S M Ferdous

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

Research Interest

My research area is high-performance computing, with a focus on designing scalable algorithms for real-world combinatorial optimization problems. I am particularly interested in leveraging modern algorithmic tools—including streaming, randomized, parallel, distributed, and dynamic techniques—to tackle problems that arise in diverse domains such as quantum chemistry, 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

- **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

- **Lead PI** of a $100,000 *pending* proposal submitted to Laboratory Directed Research & Development call at PNNL. 2025
- **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.

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*

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)20] 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

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 Picasso [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 Dʙ-LP[InSub3]

Professional Services & Miscellany

- Journal review:
  - 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

- 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.