Vivek L. Kale

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U.S. Citizen

Education

Bachelor of Science, Computer Science:University of Illinois at Urbana-Champaign, 2007

Doctor of Philosophy, Computer Science: University of Illinois at Urbana-Champaign, 2015
Advisor: William D. Gropp

Honors

- SC 2017 Early Career Program Invitee and Participant
- 2015 Heidelberg Laureate Forum Invitee and Participant.
- Fellow at Lawrence Livermore National Laboratory through Lawrence Scholar Program.

Technical Skills

Languages: C, C++, python, Fortran, bash, csh, CUDA

Tools: LaTeX, gnuplot, emacs, autoconf, cmake, svn

Libraries for Parallelism: POSIX threads (Pthreads), MPI (mpich3), OpenMP (gomp, llvm), OpenACC (pgi)

Performance Profiling Tools and Libraries: hpcToolkit, PAPI, nvprof, gprof

Experience

Charmworks, Inc.   Software Developer   Jun '18 - present
- Integrating a shared memory library for sophisticated loop scheduling strategies, with some strategies being based on strategies I've developed for my dissertation, into the current version of Charm++.
- Comparing performance of a loop scheduling strategy available in the integrated shared memory library with the performance of the corresponding loop scheduling strategy available in LLVM's OpenMP library.
- Providing feedback for tutorials on Charm++ to improve them.

University of Southern California   Computer Scientist   Dec. '16 - Jun '18
- Working with postdoc from LLNL on a proposal to study techniques that combine loop scheduling and load balancing to improve performance of scientific applications.
- Working with OpenMP Language Committee to support `https://sites.google.com/site/userdefschedopenmp`[user-defined schedules] in OpenMP.
- Translating an x-ray tomography code written in Matlab code to C code and then parallelizing it to run on a supercomputer having nodes with GPGPUs.
- Working on modifications to LLVM compiler to support new OpenMP loop schedules.

- Worked on ensuring external network infrastructure to support transfer of application code's input data files were adequate for an application code's efficient execution using the Globus Toolkit.
- Working in team to manage computational performance aspects of running an application program involving Fast Fourier Transformation and image reconstruction algorithms.

Charmworks, Inc. Developer   Jan. '16 - Nov. '16
- Implemented mixed static/dynamic loop scheduling strategies within Charm++'s thread scheduling library.
- Helped to improve portability of Charm++ to a variety of platforms.
- Assisted with business aspects of a high-tech startup.

University of Illinois   Postdoctoral Associate   Jul. '15 – Dec. '15
- Developed library that allows application programmers to use strategies from dissertation.
- Adapted a plasma physics application code to work on a GPGPU processor and Intel Xeon Phi.
- Incorporated over-decomposition and locality-aware scheduling into strategies from dissertation.

Lawrence Livermore Nat'l Lab   Lawrence Scholar   Feb. '12 – Jun. '14
- Measured MPI communication delays for micro-benchmarks codes run on supercomputers and worked to find tools to measure dequeue overheads of OpenMP loop schedulers.
- Created a software system for automated performance optimization and application programmer usability of low-overhead hybrid scheduling strategies.
- Developed a ROSE-based custom compiler for automatically transforming MPI+OpenMP applications to use low-overhead scheduling techniques and runtime.
- Assessed further opportunities for performance improvement of low-overhead schedulers, including improvement of spatial locality of low-overhead schedulers.

Lawrence Livermore Nat'l Lab   Scholar   Jun. '11 - Sep. '11
- Experimented with different OpenMP parameters of implemented MPI+OpenMP application code to understand performance optimizations on LLNL supercomputers.
- Developed software design for low-overhead loop scheduling library based on libgomp software design.

Lawrence Berkeley Nat'l Lab   Summer Scholar   Aug. '10 - Sep. '10
- Analyzed results for the performance tests developed on NERSC machines.
- compared with collectives in reference to MPI (mpich2) runtime system.

Lawrence Livermore Nat'l Lab   Scholar   May. '10 - Aug. '10
- Modified libgomp runtime system in order to integrate low-overhead schedulers within it.
- Developed an algorithm multi-stage low-overhead loop scheduler with each stage associated with a level in the memory hierarchy, allowing for MPI-shared memory extensions to be used in conjunction with the low-overhead loop scheduling strategies.

Goldman-Sachs   Summer Analyst   Jun. '09 – Sep. '09
- Wrote code for testing trading system infrastructure functions under extreme market conditions.
- Analyzed performance bottlenecks of system infrastructure functions.

List of Publications

1. Vivek Kale and Martin Kong. *Enhancing Support in OpenMP to Improve Data Locality in Application Programs Using Task Scheduling*. OpenMPCon 2018. September 2018. Barcelona, Spain.

2. Vivek Kale, Harshitha Menon and Karthik Senthil. ***Adaptive Loop Scheduling with Charm++ to Improve Performance of Scientific Applications***. SC '17. November 2017. Denver, USA. *(Selected as a Candidate for Best Poster)*

3. Vivek Kale and William D. Gropp. ***A User-defined Schedule for OpenMP***. Extended Abstract. OpenMPCon 2017. September 2017. New York, USA.

4. Vivek Kale, Harshitha Menon and Karthik Senthil. ***Adaptive Loop Scheduling with Charm++ to Improve Performance of Scientific Applications***. Technical Report. University of Southern California. May 2017.

5. Vivek Kale and William D. Gropp. ***Composing Low-Overhead Scheduling Strategies for Improving Performance of Scientific Applications***. IWOMP 2015. October 2015. Aachen, Germany.

6. Vivek Kale, Simplice Donfack, Laura Grigori and William D. Gropp. ***Balancing the Trade-off Between Load Balancing and Locality to Improve Performance of Scientific Applications***. SC '14. November 2014. New Orleans, USA.

7. Vivek Kale, Amanda Randles and William D. Gropp. ***Locality-Optimized Mixed Static/Dynamic Scheduling for Load Balancing on SMPs***. EuroMPI/ASIA 2014. September 2014. Kyoto, Japan.

8. Vivek Kale, Todd Gamblin, Torsten Hoefler, Bronis R. de Supinski and William D. Gropp. ***Slack-conscious Lightweight Loop Scheduling for Scaling Past the Noise Amplification Problem***. SC '12. November 2012. Salt Lake City, USA.

9. Simplice Donfack, Vivek Kale, Laura Grigori and William D. Gropp. ***Hybrid Static/Dynamic Scheduling for Already Optimized Dense Matrix Factorizations***. IPDPS 2012. May 2012. Shanghai, China.

10. Vivek Kale, Abhinav Bhatele and William D. Gropp. ***Weighted Locality-sensitive Scheduling for Noise Mitigation on Multicore Clusters***. HiPC 2011. December 2011. Bangalore, India.

11. Vivek Kale and William D. Gropp. ***Load Balancing for Regular Meshes on a Cluster of SMPs with MPI***. EuroMPI 2010. September 2010. Stuttgart, Germany. *(Selected as a Best Paper)*

12. Torsten Hoefler, James Dinan, Darius Buntinas, Pavan Balaji, Brian Barrett, Ron Brightwell, William Gropp, Vivek Kale and Rajeev Thakur. ***MPI+MPI: A New Hybrid Approach to Parallel Programming with MPI Plus Shared Memory***. EuroMPI 2012. September 2012. Madrid, Spain.

13. Amanda Randles, Vivek Kale, Jeff Hammond, William D. Gropp and Efthimios Kaxiras. ***Performance Analysis of the Lattice Boltzmann Model Beyond Navier-Stokes***. IPDPS 2013. May 2013. Boston, USA.

14. Vivek Kale. ***Towards Using and Improving the NAS Parallel Benchmarks: A Parallel Patterns Approach***. ParaPLoP 2010. April 2010. Carefree, USA.

15. Vivek Kale and Edgar Solomonik. ***Parallel Sorting Pattern***. ParaPLoP 2010. April 2010. Carefree, USA.

16. Vivek Kale. ***The Correlation between Parallel Patterns and the NAS Parallel Benchmarks***. ICSE 2010. May 2010. Johannesberg, South Africa.

17. Vivek Kale. ***A Pattern Language for Dynamic Scheduling***. ParaPLoP 2011. May 2011. Carefree, USA.

Membership of Organizations

- Society for Industrial and Applied Mathematics
- Association for Computing Machinery
- Institute of Electrical and Electronics Engineers
- Association for Computing Machinery's SIGHPC

Teaching Experience

1. Teaching Assistant for Programming Studio (CS 242) at University of Illinois at Urbana-Champaign for Spring 2009.
2. Teaching Assistant for Programming Studio (CS 242) at University of Illinois at Urbana-Champaign for Fall 2009.
3. Teaching Assistant for Programming Studio (CS 242) at University of Illinois at Urbana-Champaign for Spring 2010.

Services

- Reviewer for 2017 Elsevier Parallel Computing Journal
- Member of Organization Committee for SC 2018's Early Career Program
- Member of Selection Committee for SC 2018's Experiencing HPC for Undergraduates Program