Advancements in Parallel Computing and Benchmarking Techniques.

Samar Aseeri, KAUST

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Overview of Workshop Initiative

- Organized workshops and minisymposia for FFT developers and users over 8 years.
- Gathered FFT experts to discuss challenges, best practices, and advancements.

Data Repository at fft.report

- All workshop presentation materials and discussions stored at fft.report.
- Repository contains valuable insights, benchmarking results, and optimization strategies.

Publication 1

Rogowski, M., Aseeri, S. A., Keyes, D. E., & Dalcin, L. (2022). MPI4py.futures: MPI-based asynchronous task execution for Python. IEEE Transactions on Parallel and Distributed Systems, 1-12.

- Introduction of MPI4py.futures, a Python package for MPI-based asynchronous task execution.
- Performance comparison with Dask, another Python parallel computing package.

Publication 2

Leu, B., Aseeri, S., & Muite, B. (2021, January). A Comparison of Parallel Profiling Tools for Programs utilizing the FFT. In Proceedings of the IXPUG'21 Workshop at HPCAsia'21.

- Comparison of parallel profiling tools for programs using the Fast Fourier Transform (FFT).
- Presented at the IXPUG'21 Workshop at HPCAsia'21.

Publication 3

Aseeri, S., Chatterjee, A., Verma, M., & Keyes, D. (2021). A scheduling policy to improve 10% of communication time in parallel FFT. In Proceedings of CUG 2020. Concurrency and Computation: Practice and Experience (CCPE) (to appear).

- Proposal of a scheduling policy to improve communication time in parallel Fast Fourier Transform (FFT) computations.
- Part of the Proceedings of CUG 2020 and will be published in Concurrency and Computation: Practice and Experience (CCPE).

Publication 4

Muite, B. K., & Aseeri, S. (2020). Benchmarking solvers for the one-dimensional cubic nonlinear Klein Gordon equation on a single core. In W. Gao, J. Zhan, G. Fox, X. Lu, & D. Stanzione (Eds.), Bench 2019: Benchmarking, Measuring, and Optimizing (pp. 172-184). Springer.

- Focus on benchmarking solvers for the one-dimensional cubic nonlinear Klein Gordon equation on a single core.
- Part of the book "Bench 2019: Benchmarking, Measuring, and Optimizing" edited by W. Gao, J. Zhan, G. Fox, X. Lu, & D. Stanzione.

Publication 5

Aseeri, S., & Muite, B. K. (2020). Benchmarking in the datacenter (BID) 2020: workshop summary. In Proceedings of the Workshop on Benchmarking in the Datacenter (BID '20) (Article 1). ACM.

- Summary of the Benchmarking in the Datacenter (BID) 2020 workshop.
- Part of the Proceedings of the Workshop on Benchmarking in the Datacenter (BID '20).

Publication 6

Aseeri, S., Muite, B. K., & Takahashi, D. (2019). Reproducibility in Benchmarking Parallel Fast Fourier Transform based Applications. In Companion of the 2019 ACM/SPEC International Conference on Performance Engineering - ICPE'19 (pp. 5-8). ACM.

- Discussion on the importance of reproducibility in benchmarking parallel Fast Fourier Transform (FFT) based applications.
- Presented at the Companion of the 2019 ACM/SPEC International Conference on Performance Engineering - ICPE'19.

Publication 7

Aseeri, S., et al. (2015, April). Solving the Klein-Gordon equation using Fourier spectral methods: A benchmark test for computer performance. In Proceedings of the 23rd High Performance Computing Symposium (HPC 2015) (pp. 1-8). ACM.

- Presentation of a benchmark test for computer performance in solving the Klein-Gordon equation using Fourier spectral methods.
- Presented at the 23rd High Performance Computing Symposium (HPC 2015).

Workshop Announcement

- Workshop: Benchmarking in the Data Center: Expanding to the Cloud
- Location: York University, Toronto, Canada, UK (co-located with ICPE 2025)
- Dates: May 5-9, 2025
- Organizers: Awais Khan (Oak Ridge National Laboratory, USA), Kaushik Velusamy (Argonne National Laboratory, USA)
- Brief Description: Explore evaluating HPC benefits for businesses and benchmarking performance in cloud environments.
- This workshop is held in conjunction with ICPE 2025: the 16th ACM/SPEC International Conference on Performance Engineering 2025.

References

S. Aseeri, O. Batrašev, M. Icardi, B. Leu, A. Liu, N. Li, B. K. Muite, E. Müller, et al., "Solving the Klein-Gordon equation using Fourier spectral methods: A benchmark test for computer performance," *arXiv preprint arXiv:1501.04552*, 2015.

E. Nuriyev, R. R. Manumachu, S. Aseeri, M. K. Verma, A. L. Lastovetsky, "SUARA: A scalable universal allreduce communication algorithm for acceleration of parallel deep learning applications," *Journal of Parallel and Distributed Computing*, vol. 183, 104767, 2024.

S. Aseeri, B. K. Muite, D. Takahashi, "Reproducibility in benchmarking parallel fast Fourier transform based applications," *Companion of the 2019 ACM/SPEC International Conference on Performance Engineering*, 2019.

S. A. Aseeri, A. Gopal Chatterjee, M. K. Verma, D. E. Keyes, "A scheduling policy to save 10% of communication time in parallel fast Fourier transform," *Concurrency and Computation: Practice and Experience*, vol. 35, no. 15, e6508, 2023.

S. Aseeri, "State-of-the-art FFT: Algorithms, implementations and applications," *SIAM Conference on Parallel Processing*, 2018.

B. Leu, S. Aseeri, B. Muite, "A comparison of parallel profiling tools for programs utilizing the FFT," *International Conference on High Performance Computing in Asia-Pacific*, 2021.

B. K. Muite, S. Aseeri, "Benchmarking solvers for the one dimensional cubic nonlinear Klein-Gordon equation on a single core," *International Symposium on Benchmarking, Measuring and Optimization*, pp. 172–184, 2019.

S. Aseeri, B. K. Muite, D. Takahashi, "Data for figures in 'Reproducibility in Benchmarking Parallel Fast Fourier Transform based Applications'."