Curriculum Vitae of S M Ferdous

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: https://www.linkedin.com/in/sm-ferdous/ | : http://bit.ly/scholar-smf | :https://github.com/smferdous1

Research Interest

My research area is at the intersection of **algorithm design and high performance computing**, where I design scalable algorithms for large-scale combinatorial optimization problems. I am particularly interested in leveraging algorithmic tools—including **streaming, randomized, parallel, and distributed approaches**—to address problems across interdisciplinary domains such as **quantum computing, data science, and machine learning**. My work integrates strong theoretical foundations, such as provable approximation guarantees, with a deep emphasis on practical applicability, ensuring that the developed algorithms are both efficient and deployable in real-world settings.

Professional Appointments

- **Data Scientist** *Oct'23 – Curr.*
  Data Science and Machine Intelligence Group
  Pacific Northwest National Lab, WA, USA.
- **Linus Pauling Distinguished Postdoctoral Fellow** *Jun'22 – Oct'23*
  Pacific Northwest National Lab, WA, USA.
- **Postdoctoral Research Associate** *Jan – Jun 2022*
  Department of Computer Science
  Purdue University, USA
- **Graduate Research Assistant** *2015 – 2021*
  Department of Computer Science
  Purdue University, USA
- **PhD Intern** *2017 & 2021(May – Aug)*
  Data Science and Machine Intelligence Group
  Pacific Northwest National Lab, WA, USA
- **PhD Intern** *2019(Jun – Aug)*
  ENSA Group
  Nokia Bell Labs, NJ, USA
- **Faculty Member** *2011 – 2015*
  Department of Computer Science and Engineering
  Ahsanullah University of Science and Technology
  Dhaka, Bangladesh

Education

- **PhD in Computer Science**, Purdue University, West Lafayette, Indiana *2015 – 2021*
  Thesis: "Algorithms for degree-constrained subgraphs and applications"
  Advisor: Prof. Alex Pothen | *GPA*: 3.93/4.00.
- **MSc Engg. in Computer Science and Engineering** *2011 – 2014*
  Bangladesh University of Engineering and Technology (BUET)
  Thesis: "Practically Efficient Algorithms for Minimum String Cover and Minimum Common String Partition" | *Advisor:* Prof. M. Sohel Rahman
- **BSc Engg. in Computer Science and Engineering**, BUET *2006 – 2011*
  Rank: 9/138, *Degree with Honors* | *GPA*: 3.89/4.00.

Fellowships

- **Linus Pauling Distinguished Postdoctoral Fellowship** at PNNL. *2022 – 2025*
- **John R. Rice Fellowship** for Scientific Computing, Purdue University. *2020 – 2021*
- **Ross Fellowship** for incoming graduate student at Purdue University. *2015 – 2016*
- **Dean's list** and **Merit scholarship** at BUET. *2006 – 2011*

Awards & Honors

- **Exceptional Contribution Award** at PNNL. 2025
- **Best paper award** at European Symposium on Algorithms (ESA). 2025
- **Best paper award** at ACM International Conference on Supercomputing (ICS). 2025
- **Outstanding Performance Award** at PNNL in recognition of outstanding contribution in exceptional research project leadership, development of high-impact scientific artifacts, and mentorship of multiple interns. 2024
- **Selected for participation** in week-long *Argonne Training Program on Extreme-Scale Computing (ATPESC)* 2021. 2021
- **Travel grant** for SIAM Combinatorial Scientific Computing Workshop in Bergen, Norway. 2018
- **Third best prize** on SIAM Computational Science and Engineering student poster competition at Purdue University. 2017
- **Travel and accommodation grant** for attending week-long SAMSI summer school on optimization at Research Triangle Park, NC. 2016
- **Tenth among 50 teams** in ACM International Collegiate Programming Regional Contest (ICPC) (Dhaka Site). 2008

News Coverage

- **PNNL news on our best paper award at ESA25:** https://www.pnnl.gov/news-media/massive-datasets-meet-their-match. 2025
- **PNNL news on our IPDPS24 paper:** https://www.pnnl.gov/news-media/scientists-speed-groundwork-essential-quantum-computing. Also shared in other coverages, including Quantum Computing Report, Inside HPC, Quantum Insider, and DOE Office of Science research news update. 2025
- **Purdue CS news on Pauling Fellowship:** https://www.cs.purdue.edu/news/articles/2022/s-m-ferdous-named-pauling-fellow.html. 2022

Proposal Writing Experience

- **Student writer** of a **$712,488** *awarded* proposal by DOE ASCR, Title: "Data Summarization and Inference at Scale", Award number: DE-SC0022260, PI: Alex Pothen. 2021

Publications

The following contains my publications starting from 2015. For the full list, please visit my Google Scholar profile at http://bit.ly/scholar-smf. (W) represents workshop papers.

Summary: Over 20 publications, including **10 research papers**, in **premier (ICORE ranking A/A*)** venues such as ESA, SC, IPDPS, KDD, ICS, and JPDC, and **one invited paper** in the prestigious Acta Numerica journal.

Under Submission/ In Preparation to Submit

[InSub1] Siddhartha Shankar Das, Naheed Anjum Arafat, Muftiqur Rahman, **SM Ferdous**, Alex Pothen, and Mahantesh M Halappanavar. *SGS-GNN: A Supervised Graph Sparsification method for Graph Neural Networks*. 2025. arXiv: 2502.10208 [cs.LG]. URL: https://arxiv.org/abs/2502.10208

[InSub2] Michael Mandulak, **SM Ferdous**, Sayan Ghosh, Mahantesh Halappanavar, and George Slota. *ApproxJoin: Approximate Matching for Efficient Verification in Fuzzy Set Similarity Join*. 2025. arXiv: 2507.18891 [cs.DB]. URL: https://arxiv.org/abs/2507.18891

[InSub3] S M Shovan, Arindam Khanda, **SM Ferdous**, Sajal K Das, and Mahantesh Halappanavar. Db-LP*: Parallel Batch Dynamic Label Propagations in GPU*. 2025

[InSub4] Amber Thrall, Vidya Chhabria, **SM Ferdous**, Mahantesh Halappanavar, and Bala Krishnamoorthy. *LockRoute: A Spatial Locking Framework for Parallel Global Routing*. 2025

[InSub5] Cameron Ibrahim, **SM Ferdous**, Erdal Mutlu, Ilya Safro, and Mahantesh Halappanavar. *Exact Hardware/Software Partitioning for Pathlike Tasks*. 2025

Conferences & Workshop

[HPEC25] Michael Mandulak, Sayan Ghosh, **SM Ferdous**, Mahantesh Halappanavar, and George Slota. "Anonymized Network Sensing using C++ 26 std:: execution on GPUs". In: *2025 IEEE High Performance Extreme Computing Conference (HPEC)*. IEEE. 2025, pp. 1–7. DOI: 10.1109/HPEC67600.2025.11196472

[ESA25a] Ahammed Ullah, **SM Ferdous**, and Alex Pothen. "Weighted Matching in a Poly-Streaming Model". In: *33rd Annual European Symposium on Algorithms (ESA 2025)*. Vol. 351. Leibniz International Proceedings in Informatics (LIPIcs). Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2025, 17:1–17:18. DOI: 10.4230/LIPIcs.ESA.2025.17. **Best Paper Award.**

[ESA25b] Henrik Reinstädtler, **SM Ferdous**, Alex Pothen, Bora Uçar, and Christian Schulz. "Semi-Streaming Algorithms for Hypergraph Matching". In: *33rd Annual European Symposium on Algorithms (ESA 2025)*. Vol. 351. Leibniz International Proceedings in Informatics (LIPIcs). Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2025, 79:1–79:19. DOI: 10.4230/LIPIcs.ESA.2025.79

[ASONAM25] Cameron Ibrahim, **SM Ferdous**, Ilya Safro, Marco Minutoli, and Mahantesh Halappanavar. *ELRUHNA: Elimination Rule-basedHypergraph Alignment*. Accepted at **ASONAM 2025**. 2025. arXiv: 2506.09866 [cs.SI]. URL: https://arxiv.org/abs/2506.09866

[ICS25] Marco Minutoli, Reece Neff, Naw Safrin Sattar, Hao Lu, John Feo, Henning Mortveit, Anil Vullikanti, Dawen Xie, Mandy L Wilson, Gregor von Laszewski, et al. "DIMPLES: Distributed Influence Maximization for Pandemic pLanning on Exascale Systems". In: *Proceedings of the 39th ACM International Conference on Supercomputing*. 2025, pp. 718–733. **Best Paper Award.**

[SEA25] Shivaram Gopal, **SM Ferdous**, Alex Pothen, and Hemanta Maji. "GreedyML: A Parallel Algorithm for Maximizing Constrained Submodular Functions". In: *23rd International Symposium on Experimental Algorithms (SEA 2025)*. Vol. 338. Leibniz International Proceedings in Informatics (LIPIcs). Dagstuhl, Germany: Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2025, 19:1–19:21. ISBN: 978-3-95977-375-1. DOI: 10.4230/LIPIcs.SEA.2025.19. URL: https://drops.dagstuhl.de/entities/document/10.4230/LIPIcs.SEA.2025.19

[SC24] Michael Mandulak, Sayan Ghosh, **SM Ferdous**, Mahantesh Halappanvar, and George Slota. "Efficient Weighted Graph Matching on GPUs". In: *SC24: International Conference for High Performance Computing, Networking, Storage and Analysis*. IEEE. 2024, pp. 1–16. • Code: ECP-ExaGraph/sumac

[ESA24] **SM Ferdous**, Bhargav Samineni, Alex Pothen, Mahantesh Halappanavar, and Bala Krishnamoorthy. "Semi-Streaming Algorithms for Weighted k-Disjoint Matchings". In: *32nd Annual European Symposium on Algorithms (**ESA 2024**)*. Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2024, 53:1–53:19. DOI: 10.4230/LIPIcs.ESA.2024.53.

[KDD24] Siddhartha Shankar Das, **SM Ferdous**, Mahantesh M. Halappanavar, Edoardo Serra, and Alex Pothen. "AGS-GNN: Attribute-guided Sampling for Graph Neural Networks". In: *Proceedings of the 30th ACM SIGKDD Conference on Knowledge Discovery and Data Mining*. **KDD '24**. ACM, 2024, pp. 538–549. DOI: 10.1145/3637528.3671940.• Code: siddhartha047/AGS-GNN

[IPDPS24] **SM Ferdous**, Reece Neff, Bo Peng, Salman Shuvo, Marco Minutoli, Sayak Mukherjee, Karol Kowalski, Michela Becchi, and Mahantesh Halappanavar. "Picasso: Memory-Efficient Graph Coloring Using Palettes With Applications in Quantum Computing". In: *2024 IEEE International Parallel and Distributed Processing Symposium (**IPDPS 2024**)*. IEEE. 2024, pp. 241–252. DOI: 10.1109/IPDPS57955.2024.00029. • Code: smferdous1/Picasso

[SEA24] **SM Ferdous**, Alex Pothen, and Mahantesh Halappanavar. "Streaming Matching and Edge Cover in Practice". In: *22nd International Symposium on Experimental Algorithms (**SEA 2024**)*. Schloss Dagstuhl–Leibniz-Zentrum für Informatik. 2024. DOI: 10.4230/LIPICS.SEA.2024.12. • Code: smferdous1/GraST

[IOS24] Bhargav Samineni, **SM Ferdous**, Mahantesh Halappanavar, and Bala Krishnamoorthy. *Approximate Bipartite b-Matching using Multiplicative Auction*. Accepted as a refereed paper in the 2024 INFORMS Optimization Society conference (**IOS24**). 2024. arXiv: 2403.05781 [cs.DS]. URL: https://arxiv.org/abs/2403.05781.

[SC(W)23] Lizhi Xiang, Arif Khan, **SM Ferdous**, Sr Aravind, and Mahantesh Halappanavar. "CuAlign: Scalable Network Alignment on GPU Accelerators". In: **SC-W '23**. Association for Computing Machinery, 2023, pp. 747–755. ISBN: 9798400707858. DOI: 10.1145/3624062.3625129. URL: https://doi.org/10.1145/3624062.3625129.

[PDP23] Pasqua DÁmbra, Fabio Durastante, **SM Ferdous**, Salvatore Filippone, Mahantesh Halappanavar, and Alex Pothen. "AMG Preconditioners based on Parallel Hybrid Coarsening and Multi-objective Graph Matching". In: *2023 31st Euromicro International Conference on Parallel, Distributed and Network-Based Processing (**PDP 2023**)*. 2023, pp. 59–67. DOI: 10.1109/PDP59025.2023.00017.

[ACDA21] **SM Ferdous**, Alex Pothen, Arif Khan, Ajay Panyala, and Mahantesh Halappanavar. "A parallel approximation algorithm for submodular *b*-matching". In: *Proceedings of the First SIAM Conference on Applied and Computational Discrete Algorithms (**ACDA 2021**)*. SIAM, 2021. DOI: 10.1137/1.9781611976830.5. • Code: smferdous1/Submodular-b-matching

[INFOCOM(W)21] Beomyeol Jeon, **SM Ferdous**, Muntasir Raihan Rahman, and Anwar Walid. "Privacy-preserving Decentralized Aggregation for Federated Learning". In: *2021 IEEE Conference on Computer Communications Workshops, **INFOCOM Workshops 2021**, Vancouver, BC, Canada, May 10-13, 2021*. **First two authors contributed equally.** IEEE, 2021, pp. 1–6. DOI: 10.1109/INFOCOMWKSHPS51825.2021.9484437.• Code: beomyeol/SecureD-FL

[SC18] Arif Khan, Krzysztof Choromanski, Alex Pothen, **SM Ferdous**, Mahantesh Halappanavar, and Antonino Tumeo. "Adaptive anonymization of data using b-edge cover". In: ***SC18**: International Conference for High Performance Computing, Networking, Storage and Analysis*. IEEE. 2018, pp. 743–753. DOI: 10.5555/3291656.3291735.

[IPDPS18] Arif Khan, Alex Pothen, and **SM Ferdous**. "Parallel algorithms through approximation: b-edge cover". In: *2018 IEEE International Parallel and Distributed Processing Symposium, **IPDPS 2018**, Vancouver, BC, Canada, May 21-25, 2018*. IEEE Computer Society, 2018, pp. 22–33. DOI: 10.1109/IPDPS.2018.00013.

[CSC18] **SM Ferdous**, Alex Pothen, and Arif Khan. "New Approximation Algorithms for Minimum Weighted Edge Cover". In: *Proceedings of the Eighth SIAM Workshop on Combinatorial Scientific Computing, **CSC 2018**, Bergen, Norway, June 6-8, 2018*. SIAM, 2018, pp. 97–108. DOI: 10.1137/1.9781611975215.10.

[WD16] **SM Ferdous**, Md Mustafizur Rahman, and Mahmuda Naznin. "Finding network connectivity failure in a Wireless Sensor Network". In: *2016 Wireless Days (WD)*. IEEE. 2016, pp. 1–6. DOI: 10.1109/WD.2016.7461522.

[NSyS15] **SM Ferdous** and M Sohel Rahman. "A metaheuristic approach for application partitioning in Mobile System". In: *2015 International Conference on Networking Systems and Security (NSysS)*. IEEE. 2015. DOI: 10.1109/NSysS.2015.7043520.

Journals

[J5] Reet Barik, Wade Cappa, **SM Ferdous**, Marco Minutoli, Mahantesh Halappanavar, and Ananth Kalyanaraman. "GreediRIS: Scalable influence maximization using distributed streaming maximum cover". In: *Journal of Parallel and Distributed Computing* 198 (2025), p. 105037. ISSN: 0743-7315. DOI: https://doi.org/10.1016/j.jpdc.2025.105037. URL: https://www.sciencedirect.com/science/article/pii/S0743731525000048

[J4] Seher Acer, Ariful Azad, Erik G. Boman, Aydın Buluç, Karen D. Devine, **SM Ferdous**, Nitin Gawande, Sayan Ghosh, Mahantesh Halppanavar, Ananth Kalyanaraman, Arif Khan, Marco Minutoli, Alex Pothen, Sivasankaran Rajamanickam, Oguz Selvitopi, Nathan R. Tallent, and Antonino Tumeo. "EXAGRAPH: Graph and Combinatorial Methods for Enabling Exascale Applications". In: *The International Journal of High Performance Computing Applications* (2021), p. 10943420211029299. DOI: 10.1177/10943420211029299.

[J3] Alex Pothen, **SM Ferdous**, and Fredrik Manne. "Approximation algorithms in combinatorial scientific computing". In: *Acta Numerica* 28 (2019), pp. 541–633. DOI: 10.1017/S0962492919000035.

[J2] **SM Ferdous** and M Sohel Rahman. "Solving the Minimum Common String Partition Problem with the Help of Ants". In: *Math. Comput. Sci.* 11.2 (2017), pp. 233–249. DOI: 10.1007/s11786-017-0293-5.

[J1] **SM Ferdous** and M. Sohel Rahman. "An Integer Programming Formulation of the Minimum Common String Partition Problem". In: *PLOS ONE* 10.7 (July 2015), pp. 1–16. DOI: 10.1371/journal.pone.0130266.

Selected Talks

2025 **SM Ferdous**. "Large-scale Graph Analytics: A case for memory efficiency". Presented in GraphBlas BOF, SC 2025, St. Louis, MO. 2025.

2024 **SM Ferdous**. "Semi-streaming algorithms for weighted k-Disjoint matching". Presented in SIAM Discrete Math 2024, Spokane, WA. 2024.

2021 **SM Ferdous** and Alex Pothen. "Locality Matters! Efficient algorithms for submodular b-matching". Presented in SIAM CSE 2021, Happened virtually. 2021.

2019 **SM Ferdous** and Alex Pothen. "Efficient Algorithms for Degree Constrained Subgraphs with Applications". Presented in SIAM CSE 2019, Spokane, WA. 2019.

2018 **SM Ferdous** and Alex Pothen. "New Approximation Algorithms for Minimum Weight Edge Cover". Presented in SIAM AN 2018, Portland, OR. 2018

Teaching Experience

- **Ahsanullah University of Science & Technology** *Mar – Aug 2015*
  Assistant Professor, Dept. of Computer Science & Engineering
  Courses Taught: Elementary Structured Programming (C)
- **Ahsanullah University of Science & Technology** *Oct'11 – Feb'15*
  Lecturer, Dept. of Computer Science & Engineering
  Courses Taught: Mathematical Analysis of Computer Science, Database, Operating System, Pattern Recognition

Research Mentoring

- **Reece Neff**, PhD student at NCSU *2023 – 2025*
  Research: Memory-efficient parallel algorithms.
  Co-author of [IPDPS24, ICS25]
- **Siddhartha Shankar Das**, PostDoc, PNNL *2023 – 2025*
  Research: Sparsification algorithms for GNN.
  Co-author of AGS-GNN [KDD24,Insub1]
- **Bhargav Samineni**, Capital One *2022 – 2024*
  Research: Semi-streaming graph algorithms.
  Co-author of k-DM [ESA24, IOS24]
- **Michael Mandulak**, PhD student at RPI *2022 – Curr.*
  Research: Parallel matching algorithms and applications.
  Co-author of [SC24, InSub2]
- **Reet Barik**, PostDoc, ANL. *2022 – 2024*
  Research: Efficient Distributed Influence Maximization
  Co-author of GreediRIS [J5]
- **Shivaram Gopal**, PhD student at Purdue. *2021 – Curr.*
  Research: Efficient Distributed Submodular Optimization
  Co-author of GreedyML [SEA25]
- **Cameron Ibrahim**, PhD student at Univ. of Delaware. *2023 – Curr.*
  Research: Hypergraph Alignment
  Co-author of ELRUHNA [ASONAM25]
- **S M Shovan**, PhD student at Missouri S&T. *2024 – Curr.*
  Research: Parallel Dynamic Algorithms
  Co-author of Db-LP[InSub3]

Professional Services & Miscellany

- Journal review:

  - VLDB Journal
  - SIAM Journal on Matrix Analysis and Applications (SIMAX)
  - ACM Transactions on Parallel Computing (TOPC)
  - IEEE Transactions on Parallel and Distributed Systems (TPDPS)
  - Springer Journal of Combinatorial Optimization (JOCO)
  - ACM Journal of Experimental Algorithmics (JEA)
  - PLOS ONE
- Conference and Workshop committee member:
  - Demo Track, WSDM 2026
  - Algorithm Track: SC 2025, SC 2026
  - European Symposium on Algorithms (ESA - Track B) 2025
  - SIAM Symposium on Algorithm Engineering and Experiments (ALENEX) 2026
  - IEEE International Parallel & Distributed Processing Symposium (IPDPS) 2024, 2025
  - SIAM Conference on Applied and Computational Discrete Algorithms (ACDA) 2025
  - Workshop on Graphs, Architectures, Programming, and Learning (GrAPL) 2025 2026
- Conference review (External):
  - SIAM Conference on Applied and Computational Discrete Algorithms (ACDA) 2021, 2023
  - Symposium on Experimental Algorithms (SEA) 2022
  - European Symposium on Algorithms (ESA) 2024
  - International Conference and Workshops on Algorithms and Computation (WALCOM) 2019
- Community Services
  - General Secretary (2019-2020), Bangladeshi Student Association (BDSA), Purdue.
  - Webmaster (2015-2016, 2017-2018), Bangladeshi Student Association (BDSA), Purdue.