

Mohammed Al Farhan

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Education

King Abdullah University of Science and Technology, PhD in Computer Science, 2014 — 2019

Dissertation: [Unstructured Computations on Emerging Architectures](#) (advisor: David Keyes)

Committee: David Keyes, Mikhail Moshkov, Hakan Bagci, Markus Hadwiger, and Edmond Chow

King Abdullah University of Science and Technology, MSc in Computer Science, 2012 — 2013

Emphasis on HPC, operating systems, distributed algorithms, scientific visualization, and linear algebra

King Faisal University, BSc in Computer Science, 2007 — 2012

Minor in applied mathematics

Experience

Hewlett Packard Enterprise, Principal Technologist, 2022 —

Administer a Cray EX supercomputer (4608+ nodes, 65PB+ storage) for HPC & AI workloads

Configure and manage high performance interconnection network, such as Slingshot, InfiniBand, and RoCE

Administer Lustre, NFS, XFS, and RAID storage, implementing tuning strategies for high throughput and low latency.

Deploy, configure, and manage Linux (SLES, RedHat, Rocky, CentOS) environments, diskless boot via iSCSI, and container orchestration with Kubernetes, Docker, Singularity

Utilize HPE HPCM for cluster provisioning, monitoring, and updates.

Administer and configure Slurm Workload Manager for efficient job scheduling and resource allocation.

Develop, automate, and maintain scripts in Bash, Python, Ruby, and Perl to streamline operations.

Monitor, configure, manage, and develop dashboards for system performance using Prometheus, Grafana, and Nagios.

Administer and automate databases (MySQL, MariaDB, SQLite) and system configurations with Ansible, Puppet, LDAP/SSSD/Kerberos.

Implement and conduct benchmarking and profiling (HPL, HPCG, IOR, STREAM, NCCL, iperf) for performance tuning.

King Abdullah Petroleum Studies and Research Center, Senior Data Engineer, 2022

Developed and maintained data pipeline architecture for energy, economy, and climate models

Technologies: Python, Apache airflow, Redis, Java, React, Angular, PostgreSQL, GO, Git, AWS, OCI

King Abdullah University of Science and Technology, Postdoctoral Researcher, 2020 — 2022

Research on scalable algorithms exploiting data sparsity (with David Keyes)

HiCMA: Hierarchical Computations on Manycore Architectures (🐙 github.com/ecrc/hicmapp)

Technologies: C/C++, CMake, CUDA, SYCL, OpenMP, Python, Git, MATLAB, \LaTeX

University of Tennessee, Knoxville, Postdoctoral Researcher, 2019 — 2021

Research on distributed, GPU-accelerated dense linear algebra (with Jack Dongarra)

SLATE: Software for Linear Algebra Targeting Exascale (🐙 github.com/icl-utk-edu/slate)

Technologies: C/C++, Make/Autotools/CMake, CUDA, Python, MPI, OpenMP, Git, MATLAB, \LaTeX

King Abdullah University of Science and Technology, Graduate Researcher, 2012 — 2019

Research on unstructured grids PDEs and fast multipole method (with David Keyes)

Technologies: C/C++, Fortran, Intrinsics, Assembly, Make, MPI, OpenMP, pthreads, Git, MATLAB, \LaTeX

RoboCrop, Cofounder, 2017 — 2019

Developed robotic systems for automating farming on the agriculture industry

Technologies: Java, Scala, C/C++, Python, GO, ROS, Git, MySQL, MATLAB

Sadeem Technology, Software Consultant, 2015 — 2017

Developed scalable scientific data visualization solutions for wireless sensing systems startup

Technologies: C/C++, MATLAB, Arduino

King Abdullah University of Science and Technology, Directed Research, Spring 2013

Research on combinatorial machine learning (with Mikhail Moshkov)

Technologies: C/C++, pthreads, L^AT_EX

Saudi Electricity Company, Software Engineer, 2012

Developed a smart system to detect anomalies in the reading meters

Technologies: VB.NET, Microsoft SQL server

Saudi Aramco, Software Engineer Intern, Summer 2011

Developed a distributed key-value store system to track IT change requests

Technologies: Java, MongoDB, JavaScript, HTML, CSS

Saudi Aramco, Software Engineer Intern, Summer 2010

Developed a database management system to log IT reported incidents

Technologies: ASP.NET, C#, Microsoft SQL server

Publication

Google Scholar: <https://scholar.google.com/citations?user=CX9cRR8AAAAJ>

Journal Articles

1. M. Gates, A. Abdelfattah, K. Akbudak, **M. Al Farhan**, R. Alomairy, D. Bielich, T. Burgess, S. Cayrols, N. Lindquist, D. Sukkari, and A. YarKhan. [Evolution of the SLATE Linear Algebra Library](#), *SAGE IJHPCA* 2024
2. **M. Al Farhan**, A. Abdelfattah, S. Tomov, M. Gates, D. Sukkari, A. Haidar, R. Rosenberg, and J. Dongarra. [MAGMA Templates for Scalable Linear Algebra on Emerging Architectures](#), *SAGE IJHPCA* 2020
3. M. Abduljabbar, **M. Al Farhan**, N. Al-Harhi, R. Chen, R. Yokota, H. Bagci, and D. Keyes. [Extreme Scale FMM-Accelerated Boundary Integral Equation Solver for Wave Scattering](#), *SIAM SISC* 2019
4. **M. Al Farhan** and D. Keyes. [Optimizations of Unstructured Aerodynamics Computations for Many-core Architectures](#), *IEEE TPDS* 2018
5. **M. Al Farhan**, D. Kaushik, and D. Keyes. [Unstructured Computational Aerodynamics on Many Integrated Core Architecture](#), *Elsevier Parallel Computing* 2016

Conference Papers

1. D. Sukkari, M. Gates, **M. Al Farhan**, H. Anzt, and J. Dongarra. [Task-Based Polar Decomposition Using SLATE on Massively Parallel Systems with Hardware Accelerators](#), *ScalAH* 2023
2. M. Gates, A. YarKhan, D. Sukkari, K. Akbudak, S. Cayrols, D. Bielich A. Abdelfattah, **M. Al Farhan**, and J. Dongarra. [Portable and Efficient Dense Linear Algebra in the Beginning of the Exascale Era](#), *P3HPC* 2022
3. M. Abduljabbar, **M. Al Farhan**, R. Yokota, and D. Keyes. [Performance Evaluation of Computation and Communication Kernels of the Fast Multipole Method on Intel Manycore Architecture](#), *Euro-Par* 2017
4. H. AbouEisha, **M. Al Farhan**, I. Chikalov, and M. Moshkov. [An Algorithm for Reduct Cardinality Minimization](#), *IEEE GrC* 2013

Technical Reports

1. A. Abdelfattah, **M. Al Farhan**, C. Brown, M. Gates, D. Sukkari, A. YarKhan, and J. Dongarra. [SLATE port to AMD and Intel platforms](#), SWAN No. 16 (ICL-UT-21-01), *ICL, UTK*, Apr 2021
2. A. YarKhan, **M. Al Farhan**, D. Sukkari, M. Gates, and J. Dongarra. [SLATE Performance Report: Updates to Cholesky and LU Factorizations](#) (ICL-UT-20-14), *ICL, UTK*, Oct 2020

3. A. Charara, M. Gates, J. Kurzak, A. YarKhan, **M. Al Farhan**, D. Sukkari, T. Burgess, N. Lindquist, and J. Dongarra. [SLATE Developers' Guide](#), [SWAN No. 11 \(ICL-UT-19-02\)](#), *ICL, UTK*, Aug 2020
4. M. Gates, A. Charara, J. Kurzak, A. YarKhan, **M. Al Farhan**, D. Sukkari, T. Burgess, N. Lindquist, and J. Dongarra. [SLATE Users' Guide](#), [SWAN No. 10 \(ICL-UT-19-01\)](#), *ICL, UTK*, Jul 2020
5. M. Gates, **M. Al Farhan**, A. Charara, J. Kurzak, D. Sukkari, A. YarKhan, and J. Dongarra. [SLATE Working Note 13: Implementing Singular Value and Symmetric/Hermitian Eigenvalue Solvers \(ICL-UT-19-07\)](#), *ICL, UTK*, Apr 2020
6. M. Gates, A. Charara, A. YarKhan, D. Sukkari, **M. Al Farhan**, and J. Dongarra. [SLATE Working Note 14 Performance Tuning SLATE \(ICL-UT-20-01\)](#), *ICL, UTK*, Jan 2020

Teaching Assistantship

AMCS 312 High Performance Computing course (with David Keyes)

Fall 2013, Fall 2014, Fall 2015, Fall 2016, Fall 2017, Fall 2018, Fall 2019, Fall 2025 (KAUST)

Fall 2016 (Blue Waters online courses, funded by US NSF at UIUC)

Fall 2018 (Saudi Aramco EXPEC Advanced Research Center)

Oral/Poster Presentations

HiCMA: Hierarchical Computations on Manycore Architectures

oneAPI Developer Summit at SC 2021, St. Louis, MO

Intel IXPUG Annual Conference 2021, Austin, TX

Tile Low-Rank Matrix-Vector Multiplication for Scientific Applications

oneAPI Developer Summit at SC 2021, St. Louis, MO

Intel IXPUG Annual Conference 2021, Austin, TX

SLATE: Software for Linear Algebra Targeting Exascale

ECP Annual Meeting 2020, Houston, TX

Unstructured Computations on Emerging Architectures

SIAM CSE 2019, Spokane, Washington

BEMFMM: An Extreme Scale FMM-Accelerated BIE Solver for Wave Scattering

SIAM CSE 2019, Spokane, Washington

Intel IXPUG 2018, KAUST

SIAM PP 2018, Tokyo, Japan

Optimizations of Unstructured Aerodynamics Computations for Intel KNL Hardware

Intel IXPUG 2018, KAUST

SIAM PP 2018, Tokyo, Japan

Intel HPC Developer Conference 2017, Denver, Colorado

PCCFD Workshop 2017, KAUST

HPC Saudi Conference 2017, KAUST [Best Poster Award]

SIAM CSE 2017, Atlanta, Georgia

SHAXC-3 Workshop 2017, KAUST

Performance Evaluation of Fast Multipole Method on Intel Manycore Architecture

Euro-Par 2017, Santiago de Compostela, Spain

ISC 2017, Frankfurt, Germany

Implicit Unstructured Computational Aerodynamics on MIC Architecture

ParCFD 2014, Trondheim, Norway

SHAXC-2 Workshop 2014, KAUST

Service and Outreach

Reviewer: ACM/IEEE SC 2015, 2021, and 2023, ACM PPOPP 2016, Euro-Par 2016 and 2021, IEEE Cluster 2016, 2021, and 2022, PLOS ONE 2018, SAGE IJHPCA 2018, IEEE IPDSPS 2019, ACM TOPC 2019, Elsevier Parallel Computing 2019 and 2020, ACM PASC 2020, ICCS 2021

Artifact Evaluator: ACM PPOPP 2016, ACM/IEEE SC 2021

Vice President: KAUST IEEE Student Chapter (2012 — 2013), KAUST ACM Student Chapter (2012 — 2015), and KAUST SIAM Student Chapter (2012 — 2017)

Treasurer: KAUST SIAM/ACM Student Chapter (2017 — 2019)

Member: KAUST Graduate Council: Academic and Research Committee (2012 — 2013) and University Relation Committee (2013 — 2014)

Co-Organizer: KAUST Code Clinic (2014 — 2019), Python Programming Camp (Spring 2014, Spring 2015, and Summer 2022), and Scientific Software Engineering Lecture Series: Fundamentals of High Performance Computing (Summer 2014 and Summer 2015), PETSc: Portable, Extensible Toolkit for Scientific Computation (Summer 2016), and Version Control using Git (Fall 2017, Fall 2020, and Summer 2022), and DoltHub: Git for Data (Summer 2022)