**Current Position**

Associate Teaching Professor, Mathematics & Statistics, Northern Arizona University

**Citizenship**

India (Permanent Resident of the USA)

**Education**

2009-2014    **Doctor of Philosophy, Mathematics**
             University of Wyoming, 2014
             Thesis Advisor: Dr. Bryan L. Shader
             Title: New Probabilistic, Combinatorial and Algebraic Methods
                     for Minimum Rank Problems

2005-2007    **Master of Science, Pure Mathematics**
             University of Calcutta, 2007

**Research Interests**

Algebraic and Spectral Graph Theory, Coding Theory, Combinatorics, Linear Algebra, Graph Theory, Combinatorial Matrix Theory.

**Publications**

19. Sudipta Mallik, *An extension of determinant and its application to fractional perfect matchings of a graph.* (under review)

18. Sudipta Mallik and Bahattin Yildiz, *Codes from incidence matrices of hypergraphs*, arXiv:2210.06733. (under review)

17. Abdullah Alazemi, Milica Andelic, and Sudipta Mallik, *Signed graphs and inverses of their incidence matrices*, Linear Algebra and its Applications 694 (2024) 78–100. https://doi.org/10.1016/j.laa.2024.04.012

16. Jerad Ipsen and Sudipta Mallik, *Incidence and Laplacian matrices of wheel graphs and their inverses*, American Journal of Combinatorics 2 (2023) 1-19. https://ajcombinatorics.org/Volume2/V2.01.pdf

15. Sudipta Mallik, *Matrix tree theorem for the net Laplacian matrix of a signed graph*, Linear and Multilinear Algebra (2023). https://doi.org/10.1080/03081087.2023.2172544

14. Sudipta Mallik, *A new formula for the minimum distance of an expander code*, J. Algebra Comb. Discrete Appl. 9(2) (2022) 79-84. https://doi.org/10.13069/jacodesmath.1111379

13. Sudipta Mallik, *New formulations of the union-closed sets conjecture*, American Journal of Combinatorics 1 (2022) 40-46. https://ajcombinatorics.org/Volume1/V1.03.pdf

12. Ryan Hessert and Sudipta Mallik, *The inverse of the incidence matrix of a unicyclic graph*, Linear and Multilinear Algebra 71 (4) 513-527 (2023).
    https://doi.org/10.1080/03081087.2022.2035307

11. Sudipta Mallik and Bahattin Yildiz, *Isodual and self-dual codes from graphs*, Algebra and Discrete Mathematics 32(1) (2021) 49-64. http://dx.doi.org/10.12958/adm1645

10. Ryan Hessert and Sudipta Mallik, *Moore-Penrose inverses of the signless Laplacian and edge-Laplacian of graphs*, Discrete Mathematics 344 (2021) 112451.
    https://doi.org/10.1016/j.disc.2021.112451

9. Sudipta Mallik and Bahattin Yildiz, *Graph theoretic aspects of minimum distance and equivalence of binary linear codes*, Australasian Journal of Combinatorics 79(3)(2021) 515-526. https://ajc.maths.uq.edu.au/pdf/79/ajc_v79_p515.pdf

8. Sudipta Mallik and Keivan Hassani Monfared, *An analog of matrix tree theorem for signless Laplacians*, Linear Algebra and its Applications 560 (2019) 43-55.
   https://doi.org/10.1016/j.laa.2018.09.016

7. Sudipta Mallik and Keivan Hassani Monfared, *Spectral characterization of matchings in graphs*, Linear Algebra and its Applications 496 (2016) 407-419.
   https://doi.org/10.1016/j.laa.2016.02.004

6. Sudipta Mallik and Bryan L. Shader, *On graphs of minimum skew rank 4*, Linear and Multilinear Algebra 64 (2016) 279-289. https://doi.org/10.1080/03081087.2015.1034642

5. Sudipta Mallik and Bryan L. Shader, *Integrally normalizable matrices with respect to a given set*, Linear Algebra and its Applications 498 (2016) 317-325.
   https://doi.org/10.1016/j.laa.2015.07.001

4. Sudipta Mallik and Keivan Hassani Monfared, *The maximum multiplicity of an eigenvalue of symmetric matrices with a given graph*, http://arxiv.org/abs/1601.02760 (2016).

3. Sudipta Mallik and Keivan Hassani Monfared, *Construction of real skew-symmetric matrices from interlaced spectral data, and graph*, Linear Algebra and its Applications 471 (2015) 241-263. https://doi.org/10.1016/j.laa.2015.01.001

2. Sudipta Mallik and Bryan L. Shader, *Classes of graphs with minimum skew rank 4*, Linear Algebra and its Applications 439 (2013) 3643-3657.
   https://doi.org/10.1016/j.laa.2013.09.022

1. Sudipta Mallik, *Alternative proofs on the indices of cacti and unicyclic graphs with n vertices*, http://arxiv.org/abs/1110.2571 (2011).

## Articles in Progress

1. S. Barik, S. Mallik, S. U. Reddy, *Complex Laplacians and their Moore-Penrose inverses.*

2. Sudipta Mallik and Hiranmoy Pal, *State transfers on signed graph revisited.*

3. M. Rajesh Kannan, Iswar Mahato, and Sudipta Mallik, *On maximum spectral radius of the eccentricity matrix of a tree.*

4. S. Mallik and S. Sivasubramanian, *Generalizing a conjecture of Graham and Lovász concerning unimodality of coefficients of the distance characteristic polynomial.*

## Student Research Supervised

- Scott Alter, Graduate research on "Spectral graph theory and the matching number of a graph", Northern Arizona University, Fall, 2022.

- Heather Vogler, Undergraduate research on "Spectral study of the chromatic number of a graph", Northern Arizona University, Fall, 2022.

- Jerad Ipsen, Undergraduate research on "Inverse of the Incidence Matrices of Various Graph Classes", Northern Arizona University, Fall, 2021 – Spring 2022.

  - Jerad Ipsen and Sudipta Mallik, *Incidence and Laplacian matrices of wheel graphs and their inverses*, American Journal of Combinatorics 2 (2023) 1-19.

- Harlan Heilman, Undergraduate research on "Quantum Walks on Graphs", Northern Arizona University, Spring – Summer, 2021.

- Ryan Hessert, Graduate research on "Moore-Penrose Inverse of Matrices associated with Graphs", Northern Arizona University, Fall, 2019 – Spring, 2021.

  - Ryan Hessert and Sudipta Mallik, *The inverse of the incidence matrix of a unicyclic graph*, Linear and Multilinear Algebra 71 (4) 513-527 (2023).
  - Ryan Hessert and Sudipta Mallik, *Moore-Penrose Inverses of the Signless Laplacian and Edge-Laplacian of Graphs*, Discrete Mathematics 344 (2021) 112451.

- Ryan Hessert (LSAMP scholar), Undergraduate research on "Edge-Laplacians of Graphs", Northern Arizona University, Spring – Summer, 2019.

## Books and Lecture Notes

1. *Concise Calculus II*, 2023 (`https://learnmathonline.org/ConciseCalculus2.pdf`)

2. Number Theory (`https://learnmathonline.org/numbertheory.html`)

3. Linear Algebra (`https://learnmathonline.org/LinearAlgebra.html`)

4. Numerical Analysis (`https://learnmathonline.org/numericalanalysis.html`)

5. Discrete Mathematics (`https://learnmathonline.org/DiscreteMath.html`)

6. Differential Equations (`https://learnmathonline.org/diffeq.html`)

## Professional Activities

- Editor-in-Chief, American Journal of Combinatorics, 2021 - present.

- Founder, learnmathonline.org (a website for mathematics students).

- Referee:

    - Linear Algebra and its Applications
    - Discrete Mathematics
    - Electronic Journal of Linear Algebra
    - Linear and Multilinear Algebra
    - AKCE International Journal of Graphs and Combinatorics
    - Information Processing Letters
    - International Journal of Computer Mathematics
    - Bulletin of the Iranian Mathematical Society

- Organizer, Conference in Honor of Bryan Shader, the University of Wyoming, 2022.

- Organizer, AMS Special Session on "Emerging Topics in Graphs and Matrices" at 2018 Joint Mathematics Meetings (JMM), San Diego.

- Organizer, AMS Special Session on "Graphs and Matrices" at 2017 JMM, Atlanta.

- Served as the elected Graduate Student Representative, Department of Mathematics, University of Wyoming, 2012 - 2013.

- Organized Graduate Students' Seminars, University of Wyoming, 2012 - 2013.

- Supervised undergraduate research as a Graduate Mentor, NSF-sponsored Mathematics REU, University of Wyoming, Summer 2011.

## Honors, Grants, and Awards

- **NSF** DMS Combinatorics Research Grant ($52,101) for *Combinatorial aspects of the Moore-Penrose inverse* (declined 2024).

- Elevating Excellence Grant ($5,000) from the President of Northern Arizona University for creating an OER Calculus textbook, Summer 2023.

- Faculty Mentor Research Grant 2022 ($1,000), Office of Undergraduate Research, NAU.

- LSAMP Faculty Mentor Research Stipend ($750), LSAMP grant G1003500, 2019.

- AMS-NSF Travel Grant ($3,300) to the International Congress of Mathematicians in Rio de Janeiro, Brazil, 2018.

- AMS Travel Grant to the Joint Mathematics Meetings, Baltimore, MD, 2014.

- Catherine Gibbs Shaw Award for Excellence in Teaching and Research at University of Wyoming, 2012.

- Virindra & Gail Sehgal Award for Excellence in Teaching and Research at University of Wyoming, 2012.

- **CSIR NET** Junior Research Fellowship and Assistant Professorship at Universities and Colleges in India, June 2009.

- National Scholarship (India) for Excellence in Higher Secondary Education, 2002.

- National Scholarship (India) for Excellence in Secondary Education, 2000.

# Teaching Experience

**Northern Arizona University, 2014 - present**
- 13 courses taught with full teaching and grading responsibilities:

  - Graduate Linear Algebra MAT 516, Fall 2022.
  - Algebraic Graph Theory MAT 697, Spring 2015.
  - Graduate Research MAT 685, Fall 2022, 2020, 2019; Spring 2020.
  - Undergraduate Research MAT 485, Fall 2022, 2021; Spring 2022, 2019.
  - Mathematics Capstone MAT 486C, Spring 2024, Fall 2023.
  - Real Analysis MAT 431, Fall 2018.
  - Numerical Analysis MAT 362 (Total 19 sections).
  - Foundations of Mathematics MAT 320 (Total 2 sections)
  - Number Theory MAT 318, Spring 2018.
  - Linear Algebra MAT 316 (Total 13 sections).
  - Differential Equations MAT 239 (Total 16 sections).
  - Differential Equations MAT 239 (online) Summer 2022.
  - Calculus III MAT 238 (Total 3 sections).
  - Calculus II MAT 137 (Total 7 sections).
  - Discrete Mathematics MAT 226 (Total 10 sections).
  - Algebra for Precalculus MAT 108, Fall 2021.

**University of Wyoming, 2009 - 2014**
- 6 courses taught with full teaching and grading responsibilities:

  - Linear Algebra, Summer 2013.
  - Calculus III (Total 2 sections).
  - Calculus II (Total 2 sections).

- Calculus I (Total 4 sections).
- Trigonometry, Summer 2010.
- College Algebra (Total 2 sections).

- Courses supervised as TA:

- Calculus III, Fall 2013 (TA and Discussion Instructor).
- College Algebra, Spring 2011 and Fall 2010 (TA and Supplemental Instructor).

- Tutor in Math Lab, 2009 - 2014.
  - Helped undergraduate students in all areas of Mathematics.

**AJC Bose College, India, 2008**
Course taught with full teaching responsibilities:

- Abstract Algebra.

**Gokhale Memorial Girls' College, India, 2007 - 2008**
5 courses taught with full teaching responsibilities:

- 2D-3D Geometry
- Abstract Algebra
- Metric Spaces
- C Programming
- Complex Analysis

**Technology Used for Teaching & Research**

- Teaching Tools: Canvas, BBLearn, WebAssign, WeBWorK, MyLabMath, Hawkes, ALEKS.

- Publishing: LaTeX, Beamer, MS Office.

- Programming: Python, SageMath, R, C, Matlab, Maple.

**Institutional Services**

Northern Arizona University

- Chair, Curriculum Committee, Dept. of Mathematics & Statistics, Fall 2022 - Spring 2023, Fall 2020 - Spring 2021.

- Member, Curriculum Committee, Dept. of Mathematics & Statistics, Spring 2024.

- Mentor, two junior mathematics lecturers, 2022-present, 2019-2020.

- Contributing Member, Tenure-track Assistant Professor Search Committee, Dept. of Physics, 2021 - 2022.

- Member, Assessment Committee, Dept. of Mathematics & Statistics, Fall 2021 - Spring 2022.

- Member, Grade Appeal Hearing Committee, College of CEFNS, Fall 2019.

- Member, Curriculum Committee (Chair, Math Capstone Subcommittee), Dept. of Mathematics & Statistics, Fall 2018 - Spring 2021.

- Member, Scholarhips & Nominations Committee, Dept. of Mathematics & Statistics, Fall 2018 - Spring 2021.

- Elected Member, Lecturer Search Committee, Dept. of Mathematics & Statistics, 2017 - 2018.

- Elected Member, Annual Review Committee (Service), Dept. of Mathematics & Statistics, 2017 - 2018.

- Coordinator, Problem of the Week, Dept. of Mathematics & Statistics, 2016 - 2018.

- Member, Math Contest/Outreach Committee, Dept. of Mathematics & Statistics, 2015 - 2016.

- Member, Discrete Mathematics Textbook Selection Committee, Dept. of Mathematics & Statistics, 2015 - 2016.

- Member, Honors Week Committee, Dept. of Mathematics & Statistics, 2014 - 2015.

**Outreach**

- Contributor, SUnMaRC Problem Contest, SUnMaRC (Southwestern Undergraduate Mathematics Research Conference) 2017.

- Co-organizer, Coconino County Math Contest 2016.

- Co-organizer, Yavapai County Math Contest 2016.

- Co-organizer, High School Math Day at NAU 2015.

**Professional Membership**

- International Linear Algebra Society, 2013 - 2016, 2023 - present.

- American Mathematical Society, 2009 - 2014.

**Talks**

1. *Combinatorial aspects of the Moore-Penrose inverse*, Invited Talk at New York Combinatorics Seminar, CUNY, March 22, 2024. `https://youtu.be/lSwGyyhMYWw?si=2k0-mIuymIo8t5fV`

2. *Fantastic incidence matrices and how to invert them*, Conference in honor of Bryan Shader, the University of Wyoming, July 28, 2022.

3. *Binary Linear Codes from Graphs*, ACGT Seminar, Northern Arizona University, January 14 & 21, 2020.

4. *Applications of Linear Algebra to Graph Theoretic Problems*, Invited Talk at RKM Vidyamandira, University of Calcutta, India, July 2, 2019.

5. *ICM in Rio de Janeiro: My Experiences*, Northern Arizona University, Friday Afternoon Mathematics Undergraduate Seminar, April 19, 2019.

6. *An Analogue of Matrix Tree Theorem*, ICM Satellite Conference LAAW 2018, UFF, Rio de Janeiro, Brazil, July 31, 2018.

7. *Matrix Tree Theorem and Beyond*, Northern Arizona University, Mathematics Colloquium, January 23, 2018.

8. *Spectral Decomposition of a Matrix*, Invited Talk at University of Calcutta, India, July 27, 2017.

9. *Spectral Characterization of Matchings in Graphs*, Joint Mathematics Meetings, Seattle, January 8, 2016.

10. *Structured Inverse Eigenvalue Problems*, Northern Arizona University, Mathematics Colloquium, September 14, 2015.

11. *Let's Prove the Four Color Theorem in One Line: Colin de Verdière Conjecture*, Northern Arizona University, Mathematics Colloquium, September 16, 2014.

12. *Probabilistic methods for minimum skew rank of graphs*, Joint Mathematics Meetings, Baltimore, January 16, 2014.

13. *Let's Prove the Four Color Theorem in One Line: Colin de Verdière Conjecture*, Invited Talk at Discrete Mathematics Seminar, University of Colorado, Denver, Oct 28, 2013.

14. *New Techniques for Finding Minimum Skew Rank of Graphs*, Rocky Mountain Mathematics Consortium, University of Wyoming, June 21, 2013.

15. *Classes of Graphs with Minimum Skew Rank* 4, AMS Central Sectional Meeting, Iowa State University, April 28, 2013.

16. *Average Minimum Skew Rank of Graphs*, Rocky Mountain Discrete Mathematics Days, Denver University, October 27, 2012.

17. *On the Characterization of Graphs with Minimum Skew Rank* 4, MIGHTY LIII Conference, Iowa Sate University, September 22, 2012.

18. *On the Characterization of Graphs with Minimum Skew Rank* 4, Rocky Mountain Discrete Mathematics Days, CSU, Colorado, May 19, 2012.

19. *On the Characterization of Graphs with Minimum Skew Rank* 4, MAA Rocky Mountain Section Meeting, UC Denver, April 14, 2012.

## Conferences Attended

- International Congress of Mathematicians, Rio de Janeiro, Brazil, August 1-7, 2018.

- ICM Satellite Conference LAAW 2018, UFF, Rio de Janeiro, Brazil, July 30-31, 2018.

- Joint Mathematics Meetings, San Diego, January 12-13, 2018.

- Joint Mathematics Meetings, Atlanta, January 4-7, 2017.

- Joint Mathematics Meetings, Seattle, January 6-10, 2016.

- Joint Mathematics Meetings, Baltimore, January 15-18, 2014.

- Rocky Mountain Mathematics Consortium (RMMC 2013), Laramie, Wyoming.

- AMS Central Sectional Meeting, Iowa State University, April 27-28, 2013.

- Rocky Mountain Discrete Mathematics Days, Denver University, Oct 27, 2012.

- MIGHTY LIII Conference, Iowa Sate University, September 21-22, 2012.

- Rocky Mountain Discrete Mathematics Days, CSU, Colorado, May 19, 2012.

- MAA Rocky Mountain Section Meeting, UC Denver, April 13-14, 2012.

- AMS Fall Central Section Meeting, University of Nebraska-Lincoln, Oct 14-16, 2011.

- Rocky Mountain Mathematics Consortium (RMMC 2011), Laramie, Wyoming.

- 2010 NSF-CBMS Regional Conference, Iowa State University, Ames, Iowa.

- MAA Regional Conference, CSU, Fort Collins, Colorado, 2010.

## Employment History

- *Northern Arizona University*
  Associate Teaching Professor (2022-2024), Senior Lecturer (2020-2022), Lecturer (2017-2020), Instructor (2014-2017).

- *University of Wyoming*
  Graduate Teaching Assistant (Fall 2009 - Summer 2014).

- *Taki Govt. High School, India* (02.13.2009 - 08.07.2009)
  Assistant Master of Mathematics, Group-A service, WB State Government of India.

- *Howrah Rabindra Vidyamandir, India*
  Assistant Teacher of Mathematics (10.03.2008 - 02.12.2009).

- *AJC Bose College, Kolkata, India*
  Part-time Lecturer of Mathematics (03.03.2008 - 09.30.2008).

- *Gokhale Memorial Girls' College, Kolkata, India*
  Guest Lecturer of Mathematics (11.13.2007 - 09.30.2008).

**Contact Information**

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| Webpage: | `https://ac.nau.edu/~sm2825/` |