Harsha Lokavarapu

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Education

University of California, Davis	MS	Computational Geodynamics (4.0 GPA)	2017–
		Thesis Adviser: Professor Louise H. Kellogg	
		Secondary Adviser: Professor Elbridge G. Puckett (EGP)	
University of California, Davis	BS	Computer Science	2015
	Minor	Applied Mathematics	2015

Appointments

2014-2017	Computational Infrastructure for Geodynamics (CIG)	Junior Assistant Programmer
2012	Certify Data Systems (Humana)	Internship as Code Developer

Programming Languages, Computing Skills, and Work Experience

Open Source Code Development

- Advanced Solver for Problems in Earth's ConvecTion (ASPECT) written in C++. I am the 17/56 most active contributor.
- State of-the-art model of the Earth's Geodynamo, Calypso written in FORTRAN 90. I am the 3/4 most active contributor.
- Generalized reservoir modeling library (MS Thesis Project: Resecore) written in Python

Parallel Processing and High Performance Computing

* Note that all "Git" links are personal code samples

Tools

- CMake, CTest - Build tool and Unit testing - (Git PR: 1, 2)
- CUDA - (Git: PR)(SHT = Spherical Harmonic Transform)
- Distributed memory parallelism - MPI for C++ and FORTRAN
- Shared memory parallelism - openMP
- SLURM HPC scheduler
- Profilers: gdb and cuda-gdb

Machines

- National Science Foundation (NSF) Texas Advanced Computing Center
  - Stampede and Stampede 2
  - Maverick

- UCD Math and Physical Sciences (MPS) HPC Cluster
  - Ymir - 38 Dual socket, quad core (Intel E5620 2.4 GHz CPUs) with 24 GB RAM.
  - Peloton - 55 nodes with 64GB ram, 16 cores/32 threads (Intel Xeon E5-2630v3 Processors).

Computations

- ASPECT
  - Design and implementation of parallel particle generation algorithms. (Git: PR)
  - Design and implementation of parallel particle interpolation algorithms including harmonic averaging and bilinear least squares. (Git PR: Harmonic Average, Bilinear least squares)
  - Design 2-D analytical solution to Stokes equations in order to benchmark the accuracy of particle algorithms in ASPECT. (Git PR: 1, 2)
  - Refactor existing benchmarks using C++ inheritance principles to reduce repetitive code with the help of Harry R. Levinson and others who added some commits on Jan 3, 2017 (Harry Levinson was a sophomore summer student that I worked with) (Git PR: SolCx, SolKz, Compositional Fields)
  - Implementation of Schmeling subducting slab benchmark from Schmeling et al., Physics of the Earth and Planetary Interiors 171 (2008) 198–223
  - Execute strong and weak scaling tests for original draft of publication [3] (see below), which was not included in the final publication
  - ASPECT contributions Git timeline
- Calypso
  - Optimization of Legendre Polynomial transform in a spherical geometry using CUDA for Nvidia GPUs
  - Design different implementations using CUDA Fast Fourier Transform (cuFFT) library, CUDA Basic Linear Algebra Subprograms (cuBLAS), and (CUB) library. (Git code: PR, Dev branch)
  - Profile and test optimizations using strong and weak scaling tests
  - Published results as poster [4], [6] (see below) at the 2014, 2015 Annual Fall AGU Meetings
  - Calypso contributions Git timeline

Data Analysis and Visualization

- Bash scripting - running numerous jobs, job monitoring, and data collection (Git: Code)
- Gnuplot - (Git: Code)
- Paraview GUI and Scripting - (Git: Code)
- Jupyter Notebooks and Python - (Git: Deep Carbon, Convergence Analysis, and more)
- R - (Git: Code)
- Visit

Continuous Integration Tools

- Jenkins - Collaborate on continuous integration testing of all CIG based codes - CIG Repository Status WebPage
- Travis

Outside Interests

- Virtual Reality - (Git: VR-Experiments using A-Frame library) - JavaScript
- 3-D Design/Printing - Tinkercad
- Machine Learning - (Keras Examples, Tensorflow Iris Classification Tutorial) - Python

Professional Affiliations and Activities

2017–	Member	Deep Carbon Observatory
May 6-17, 2017	Participant	ASPECT Hackathon
June 14-September 20, 2017	Primary Mentor	Prof. Puckett's Research Experience for Undergraduates (REU) Program
2014-2016	Member	American Geophysical Union
June 14-September 20, 2016	Assistant Mentor	Prof. Puckett's REU Program
June 24-July 2, 2016	Participant	CIG - All Hands Meeting
2015	Participant	ASPECT Hackathon

Publications

Refereed Journal Publications

Submitted

[1] L. H. Kellogg, D. L. Turcotte, M. Weisfeiler, H. Lokavarapu*, S. Mukhopadhyay, (2018) "Implications of a Reservoir Model for the Evolution of Deep Carbon", *Earth and Planetary Science Letters*, Ms. Ref. No.: EPSL-D-17-01055

Accepted

[2] R. Gassmoeller, H. Lokavarapu*, E. Heien, E. G. Puckett, and W. Bangerth, (2018) "Flexible and scalable particle-in-cell methods with adaptive mesh refinement for geodynamic computations", *Geochemistry, Geophysics, Geosystems* manuscript 2018GC007508R View Accepted Manuscript

Appeared

[3] E. G. Puckett, D. L. Turcotte, L. H. Kellogg, Y. He†, J. M. Robey*, and H. Lokavarapu@ (2018) "New numerical approaches for modeling thermochemical convection in a compositionally stratified fluid", Special issue of . *Physics of the Earth and Planetary Interiors* associated with the 15th Studies of the Earth's Deep Interior (SEDI) Symposium (*Phys. Earth. Planet. In.)* **276**:10–35, 10.1016/j.pepi.2017.10.004 View Article

Poster Presentations

[1] L. H. Kellogg, H. Lokavarapu*, D. L. Turcotte, and S. Mukhopadhyay (2017) "A reservoir model study of the flux of carbon from the atmosphere, to the continental crust, to the mantle", *Annual Geophysical Union Fall Meeting 2017* View Abstract

[2] J. Jiang, A. P. Kaloti, H. R. Levinson, N. Nguyen, E. G. Puckett, and H. Lokavarapu@ (2016) "Benchmark Results Of Active Tracer Particles In The Open Souce Code ASPECT For Modelling Convection In The Earth's Mantle", *Annual Geophysical Union Fall Meeting 2016* View Abstract

[3] E. G. Puckett, D. L. Turcotte, L. H. Kellogg, H. Lokavarapu@, Y. He†, and J. M. Robey* (2016) "New Numerical Approaches To thermal Convection In A Compositionally Stratified Fluid", *Annual Geophysical Union Fall Meeting 2016* View Abstract

[4] H. Lokavarapu[@], and H. Matsui (2015) "Optimization of Parallel Legendre Transform using Graphics Processing Unit (GPU) for a Geodynamo Code", *Annual Geophysical Union Fall Meeting 2015* View Abstract

[5] J. A. Russo, E. H. Studley, H. Lokavarapu[@], I. Cherkashin, and E. G. Puckett (2014) "A New Monotonicity-Preserving Numerical Method for Approximating Solutions to the Rayleigh-Benard Equations", *Annual Geophysical Union Fall Meeting 2014* View Abstract

[6] H. Lokavarapu[@], H. Matsui, and E. M. Heien (2014) "Parallelization of the Legendre Transform for a Geodynamics Code", *Annual Geophysical Union Fall Meeting 2014* View Abstract

[@]Undergraduate Student
[*]Graduate Student
[†]Postdoctoral Scholar

CLASSES

Computer Science Courses

- 10 - Concepts of Computing
- 20 - Discrete Mathematics for Computer Science
- 30 - Introduction to Programming and Problem Solving
- 40 - Software and Object-Oriented Programming
- 50 - Machine Dependent Programming
- 60 - Data Structures and Programming
- 120 - Theory of Computation
- 122A - Algorithm Design
- 140A - Programming Languages
- 150 - Operating Systems
- 152A - Computer Networks
- 153 - Computer Security
- 154A - Computer Architecture
- 158 - Parallel Architectures
- 170 - Artificial Intelligence
- 188 - Ethics in an Age of Technology

Mathematics

- 21A - Differential Calculus
- 21B - Integral Calculus
- 21C - Expansions, Series, etc.
- 21D - Vector Analysis
- 22A - Linear Algebra
- 22B - Ordinary Differential Equations
- 118A - Partial Differential Equations (first quarter)
- 118B - Partial Differential Equations (second quarter)
- 125A - Real Analysis (Foundations of Calculus)
- 125B - Real Analysis (second quarter)
- 135A - Probability
- 150A - Modern Algebra (first quarter)
- 150B - Modern Algebra (second quarter)
- 167 - Advanced Linear Algebra: Machine Learning
- 228A - Computational methods for Partial Differential Equations