MOHAMMED ALFARHAN

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Education

2014-2019   **PhD, Computer Science**, *King Abdullah University of Science and Technology*, Thuwal, Saudi Arabia.
Dissertation: Unstructured Computations on Emerging Architectures. Advisor: David E. Keyes.

2012-2013   **MSc, Computer Science**, *King Abdullah University of Science and Technology*, Thuwal, Saudi Arabia.

2007-2012   **BSc, Computer Science**, *King Faisal University*, Hofuf, Saudi Arabia.

Experience

Research

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: Mark Gates and Jakub Kurzak.
  - Developing an object-oriented dense linear algebra framework to scale linear solvers on accelerator-driven HPC systems.
- *MAGMA: Matrix Algebra on GPU and Multicore Architectures*. Co-PI: Stanimire Tomov.
  - Developed a performance-portable API to assist porting scientific applications onto various emerging architectures.

2013-2019   **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.

2012-2013   **Directed Research**, *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.

Industry

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.

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.

Teaching

2014-2018   **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: 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).
- KAUST short courses and trainings on high performance computing:
  - Summer 2016 (KAUST visualization and supercomputing summer school).
  - Summer 2015 (KAUST gifted student program).
  - Summer 2014 (KAUST Saudi research science institute).

Research

Preprints and Working Papers

[1] **Mohammed A. Al Farhan**. *Demystifying the Parallel and Distributed Dense Linear Algebra Algorithms for High Performance Computing Implementation*. To be submitted, CSUR 2021.

[2] **Mohammed A. Al Farhan**, Hakan Bagci, and David E. Keyes. *ExaBEM: Exascale Boundary Element Method Solver for Acoustic Simulation*. To be submitted, SC 2021.

[3] **Mohammed A. Al Farhan** and David E. Keyes. *GPU-Optimized Unstructured Computations*. To be submitted, TPDS 2021.

[4] **Mohammed A. Al Farhan** and David E. Keyes. *FPGA-Optimized Unstructured Computations using SYCL*. To be submitted, PPoPP 2021.

[5] **Mohammed A. Al Farhan**, Ali Charara, Mark Gates, Asim YarKhan, Dalal Sukkari, Jakub Kurzak, and Jack Dongarra. *Object-Oriented Framework for Dense Linear Algebra Solvers at Scale*. To be submitted, SC 2020.

[6] **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*. Under review at IJHPCA, 2019.
https://bitbucket.org/icl/magma_templates.

Conference and Journal Articles

[7] 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/.

[8] **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.
https://ecrc.github.io/kfun3d/.

[9] 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.

[10] **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.

[11] 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/MinReduct/.

Services

Reviewer | 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 (IPDSPS) 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 clinic (2014-2019).

Co-organizer | Python programming tutorials (2013-2015).

Talks

[1] **Unstructured Computations on Emerging Architectures**.
  ○ SIAM Conference on Computational Science and Engineering (CSE), 2019, Spokane, Washington.

[2] **BEMFMM: An Extreme Scale FMM-Accelerated BIE Solver for Wave Scattering**.
  ○ SIAM Conference on Computational Science and Engineering (CSE), 2019, Spokane, Washington.
  ○ Intel eXtreme Computing User Group (IXPUG) Meeting, 2018, KAUST, Thuwal.
  ○ SIAM Conference on Parallel Processing for Scientific Computing (PP), 2018, Tokyo, Japan.

[3] **Optimizations of Unstructured Aerodynamics Computations for Intel Knights Landing Architecture**.
  ○ Intel eXtreme Computing User Group (IXPUG) Meeting, 2018, KAUST, Thuwal.
  ○ SIAM Conference on Parallel Processing for Scientific Computing (PP), 2018, Tokyo, Japan.
  ○ Intel HPC Developer Conference (DevCon), 2017, Denver, Colorado.
  ○ Fully Predictive Complex Computational Fluid Dynamics Workshop, 2017, KAUST, Thuwal.
  ○ High Performance Computing Saudi Arabia Conference (HPC Saudi), 2017, KAUST, Thuwal. (Best poster award.)
  ○ SIAM Conference on Computational Science and Engineering (CSE), 2017, Atlanta, Georgia.
  ○ Scalable Hierarchical Algorithms for eXtreme Computing Workshop (SHAXC), 2017, KAUST, Thuwal.

[4] **Performance Evaluation of Fast Multipole Method on Intel Manycore Architecture**.
  ○ International European Conference on Parallel and Distributed Computing (Euro-Par), 2017, Galicia, Spain.
  ○ HPC in Asia Poster Competition, International Supercomputing Conference (ISC), 2017, Frankfurt, Germany.

[5] **Implicit Unstructured Computational Aerodynamics on Many-Integrated Core Architecture**.
  ○ International Conference on Parallel Computational Fluid Dynamics, 2014, Trondheim, Norway.
  ○ 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, OpenCL, Cilk.

Tools | Make, CMake, Autotools, perf, Valgrind, gdb, git, hg, vi/vim, Tracing and profiling for performance optimization.