Arturo Vargas

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Education

May 2017 **Ph.D. Computational and Applied Mathematics**, *Rice University*, Houston, TX.
Thesis: Hermite methods for the simulation of wave propagation
Advisors: Tim Warburton, Adrianna Gillman

May 2015 **M.A. Computational and Applied Mathematics**, *Rice University*, Houston, TX.
Thesis: Radial MILO: A 4D image registration algorithm based on filtering block match data via l_1-minimization
Advisors: Yin Zhang, Edward Castillo

June 2012 **B.S. Mathematics**, *University of California*, Irvine, CA.

Professional Experience

July 2017 - Present — Computer Scientist, *Lawrence Livermore National Laboratory*, Livermore, CA

- Scientific software developer for GEOS, a three-dimensional, multi-physics modeling code that addresses problems of subsurface fracturing in rocks.
- Scientific software developer for RAJA, a collection of C++ software abstractions which enable architecture portability.

Research Experience

Aug 2012 - May 2017 — Graduate Research Assistant, *Department of Computational and Applied Mathematics, Rice University*, Houston, TX

- Developed multi-core algorithms based on Hermite interpolation for modeling wave propagation using an MPI + OCCA model. OCCA is a portable threading API which allows cross compilation in CUDA, OpenCL, and OpenMP.
- Developed new strategies for a hybrid discontinuous-Galerkin and Hermite scheme.

Aug 2013- Sept 2014 — Graduate Research Assistant, *Department of Radiation Physics, UT MD Anderson Cancer Center*, Houston, TX

- Introduced a GPU accelerated point cloud 4D image registration algorithm: *Radial MILO* using OpenCL and C++.
- Radial MILO was demonstrated to be competitive to existing algorithms using benchmark images from the Deformable Image Laboratory.

Sept 2011- July 2012 — Research Fellow, *Department of Mathematics, University of California*, Irvine, CA

- Constructed a mathematical model for the G_2/M cell cycle checkpoint.
- Implemented numerical algorithms in MATLAB to simulate the cell's ability to trigger mitosis.

Industry Experience

May 2016 - Aug 2016 — Student Intern, *Lawrence Livermore National Laboratory*, Livermore, CA

- Accelerated the mass matrix assembly in the Modular Finite Element Library (MFEM) through the use of GPUs using C++ and OCCA.
- Gave oral and poster presentations to present achieved performance with the new kernels.

May 2015 - Aug 2015 — Geophysics Intern, *Hess*, Houston, TX
- Developed new isotropic and anisotropic wave equation solvers on the GPU using CUDA and OCCA.
- Implemented method to minimize wave dispersion for a given frequency and velocity.

May 2014- Aug 2014 — Scientific Developer Intern, *Z-Terra*, Houston, TX
- Developed a 2D Reverse Time Migration (RTM) solver framework using C and OpenMP.
- Implemented a finite difference scheme to solve the wave equation and cross-correlation for the imaging condition.

Papers and Technical Reports

2018 **A. Vargas**, T. Hagstrom, J. Chan, T. Warburton, *Hermite-leapfrog methods for the simulation of wave propagation*, In preparation.

2018 D. Appelo, T. Hagstrom, **A. Vargas**, *Hermite methods for the scalar wave equation*, Submitted.

2017 **A. Vargas**, J. Chan, T. Hagstrom, T. Warburton, *GPU acceleration of Hermite methods for the simulation of wave propagation*, International conference on spectral and high order methods proceedings 2016.

2017 **A. Vargas**, J. Chan, T. Hagstrom, T. Warburton, *Variations on Hermite Methods for Wave Propagation*, Communications in computational physics.

2014 G. Enciso, D. Kellogg, and **A. Vargas**, *Compact Modeling of Allosteric Multisite Proteins: Application to a Cell Size Checkpoint*, PLoS Computational Biology.

Academic Mentoring

2013 Rice Learning Assistant, *Rice University*, Houston, TX
- Led weekly lab sections for a course in Computational Engineering.
- Evaluated homework and discussed fundamental programming concepts with the class using MATLAB.

Skills

Numerics: Linear Algebra, Optimization, Differential Equations

Software: Matlab (Skilled), Git

Computing: C/C++ (Proficient), CUDA (Skilled), OpenCL (Skilled), OpenMP (Skilled), MPI (Proficient), Python (Basic)

Systems: Linux, Mac OS

Languages: Spanish

Talks and Presentations

2017 Sandia National Laboratory, Albuquerque, New Mexico
A.Vargas *Simulating Wave Propagation with Hermite Interpolation*.

2016 International Conference on Spectral and High Order Methods, Rio de Janeiro, Brazil
A.Vargas, J. Chan, T. Warburton, *GPU Accelerated Hermite methods for the Simulation of Waves*.

2016 Rice Oil and Gas Workshop, Houston, TX
A.Vargas, J. Chan, T. Warburton, *GPU Accelerated Hermite Methods for the Simulation of Waves*.

2015 Joint Mathematics Meetings, San Antonio, TX
A.Vargas, *Parameterized Spatial Transformations for Block Match Based Medical Image Registration*.

Workshops

2016 Computational and Numerical Analysis of Transient Problems in Acoustics, Elasticity, and Electromagnetism, *Banff*, AB, Canada.

Awards

2016 Alan Weiser Memorial Travel Award, *Rice University*

2013 National Science Foundation Graduate Fellow, *Rice University*

2012 Chancellor's Award for Excellence in Undergraduate Research, *University California Irvine*

2012 Undergraduate Research/Departmental Service Award for Mathematics, *University California Irvine*

2012 Undergraduate Research/Departmental Service Award for Mathematics, *COMAP*

Languages

English **Native**

Spanish **Fluent**

References

Tim Warburton
John K. Costain Faculty Chair in the College of Science
Virginia Tech
Blacksburg, VA 24061
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