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Research Interests

- **Automata processing**
- **GPU and multicore optimization**
- **Heterogeneous architecture**
- **Power distribution network modeling and optimization**

Academic Positions

- Research Scientist, Jan. 2014 - present
University of Virginia
- Research Associate, Jul. 2012 – Jan. 2014
University of Virginia
- Postdoctoral researcher, Oct. 2011- Jul. 2012
University of California Riverside
- Associate Professor, Jun. 2010 - Oct. 2011
Lab. of Parallel Software and Computational Science, Institute of Software, Chinese Academy of Sciences
- Assistant Professor, Jul. 2009 – Jun. 2010
Lab. of Parallel Software and Computational Science, Institute of Software, Chinese Academy of Sciences
- Postdoctoral researcher, Jul. 2007 – Jul. 2009
Institute of High Performance Computing, Dept. of Computer Science & Technology, Tsinghua University, China
- Visiting researcher, Sep. 2008 - Nov. 2008
Delft Institute of Applied Mathematics, Delft University of Technology, the Netherland

Education

- Ph.D. in Chemical Engineering, Jul. 2007
Tsinghua University, China
- B.S. in Environmental Engineering, Jul. 2002
Beijing University of Technology, China

Project Experience

- **Developing applications/building-blocks on Micron's Automata Processor.** Accelerated association rule mining (data mining) by using Micron's Automata Processor (AP); accelerated Brill Tagging (natural language processing) by using the AP; advising multiple graduate students on Automata-related research. Research Scientist, project leadership team, 2013-present.

- **Developing applications/building-blocks on Micron's Automata Processor.** Developed Turing Complete automata – Game of Life and Elementary Cellular automata on Micron's Automata Processor; developed stack-like memory structure on Micron's Automata Processor. Research Associate/Scientist, project leadership team, 2013-14.
- **Time domain and frequency domain analysis for on-chip power distribution network.** Developed numerical algorithm for fast power distribution network simulation; developed frequency domain analysis for resonance phenomena. Research Associate/Scientist, 2012-present.
- **Pad placement optimization method for static / transient voltage noise control.** Proposed a novel virtual-force-directed pad-placement optimization method for minimizing global IR drop; developed pad-placement optimization method for transient voltage noise control. Research Associate/Scientist, 2012-present.
- **GPU optimization tool.** Developed an automated thread block reshaping tool and this tool support automated thread block shape selection and runtime shape switch base on profiling information. Research Associate/Scientist, 2012-present.
- **GPU benchmark characterization analysis.** Coverage and diversity analysis of Rodinia and Parboil benchmarks. Research Associate/Scientist, 2012-present.
- **SPEC accelerator benchmarks.** Porting Rodinia benchmark for inclusion in the SPEC ACCEL suite, which was released in 2014—Rodinia benchmarks comprise over half of this SPEC suite. Research Associate/Scientist, 2012-present.
- **Designed new benchmarks for Rodnia benchmark suite.** Research Associate/Scientist, 2012-present.
- **Problem analysis and computing solution development** for charging/discharging process of a super-capacitor. Numerical algorithm design and implementation. Postdoctoral Research at UC Riverside CA, 2011- 2012.
- **Team Leader for Vector Math Library and Fast Fourier Transform group.** Performed algorithm analysis and performance improvements through software optimization, use of Single Instruction Multiple Data (SIMD) and Fused Multiply- Add Instructions (FMAD) techniques. Principal Investigator, National Science Foundation of China (Grant #60803019), 2009 - 2011.
- **Team Leader for performance tuning of power grid simulation software.** Performance analysis and tuning, using symmetric minimum degree ordering, math library calling interface optimization and code level algorithm optimization of direct solver. 33.3% reduction in computational time. Group leader, Beijing, China, 2009 - 2010
- **Team Leader for staff statistical software.** Process Excel files and implement statistical computation. Design software architecture and GUI. Managed the project. Group leader, Beijing, China, 2009 - 2010
- **Proposed and implemented a novel numerical method for the simulation of large scale power systems.** Introduced new preconditioning method, achieved a 30% reduction in time compared with conventional direct solver. Principal Investigator, the Science Foundation of China Postdoctoral Researcher, 2008 - 2009.
- **Led the parallel algorithm design of an online security early warning system for power grid management** with the support of Microsoft. Parallel algorithm design and implement on MPI. Load balance based on metis graph partitioning. Key member of research team, Beijing, China, 2007-2009.
- **Led the parallel algorithm design and MPI** implementation of a Brownian Dynamics program with the support of Hewlett-Packard Taiwan. Parallel algorithm design and implement on MPI. Overlapping communication and computation using non-blocking point-to-point operation. Group leader, Beijing, China, 2007.

- **Implement PDE solver for option pricing.** Cooperated with mathematician and implemented PDE solver for his new option pricing theory. Intern, Beijing, China, 2007
- **Intern-image and audio search engine.** Install and configure web crawler, implement parallel singular value decomposition (SVD), implement a sparse dynamic array using Judy library. Intern, Beijing, China, 2006.

Publications

1. **Ke Wang**, Mircea Stan and Kevin Skadron. Association Rule Mining with the Micron Automata Processor. *29th IEEE International Parallel & Distributed Processing Symposium, IPDPS'15*, accepted
2. Qi Zhou, Jeffrey J. Fox, **Ke Wang**, Donald E. Brown. Brill Tagging using the Micron Automata Processor. *9th IEEE International Conference on Semantic Computing, ICSC'15*, accepted
3. Guido Juckeland, William Brantley, Sunita Chandrasekaran, Barbara Chapman, Shuai Che, Mathew Colgrove, Huiyu Feng, Alexander Grund, Robert Henschel, Wen-Mei W. Hwu, Huian Li, Matthias S. Müller, Wolfgang E. Nagel, Maxim Perminov, Pavel Shelepugin, Kevin Skadron, John Stratton, Alexey Titov, **Ke Wang**, Matthijs van Waveren, Brian Whitney, Sandra Wienke, Rengan Xu, and Kalyan Kumaran. SPEC ACCEL: A Standard Application Suite for Measuring Hardware Accelerator Performance. *5th International Workshop on Performance Modeling, Benchmarking and Simulation of High Performance Computer Systems, PMBS14*, Nov 2014
4. **Ke Wang**, Brett H. Meyer, Runjie Zhang, Mircea Stan and Kevin Skadron. Walking Pads: Managing C4 Placement for Transient Voltage Noise Minimization. In *the Proceedings of the Design Automation Conference, DAC '14*, June 2014
5. Runjie Zhang, **Ke Wang**, Brett H. Meyer, Mircea Stan and Kevin Skadron. Architecture Implications of Pads as a Scarce Resource. In *the Proceedings of the ACM/IEEE International Symposium on Computer Architecture, ISCA '14*, June 2014
6. **Ke Wang**, Brett H. Meyer, Runjie Zhang, Kevin Skadron and Mircea Stan. Walking pads: Fast power-supply pad-placement optimization. In *the Proceedings of the 19th Asia and South Pacific Design Automation Conference, ASP-DAC '14*, January 2014. (**Best Paper Candidate**)
7. Shi-Ming Xu, Wei Xue, **Ke Wang**, Hai-Xiang Lin. Fast time domain simulation of power systems using multilevel preconditioners with adaptive reconstruction strategies. *Simulation Modeling Practice and Theory*, 2012, 25, 90-105
8. **Ke Wang**, Wei Xue, Hai-Xiang Lin, Shi-Ming Xu, Wei-Min Zheng. Updating preconditioner for iterative method in time domain simulation of power systems. *Science China: Technological Sciences*, 2011, 54(4): 1024-1034 (**SCI, impact factor [2013] = 1.113**)
9. Shi-Ming Xu, Wei Xue, **Ke Wang**, Hai-Xiang Lin. Generating Approximate Inverse Preconditioners for Sparse Matrices using CUDA and GPGPU. *Journal of Algorithms and Computational Technology*, 2011, 5(3): 475-500.
10. Hui Fei, Yunquan Zhang, **Ke Wang**, Yawu Xu, Parallel Algorithm and Implementation for Molecular Dynamics Simulation Based on GPU (In Chinese), *Computer Science*, 2011, 38(9): 275-278
11. Qingchun Xie, Yunquan Zhang, **Ke Wang**, Yan Li, Yawu Xu, Research of the SIMD and Vector Math Library (In Chinese), *Computer Science*, 2011, 38(7): 298-301
12. Liang Yuan, Yunquan Zhang, Guoping You, **Ke Wang**, Xianyi Zhang, A GPU Computational Model Based on Latency Hidden Factor (In Chinese), *Journal of Software*, 2010, 21:251-262
13. Yan Li, Yunquan Zhang, **Ke Wang**, Wenhua Guan. Heterogeneous Multi-core Parallel SGEMM Performance Testing and Analysis on Cell/B.E Processor. *IEEE International Conference on Networking, Architecture and Storage (NAS)*, 2010, July 15-17, Macau, China: 202-207

14. Shi-Ming Xu, Hai-Xiang Lin, **Ke Wang**, Wei Xue. Utilizing CUDA for preconditioned GMRES solvers. In *Proceeding of 8th International Symposium on Distributed Computing and Applications to Business, Engineering and Sciences (DCABES 2009)*, Huhan, China: 8-12
15. **Ke Wang**, Yang-Xin Yu, Guang-Hua Gao. Density functional study on the structural and thermodynamic properties of aqueous DNA-electrolyte solution in the framework of cell model. *Journal of Chemical Physics*, 2008, 128: 185101 (*SCI, impact factor [2013] = 3.122*)
16. Yang-Xin Yu, **Ke Wang**, Guang-Hua Gao. Density functional study on the osmotic coefficient for the DNA–electrolyte solutions. *Fluid Phase Equilibria*, 256 (1), 20-26
17. **Ke Wang**, Yang-Xin Yu, Guang-Hua Gao, et al. Preferential interaction between DNA and small ions in mixed-size counterion systems: Monte Carlo simulation and density functional study. *Journal of Chemical Physics*, 2007, 126(13): 135102 (*SCI, impact factor [2013] = 3.122*)
18. **Ke Wang**, Yang-Xin Yu, Guang-Hua Gao, et al. Density-functional theory and Monte Carlo simulation study on the electric double layer around DNA in mixed-size counterion systems. *Journal of Chemical Physics*, 2005, 123(23): 234904 (*SCI, impact factor [2013] = 3.122*)
19. **Ke Wang**, Shu-mei Wang, Yang-xin Yu. Prediction of properties of charged semipermeable membranes using density functional theory. *Journal of Tsinghua University (Science and Technology)*, 2005, 45(9): 1251-1254 (EI)
20. **Ke Wang**, Yang-Xin Yu, Guang-Hua Gao. Density functional study on the structures and thermodynamic properties of small ions around polyanionic DNA. *Physical Review E*, 2004, 70: 011912 (*SCI, impact factor [2013] = 2.326*)

Patents

- **Ke Wang**, Kevin Skadron, Mircea Stan, Brett H. Meyer and Runjie Zhang. System, Method, and Computer Readable Medium for Walking Pads: Fast Power- Supply Pad-Placement Optimization. U.S. Provisional Patent Application Serial No. 61/915,410
- **Ke Wang**, Kevin Skadron, Mircea Stan, Brett H. Meyer and Runjie Zhang. Placement optimization of chip design for transient noise control. U.S. Provisional Application No. 62/004,915
- Jack Wadden, **Ke Wang**. Uses for Random and Stochastic Input on Automata Processor and Related. U.S. Provisional Patent Application Serial No. 62/078,997
- **Ke Wang**, Kevin Skadron. Association rule mining with Micron Automata Processor. Disclosed.
- Qi Zhou, Jeffrey J. Fox, Donald E. Brown, **Ke Wang**. Brill Tagging using the Micron Automata Processor. Disclosed.

Research Funding

- Principal Investigator, NSF China (grant #60803019), Research of High Performance Algorithm in Prediction of the Interaction between Charged Bio-macromolecules. Jan. 2009-Dec. 2011.
- Principal Investigator, The Science Foundation of China Postdoctor, Parallel iterative algorithm study for security analysis of power system. May. 2008- June. 2009
- Key member, design of online security early warning system for power grid management. Supported by Microsoft. May. 2007-July. 2009

Invited Talks

- Code optimization and performance tuning on Linux system. Aug. 2010, China Electric Power Research Institute
- Introduction to MPI Programming. Oct. 2007 - Nov. 2007, Tsinghua University, China

Awards

- SPECTacular Contributor Award, in *Standard Performance Evaluation Corporation*, Jan. 2014
- Scholarships for Straight-A Student of Tsinghua University from Bechtel Corporation in 2006
- Guanghai First-class Scholarship in 2004
- Excellent graduate of Beijing in 2002
- Award for Straight-A Student of Beijing in 2000 and 2001
- **First Prize in 12th University Students Mathematics Competition of Beijing in 2000 (ranked sixth in total)**
- Sony Scholarship for Outstanding Students from Universities of Beijing in 1999