

# S M FERDOUS

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## Research Interest

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My research lies at the intersection of scientific 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

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- Oct'23 – Current*    **Data Scientist**  
Data Science and Machine Intelligence Group  
Pacific Northwest National Lab, WA, USA.
- Jun'22 – Oct'23*    **Pauling Postdoctoral Fellow**  
Pacific Northwest National Lab, WA, USA.
- 2022(Jan – Jun)*    **Postdoctoral Research Associate**  
Department of Computer Science  
Purdue University, USA
- 2015 – 2021*        **Graduate Research Assistant**  
Department of Computer Science  
Purdue University, USA.
- 2015(Mar – Jul)*    **Assistant Professor**  
Department of Computer Science and Engineering  
Ahsanullah University of Science and Technology  
Dhaka, Bangladesh.

## Education

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- 2015 – 2021*        **PhD in Computer Science**, Purdue University, West Lafayette, Indiana  
*Thesis:* “Algorithms for degree-constrained subgraphs and applications”  
*Advisor:* Prof. Alex Pothen | *GPA:* 3.93/4.00.
- 2011 – 2014*        **MSc Engg. in Computer Science and Engineering**  
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.
- 2006 – 2011*        **BSc Engg. in Computer Science and Engineering**, BUET  
*Rank:* 9/138, *Degree with Honors* | *GPA:* 3.89/4.00.

## Fellowships

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2022 – Current	<b>Linus Pauling Distinguished Postdoctoral Fellowship</b> at Pacific Northwest National Lab.
2020 – 2021	<b>John R. Rice Fellowship</b> for Scientific Computing, Purdue University.
2015 – 2016	<b>Ross Fellowship</b> for incoming graduate student at Purdue University.
2006 – 2011	<b>Dean’s list</b> and <b>Merit scholarship</b> at Bangladesh University of Engineering and Technology.

## Awards & Honors

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2021	<b>Selected for participation</b> in week long <i>Argonne Training Program on Extreme-Scale Computing (ATPESC)</i> 2021.
2018	<b>Travel grant</b> for SIAM Combinatorial Scientific Computing Workshop in Bergen, Norway.
2017	<b>Third best prize</b> on SIAM Computational Science and Engineering student poster competition at Purdue University.
2016	<b>Travel and accommodation grant</b> for attending week-long SAMSI summer school on optimization at Research Triangle Park, NC.
2008	<b>Tenth among 50 teams</b> in ACM International Collegiate Programming Regional Contest (ICPC) (Dhaka Site).

## Publications

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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

2024	Shivaram Gopal, <b>SM Ferdous</b> , Hemanta K. Maji, and Alex Pothen. <i>GreedyML: A Parallel Algorithm for Maximizing Submodular Functions</i> . 2024. arXiv: <a href="https://arxiv.org/abs/2403.10332">2403.10332</a> [cs.DC]. URL: <a href="https://arxiv.org/abs/2403.10332">https://arxiv.org/abs/2403.10332</a>
2024	Reet Barik, Wade Cappa, <b>SM Ferdous</b> , Marco Minutoli, Mahantesh Halappanavar, and Ananth Kalyanaraman. <i>GreedyRIS: Scalable Influence Maximization using Distributed Streaming Maximum Cover</i> . 2024. arXiv: <a href="https://arxiv.org/abs/2408.10982">2408.10982</a> [cs.DC]. URL: <a href="https://arxiv.org/abs/2408.10982">https://arxiv.org/abs/2408.10982</a>

## Conference

2024	Michael Mandulak, Sayan Ghosh, <b>SM Ferdous</b> , Mahantesh Halappanavar, and George Slota. <i>Efficient Weighted Graph Matching on GPUs</i> . To appear in <b>SC 2024</b> . 2024
2024	<b>SM Ferdous</b> , Bhargav Samineni, Alex Pothen, Mahantesh Halappanavar, and Bala Krishnamoorthy. “Semi-Streaming Algorithms for Weighted k-Disjoint Matchings”. In: <i>32nd Annual European Symposium on Algorithms (ESA 2024)</i> . Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2024, 53:1–53:19. DOI: <a href="https://doi.org/10.4230/LIPIcs.ESA.2024.53">10.4230/LIPIcs.ESA.2024.53</a>
2024	Siddhartha Shankar Das, <b>SM Ferdous</b> , Mahantesh M. Halappanavar, Edoardo Serra, and Alex Pothen. “AGS-GNN: Attribute-guided Sampling for Graph Neural Networks”. In: <i>Proceedings of the 30th ACM SIGKDD Conference on Knowledge Discovery and Data Mining. KDD ’24</i> . ACM, 2024, pp. 538–549. DOI: <a href="https://doi.org/10.1145/3637528.3671940">10.1145/3637528.3671940</a>

- 2024 **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)*. IEEE. 2024, pp. 241–252. DOI: [10.1109/IPDPS57955.2024.00029](https://doi.org/10.1109/IPDPS57955.2024.00029)
- 2024 **SM Ferdous**, Alex Pothén, 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](https://doi.org/10.4230/LIPICS.SEA.2024.12)
- 2023 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](https://doi.org/10.1145/3624062.3625129). URL: <https://doi.org/10.1145/3624062.3625129>
- 2023 Pasqua D’Ámbra, Fabio Durastante, **SM Ferdous**, Salvatore Filippone, Mahantesh Halappanavar, and Alex Pothén. “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](https://doi.org/10.1109/PDP59025.2023.00017)
- 2021 **SM Ferdous**, Alex Pothén, 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)*. SIAM, 2021. DOI: [10.1137/1.9781611976830.5](https://doi.org/10.1137/1.9781611976830.5)
- 2021 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](https://doi.org/10.1109/INFOCOMWKSHPS51825.2021.9484437)
- 2018 Arif Khan, Krzysztof Choromanski, Alex Pothén, **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](https://doi.org/10.5555/3291656.3291735)
- 2018 Arif Khan, Alex Pothén, 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](https://doi.org/10.1109/IPDPS.2018.00013)
- 2018 **SM Ferdous**, Alex Pothén, 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](https://doi.org/10.1137/1.9781611975215.10)
- 2016 **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](https://doi.org/10.1109/WD.2016.7461522)
- 2015 **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](https://doi.org/10.1109/NSysS.2015.7043520)

## Journals

- 2021 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 Pothén, 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](https://doi.org/10.1177/10943420211029299).
- 2019 Alex Pothén, **SM Ferdous**, and Fredrik Manne. “Approximation algorithms in combinatorial scientific computing”. In: *Acta Numerica* 28 (2019), pp. 541–633. DOI: [10.1017/S0962492919000035](https://doi.org/10.1017/S0962492919000035).
- 2017 **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](https://doi.org/10.1007/s11786-017-0293-5).
- 2015 **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](https://doi.org/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 Pothén. “Locality Matters! Efficient algorithms for submodular  $b$ -matching”. Presented in SIAM CSE 2021, Happened virtually. 2021.
- 2019 **SM Ferdous** and Alex Pothén. “Efficient Algorithms for Degree Constrained Subgraphs with Applications”. Presented in SIAM CSE 2019, Spokane, WA. 2019.
- 2018 **SM Ferdous** and Alex Pothén. “New Approximation Algorithms for Minimum Weight Edge Cover”. Presented in SIAM AN 2018, Portland, OR. 2018

## Academic Service

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- 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 committee member:
    - IEEE International Parallel & Distributed Processing Symposium (IPDPS) 2024.
  - 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