S M Ferdous

: sm.ferdous@pnnl.gov; ferdous.csebuet@gmail.com | : +1(765)-409-8632

: https://smferdous1.github.io | : http://bit.ly/linkedIn-smf | : http://bit.ly/scholar-smf

Research Interest

My research lies at the intersection of high-performance computing and algorithm design, focusing on scalable solutions for real-world combinatorial optimization problems. I am particularly interested in developing parallel and distributed algorithms that enhance performance, memory-efficient streaming algorithms for large-scale data processing, and dynamic algorithms that efficiently handle data modifications such as insertions and deletions. My work combines strong theoretical foundations—such as guaranteed approximation ratios—with practical applicability, ensuring that the algorithms can be used effectively in real-world scenarios.

Professional Appointments

- **Data Scientist** *Oct 23 – Present*
  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
- **Assistant Professor** *Mar – Jul 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 | *GPA*: 3.33/4.00.
- **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 – Current*
- **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

- **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*

Publications

The following contains my publications from 2015 to 2024. For the full list, please visit my Google Scholar profile at http://bit.ly/scholar-smf.

Under Submission

[InSub1] Reet Barik, Wade Cappa, **SM Ferdous**, Marco Minutoli, Mahantesh Halappanavar, and Ananth Kalyanaraman. *GreediRIS: Scalable Influence Maximization using Distributed Streaming Maximum Cover*. 2024. arXiv: 2408.10982 [cs.DC]. URL: https://arxiv.org/abs/2408.10982

[InSub2] Ahammed Ullah, **SM Ferdous**, and Alex Pothen. *Matching in Poly-streaming Model*. 2024

[InSub3] Bhargav Samineni, **SM Ferdous**, Mahantesh Halappanavar, and Bala Krishnamoorthy. *Approximate Bipartite b-Matching using Multiplicative Auction*. 2024. arXiv: 2403.05781 [cs.DS]. URL: https://arxiv.org/abs/2403.05781

Conferences

[C14] Michael Mandulak, Sayan Ghosh, **SM Ferdous**, Mahantesh Halappanavar, and George Slota. *Efficient Weighted Graph Matching on GPUs*. To appear in **SC 2024**. 2024.

[C13] **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.

[C12] 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.

[C11] **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.

[C10] **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.

[C9] 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.

[C8] 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.

[C7] **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.

[C6] 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.

[C5] 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.

[C4] 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.

[C3] **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.

[C2] **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.

[C1] **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

[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.

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

Research Mentoring

- **Reece Neff**, PhD student at NCSU *2023 – Curr.*
  Research: Memeroy efficient parallel algorithms.
  Co-author of Picasso[C11]
- **Siddhartha Shankar Das**, PhD student at Purdue University *2023 – Curr.*
  Research: Sampling algorithms for GNN.
  Co-author of AGS-GNN[C12]
- **Bhargav Samineni**, Masters student at UT Austin *2022 – Curr.*
  Research: Semi-streaming graph algorithms.
  Co-author of k-DM [C13] and [InSub3]
- **Michael Mandulak**, PhD student at RPI *2022 – Curr.*
  Research: Matching in GPUs.
  Co-author of approximate matching in GPU [C14]
- **Reet Banik**, PhD student at WSU Pullman. *2022 – Curr.*
  Research: Efficient Distributed Submodular Optimization
  Co-author of GreediRIS [InSub1].

Academic Service

- Journal review:
  - PLOS ONE
  - ACM Transaction on Parallel Computing (TOPC)
  - IEEE Transaction on Parallel and Distributed Systems (TPDPS)
  - Springer Journal of Combinatorial Optimization (JOCO)
- Conference and Workshop committee member:
  - 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