARH COLLEGE, ODISHA, INDIA

2006

High School Certificate Examination (BOARD OF SECONDARY EDUCATION, ODISHA)
SABARI VIDYA BHAWAN, MALKANGIRI, ODISHA, INDIA

2004

Ph.D. Thesis

Title: Strong Linearizations of Polynomial and Rational Matrices and Recovery of Spectral Data
Advisor: PROF. RAFIKUL ALAM

- Date of Submission: 01 April 2019
- Date of Defense: 30 August 2019
- Summary of the Thesis: Nonlinear eigenvalue problems arise in a wide range of applications, and nonlinear eigenvalue problem numerics is a rapidly growing field of study. The numerics of polynomial and rational eigenvalue problems are the subject of my Ph.D. dissertation.

The thesis builds an unified framework of strong linearizations of matrix polynomials with the aim of providing a direct solution for polynomial eigenvalue problems. This framework subsumes all

the known classes of Fiedler-like strong linearizations available in the literature, allowing structure-preserving strong linearizations of matrix polynomials with additional properties such as low bandwidth pencils. The operation-free simple recovery of eigenvectors, minimal bases, and minimal indices of matrix polynomials from those of strong linearizations is a key feature of this framework.

The notion of strong linearizations of rational matrices is introduced in the thesis, and Fiedler-like and vector space form strong linearizations are built to provide a direct solution of rational eigenvalue problems. The thesis describes how to recover spectral data (poles, zeros, eigenvalues, eigenvectors, minimal bases, and minimal indices) of rational matrices from those of the strong linearizations. In addition, it describes the construction of structure-preserving linearizations of various structured rational matrices (symmetric, skew-symmetric, Hamiltonian, skew-Hamiltonian, and so on). Also, the thesis describes various algorithms for the construction of the linearizations that could be used to build Matlab toolboxes for the computational aspects of rational/polynomial eigenvalue problems.

Publications

- R. K. Das and R. Alam, **Affine spaces of strong linearizations for rational matrices and the recovery of eigenvectors and minimal bases**, *Linear Algebra Appl.*, 569 (2019), pp. 335–368. <https://doi.org/10.1016/j.laa.2019.02.001>
- R. K. Das and R. Alam, **Recovery of minimal bases and minimal indices of rational matrices from Fiedler-like pencils**, *Linear Algebra Appl.*, 566 (2019), pp. 34–60. <https://doi.org/10.1016/j.laa.2018.12.021>
- R. K. Das and R. Alam, **Automatic recovery of eigenvectors and minimal bases of matrix polynomials from generalized Fiedler pencils with repetition**, *Linear Algebra Appl.*, 569 (2019), pp. 78–112. <https://doi.org/10.1016/j.laa.2019.01.013>
- R. K. Das and R. Alam, **Palindromic linearizations of palindromic matrix polynomials of odd degree obtained from Fiedler-like pencils**. *Vietnam Journal of Mathematics*, 48 (2020), pp. 865–891. <https://doi.org/10.1007/s10013-020-00444-w>
- R. K. Das and R. Alam, **Structured strong linearizations of structured rational matrices**. *Linear And MultiLinear Algebra*, 2021, pp. 1-34. <https://doi.org/10.1080/03081087.2021.1945525>

Manuscripts Under Preparation

- R. K. Das **Fiedler-like linearizations for polynomial and rational matrices and recovery of eigenvectors, minimal bases and minimal indices.**
- R. K. Das **Fiedler-like Hermitian linearizations preserving sign characteristic of Hermitian matrix polynomial.**
- R. K. Das and Zoran Tomljanovic, **Approximation of damped quadratic eigenvalue problem by dimension reduction via Brauer’s ovals of Cassini.**

Awards

- ICIAM 2019 Travel Award to attend ICIAM 2019 conference at Valencia, Spain.
- SIAM Student Travel Awards to attend SIAM ALA18 conference at Hong Kong.
- Qualified CSIR-NET 2013 in Mathematical Sciences with all India rank 42.
- Qualified GATE 2013 in Mathematics with all India rank 94
- Awarded MHRD scholarship for pursuing Ph.D. at IIT Guwahati.
- Qualified JAM 2010 in Mathematics with all India rank 15.

Conference/Workshops

- 11th Conference on Applied Mathematics and Scientific Computing (05-09 September 2022), Brijuni, Croatia.
Talk: Solving polynomial and rational eigenvalue problems through linearizations
- 7th Croatian Mathematical Congress (15-18 June, 2022), University of Split, Croatia.
Talk: Solving polynomial and rational eigenvalue problems through linearizations

- 3rd Workshop on Optimal Control of Dynamical Systems and applications March 28-April 01, 2022 at Department of Mathematics, J. J. Strossmayer University of Osijek, Croatia.
Talk: Fiedler-like structure preserving strong linearizations for structured matrix polynomials
- *9th International Congress on Industrial and Applied Mathematics-ICIAM 2019 (15-19 July, 2019), University of Valencia, Valencia, Spain.*
Talk: Affine spaces of strong linearizations for rational matrices and the recovery of eigenvectors and minimal bases
- *SIAM Conference on Applied Linear Algebra (04-08 May, 2018), Hong Kong Baptist University, Hong Kong.*
Talk: Extended generalized Fiedler pencils for matrix polynomials and the recovery of eigenvectors and minimal bases
- *International Conference on Linear Algebra and its Applications (11-15 December, 2017), Manipal University, Manipal-576104, Karnataka, India.*
Talk: Generalized Fiedler pencils with repetition for polynomial eigenproblems and the recovery of eigenvectors, minimal bases and minimal indices.
- *National Conference on "Advances in Mathematical Sciences" (22-23 December, 2016), Gauhati University, Guwahati-781014, Assam, India.*
Talk: Solving rational eigenvalue problem by constructing a new family of pencils.
- Advanced Instructional Schools on Matrix Analysis (02-21 May, 2016), Shiv Nadar University, Greater Noida, Uttar Pradesh - 201314, India.
- Presenter in Intra IIT Latex Workshop-2017, organised by Indian Institute of Technology Guwahati, India.
- Poster presentation in Research Conclave- 2016 organized by IIT Guwahati, India.

Teaching

IIT Guwahati | TEACHING ASSISTANT AND LAB INSTRUCTOR

- Linear Algebra and Calculus (July-Nov 2014, 2015, 2016)
- Multivariable Calculus and Ordinary Differential Equations (Jan- May 2016)
- Numerical Linear Algebra with MATLAB (Jan-May 2015, 2017)
- Matrix Computations with MATLAB (July-Nov 2017)

Skills

- \LaTeX • MATLAB • C

Community Services

- Reviewer for the journal of Linear Algebra and Its Applications.
- Reviewer for the journal of Applied Mathematics and Computation
- Reviewer for "Mathematical Reviews"