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Personal Website

Timbwaoga A. J. Ouermi

Education

Aug. 2016– Jul. 2022 **University of Utah School of Computing**, *Ph.D. in Scientific Computing*.

Sep. 2013– Jun. 2016 **University of Oregon**, *Bachelor of Science, Physics and Computer Science*.

Sep. 2010– Jun. 2013 **Lane Community College, Oregon**, *Associate Degree in Engineering and Physics*.

Short Bio

Timbwaoga Aime Judicael Ouermi (TAJO) is a Ph.D. student at the University of Utah. He is currently co-advised by Dr. Martin Berzins and Dr. Mike Kirby. His Ph.D. dissertation focuses on accelerating physics schemes in Numerical Weather Prediction Codes (NWP) and developing conservative mapping for coupling different numerical models. TAJO has developed performance optimization approaches based on an effective data and code restructuring that lends itself to vectorization and parallelism across cores. He has also developed a high-order data-bounded and positivity-preserving interpolation algorithm for mapping between meshes when coupling different numerical models.
Prior to joining the University of Utah, TAJO obtained his bachelor's degree in Computer Science and Physics (double major) at the University of Oregon. His B.S. thesis explored particle path tracing under Lagrangian representation (Hank Childs advisor).

Research

TAJO's research interests span different areas of scientific computing, with a primary focus on:

- High-performance-computing (HPC): parallel algorithms, vectorization, optimization, and portability of scientific applications.
- Numerical methods: high-order methods, solutions to ODEs and PDEs, numerical algorithms for scientific and data computing, numerical analysis.

Project and Experience

Aug 2016– Ongoing **Optimization of Scientific Applications on Multi- and Many-Core Architectures**, University of Utah, SCI Institute.

- Developing and transforming existing legacy codes to utilize parallel hardware resources to achieve portable performance.
- Investigating and developing programming paradigms for optimizing scientific software with a primary focus on Numerical Weather Prediction (NWP) codes.
- Optimizing different physics routines in NWP codes to better take advantage of Intel many- and multi-core architectures.
- Using OpenMP API directives for vectorization of complex loops and outlining various code and data transformations required to enable thread and vector parallelism in NWP physics codes.

Dec. 2018– Ongoing **High-Order Polynomial Approximation for Mapping Between Meshes**, University of Utah SCI Institute.
- Investigating and developing high-order polynomial approximations that preserve positivity and/or mass for mapping between different meshes.
- Developed an adaptive polynomial interpolation based on Newton polynomials that preserves positivity or data boundedness.
- Constructed mathematical proofs for sufficient conditions needed for preserving the desired positivity or data boundedness.

Jun. 2016– Aug. 2016 **Integration API Between VisIt and Scrubjay**, Lawrence Livermore National Laboratory.
- Developed an integration API to communicate with VisIt and Scrubjay.
- Facilitated post hoc performance analysis of performance data.
- Mapped performance data onto simulation code's mesh for analyzing performance bottlenecks.

Mar. 2015– Jun. 2016 **Particle Path Tracing With Lagrangian Representation**, University of Oregon .
- Investigated different search structures for Lagrangian-based particle path tracing.
- Approximated the path (journey) of seeded particles given a set of Lagrangian basis flows.
- Constructed and compared K-d trees and bounding volume hierarchy (BVH) trees as search structures in the context of Lagrangian-based particle path tracing.
- Evaluated the storage size, build time, and search time of the different search structures over various configurations.

Publications

2022 [1] **Ouermi, T.A.J.,** Kirby, R.M. and Berzins, M., 2022. A Data-Bounded and Positivity-Preserving Interpolation Software (Manuscript in preparation).

2022 [2] **Ouermi, T.A.J.,** Kirby, R.M. and Berzins, M., 2022. ENO-Based High-Order Data-Bounded and Constrained Positivity-Preserving Interpolation (Manuscript accepted for publication by Numerical Algorithms).

2020 [3] **Ouermi, T.A.J.,** Kirby, R.M. and Berzins, M., 2020. Numerical Testing of a New Positivity-Preserving Interpolation Algorithm. arXiv preprint arXiv:2009.08535.

2018 [4] **Ouermi, T.A.J.,** Kirby, R.M. and Berzins, M., 2018. Performance Optimization Strategies for WRF Physics Schemes Used in Weather Modeling. International Journal of Networking and Computing, 8(2), pp.301-327.

2017 [5] **Ouermi, T.A.J.,** Knoll, A., Kirby, R.M. and Berzins, M., 2017, November. Optimization Strategies for WRF Single-Moment 6-class Microphysics Scheme (WSM6) on Intel Microarchitectures. In 2017 Fifth International Symposium on Computing and Networking (CANDAR) (pp. 146-152) **(Best paper)**.

2017 [6] **Ouermi, T.A.J.,** Knoll, A., Kirby, R.M. and Berzins, M., 2017. Openmp 4 Fortran Modernization of WSM6 for KNL. In Proceedings of the Practice and Experience in Advanced Research Computing 2017 on Sustainability, Success and Impact (pp. 1-8).

Talks

Sep. 2018 [1] Performance Optimization Techniques for Accelerating WRF Physics Codes on Intel Micro-Architectures at IXPUG 2018 on Intel Corporation Campus, Portland, Oregon, USA.

Sep. 2018 [2] Performance Optimization Techniques for Accelerating WRF Physics Codes on Intel Micro-architectures, *at The NCAR Multicore 8 Workshop*, Boulder, Colorado, USA.

Jul. 2018 [3] Scalar Conservation Mapping in Physics Dynamics Coupling (PDC), *at the ECMWF Third Workshop on Physics Dynamics Coupling (PDC18)*, Reading, UK.

Nov. 2017 [4] Optimization Strategies for WRF Single-Moment 6-Class Microphysics Scheme (WSM6) on Intel Microarchitectures, *at The Fifth International Symposium on Computing and Networking (CANDAR 17)*, Aomori, Japan, November 2017.

Sep. 2017 [5] Optimization Strategies for WSM6, *at IXPUG 2017*, University of Texas Advanced Computing Center, Austin, Texas, USA.

Teaching Assistant (TA)

Spring 2018 Introduction to Scientific Computing (CS 3200), *University of Utah*.

Fall 2019 Advanced Scientific Computing I (CS 6210), *University of Utah*.

Awards & Honors

Nov. 2017 Best paper award at CANDAR 17.

Sep. 2017 Travel scholarship award from University of Utah School of computing to the Richard Tapia conference.

Sep. 2016 Travel scholarship award to the Richard Tapia conference.

Sep. 2013 International Cultural Service Program Scholarship from University of Oregon.

List of Relevant Courses

Fall. 2016 Advanced Scientific Computing I (CS 6210), *University of Utah*.

Spring. 2017 HPC and Parallel Computing (CS 6230), *University of Utah*.

Spring. 2017 Decomposition Techniques for Computational Data-Enabled Science and Engineering (CS 6962), *University of Utah*.

Fall. 2017 Numerical Weather Prediction (ATMOS 6500), *University of Utah*.

Fall. 2018 Orthogonal Polynomial and Spectral Element Methods (MATH 6080), *University of Utah*.

Spring. 2018 Advanced Scientific Computing II (CS 6220), *University of Utah*.

Spring. 2019 Numerical Methods for Hyperbolic Conservation Laws (MATH 6630), *University of Utah* .

Summer. 2021 Quantum Mechanics and Quantum Computation (Online), *UC Berkeley (by Umesh Vazirani)*.

Skills

Programming Fortran, C, C++, OpenMP, MPI, Matlab, Python

Languages English, French, Mõre

Other Teaching, Mentorship, Public Speaking