

# MOHAMMED ALFARHAN

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## Education

- 2014-2019 **Ph.D., Computer Science**, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia.  
Dissertation: Unstructured Computations on Emerging Architectures. Advisor: David E. Keyes.
- 2012-2013 **M.Sc., Computer Science**, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia.
- 2007-2012 **B.Sc., Computer Science**, King Faisal University, Hofuf, Saudi Arabia.

## Experience

- 2019-Present **Postdoctoral Research Associate**, The University of Tennessee, Knoxville, Tennessee, United States.  
Research on developing numerical software libraries for solving linear algebra problems at scale. PI: Jack Dongarra.
  - SLATE: Software for Linear Algebra Targeting Exascale. Co-PI: Jakub Kurzak.
  - MAGMA: Matrix Algebra on GPU and Multicore Architectures. Co-PI: Stanimire Tomov.
- 2012-2019 **Graduate Research Assistant**, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia.  
Developed performance-centric algorithms for high performance computing architectures. PI: David E. Keyes.
- 2017-2019 **Co-founder and Software Consultant**, RoboCrop Systems, Thuwal, Saudi Arabia.  
Worked as a robotics software engineer and full stack developer for a robotics solutions startup.
- 2014-2018 **Graduate Teaching Assistant**, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia.  
Worked as a TA for High Performance Computing (AMCS 312) course. Instructor: David E. Keyes.
  - KAUST CEMSE Division: Fall 2014, Fall 2015, Fall 2016, Fall 2017, Fall 2018.
  - Saudi Aramco: Fall 2018.
  - Blue Waters Online Courses: Fall 2016 (Introduction to High Performance Computing).
  - High Performance Computing Short Courses at KAUST:
    - Summer 2016 (KAUST Visualization and Supercomputing Summer School).
    - Summer 2015 (KAUST Gifted Student Program).
    - Summer 2014 (KAUST Saudi Research Science Institute).
- Spring 2013 **Independent Research Project**, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia.  
Developed a dynamic programming combinatorial algorithm for multi-pruning of decision trees. PI: Mikhail Moshkov.
- 2012 **Software Engineer**, Saudi Electricity Company, Riyadh, Saudi Arabia.  
Developed distributed systems to monitor and detect anomalies in the reading meters.
- Summer 2011 **Software Engineer Intern**, Saudi Aramco, Dhahran, Saudi Arabia.  
Developed a distributed key-value store system to monitor IT incidents and infrastructure change requests.
- Summer 2010 **Software Engineer Intern**, Saudi Aramco, Dhahran, Saudi Arabia.  
Developed a database system to collect and log reports on IT problems for further processing with ease.

## Research

### Preprints and Working Papers

- [1] **Mohammed A. Al Farhan**, Hakan Bagci, and David E. Keyes. *ExaBEM: Exascale Boundary Element Method Solver for Acoustic Simulation*. To be submitted, SC 2021.  
<https://ecrc.github.io/ExaBEM/>.
- [2] **Mohammed A. Al Farhan** and David E. Keyes. *GPU-Optimized Unstructured Computations*. To be submitted, TPDS 2021.  
<https://ecrc.github.io/KFUN3D/>.
- [3] **Mohammed A. Al Farhan**, Ali Charara, Mark Gates, Asim YarKhan, Dalal Sukkari, Jakub Kurzak, and Jack Dongarra. *Object-Oriented Framework for Scalable Dense Linear Solvers Targeting Accelerator-Driven Supercomputing*. To be submitted, TOMS 2020.
- [4] **Mohammed A. Al Farhan**, Ali Charara, Mark Gates, Asim YarKhan, Dalal Sukkari, Jakub Kurzak, and Jack Dongarra. *Dense Linear Algebra Solvers at Scale*. To be submitted, SC 2020.

### Conference and Journal Articles

- [5] **Mohammed A. Al Farhan**, Ahmad Abdelfattah, Stanimire Tomov, Mark Gates, Dalal Sukkari, Azzam Haidar, Robert Rosenberg, and Jack Dongarra. *MAGMA Templates for Scalable Linear Algebra on Emerging Architectures*. The International Journal of High Performance Computing Applications, 2019. (Under review.)

- [6] Mustafa Abduljabbar, **Mohammed A. Al Farhan**, Noha Al-Harthi, Rui Chen, Rio Yokota, Hakan Bagci, and David E. Keyes. *Extreme Scale FMM-accelerated Boundary Integral Equation Solver for Wave Scattering*. SIAM Journal on Scientific Computing (SISC), 2019.  
<https://ecrc.github.io/BEMFMM/>.
- [7] **Mohammed A. Al Farhan** and David E. Keyes. *Optimizations of Unstructured Aerodynamics Computations for Many-core Architectures*. IEEE Transactions on Parallel and Distributed Systems (TPDS), 2018.
- [8] Mustafa Abduljabbar, **Mohammed A. Al Farhan**, Rio Yokota, and David E. Keyes. *Performance Evaluation of Computation and Communication Kernels of the Fast Multipole Method on Intel Manycore Architecture*. International European Conference on Parallel and Distributed Computing (Euro-Par), 2017.
- [9] **Mohammed A. Al Farhan**, Dinesh K. Kaushik, and David E. Keyes. *Unstructured Computational Aerodynamics on Many Integrated Core Architecture*. Elsevier Parallel Computing Journal (PARCO), 2016.
- [10] Hassan AbouEisha, **Mohammed A. Al Farhan**, Igor Chikalov, and Mikhail Moshkov. *An Algorithm for Reduct Cardinality Minimization*. IEEE International Conference on Granular Computing (GrC), 2013.  
<https://farhanma.github.io/reduct/>.

## Services

- Reviwer The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC) 2015, International European Conference on Parallel and Distributed Computing (Euro-Par) 2016, Symposium on Principles and Practice of Parallel Programming (PPoPP) 2016 [Artifact Evaluator], IEEE Cluster 2016, PLOS One 2018, International Journal of High Performance Computing Applications (IJHPCA) 2018, IEEE International Parallel & Distributed Processing Symposium (IPDPS) 2019, ACM Transactions on Parallel Computing (TOPC) 2019, Elsevier Parallel Computing (PARCO) 2019.
- Member KAUST IEEE Student Chapter (2012-2013), KAUST Graduate Council (2012-2014), KAUST ACM/SIAM Student Chapter (2012-2019), and KAUST Code Clinics (2014-2019).
- Co-organizer Python programming tutorials (2013-2015).

## Talks

- [1] **Unstructured Computations on Emerging Architectures.**
  - o SIAM Conference on Computational Science and Engineering (CSE), 2019, Spokane, Washington.
- [2] **BEMFMM: An Extreme Scale FMM-Accelerated BIE Solver for Wave Scattering.**
  - o SIAM Conference on Computational Science and Engineering (CSE), 2019, Spokane, Washington.
  - o Intel eXtreme Computing User Group (IXPUG) Meeting, 2018, KAUST, Thuwal.
  - o SIAM Conference on Parallel Processing for Scientific Computing (PP), 2018, Tokyo, Japan.
- [3] **Optimizations of Unstructured Aerodynamics Computations for Intel Knights Landing Architecture.**
  - o Intel eXtreme Computing User Group (IXPUG) Meeting, 2018, KAUST, Thuwal.
  - o SIAM Conference on Parallel Processing for Scientific Computing (PP), 2018, Tokyo, Japan.
  - o Intel HPC Developer Conference (DevCon), 2017, Denver, Colorado.
  - o Fully Predictive Complex Computational Fluid Dynamics Workshop, 2017, KAUST, Thuwal.
  - o High Performance Computing Saudi Arabia Conference (HPC Saudi), 2017, KAUST, Thuwal.
  - o SIAM Conference on Computational Science and Engineering (CSE), 2017, Atlanta, Georgia.
  - o Scalable Hierarchical Algorithms for eXtreme Computing Workshop (SHAXC), 2017, KAUST, Thuwal.
- [4] **Performance Evaluation of Fast Multipole Method on Intel Manycore Architecture.**
  - o International European Conference on Parallel and Distributed Computing (Euro-Par), 2017, Galicia, Spain.
  - o HPC in Asia Poster Competition, International Supercomputing Conference (ISC), 2017, Frankfurt, Germany.
- [5] **Implicit Unstructured Computational Aerodynamics on Many-Integrated Core Architecture.**
  - o International Conference on Parallel Computational Fluid Dynamics, 2014, Trondheim, Norway.
  - o Scalable Hierarchical Algorithms for eXtreme Computing Workshop (SHAXC), 2014, KAUST, Thuwal.

## Programming

- Languages C/C++, Python, Java, Unix Shell, MATLAB,  $\LaTeX$ .
- Models Intrinsics, MPI, OpenMP, pThreads, CUDA, TBB, HIP, ROCm, SYCL, Cilk.
- Tools Make, CMake, Autotools, perf tools, Valgrind, GDB, Git, Tracing and profiling for performance optimization.