

Li-Wen Chang

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OBJECTIVE

Research Scientist for Parallel Computing or Senior Software Engineer

EDUCATION

Ph.D. candidate in Electrical and Computer Engineering (ECE)	Aug. 2009-present
University of Illinois at Urbana-Champaign (UIUC), IL	
BS in Electrical Engineering (EE), with a Minor degree in Mathematics	Jun. 2007
National Taiwan University (NTU), Taipei, Taiwan	
Visiting student, ECE, UIUC	Aug. 2006-May 2007

WORK EXPERIENCE

Research Assistant, IMPACT Lab., UIUC	Fall 2009-present
– Researched in high-performance computing, compiler optimization, and computer architecture	
Intern, NVIDIA	Jun. 2012-Sept. 2012
– Developed real-time image inpainting for Tegra 3	
Research Assistant and Engineer, Ultrasonic Imaging Lab., NTU	Feb. 2008-Jul. 2009
– Developed a novel high-frequency (50MHz) real-time ultrasonic imaging system, using FPGA and GPGPU	

RESEARCH INTERESTS

Parallel computing, heterogeneous computing, compiler optimization, computer vision, and machine learning

SELECTED PUBLICATIONS

Journal:

- J. Gómez-Luna, I.-J. Sung, **L.-W. Chang**, J. M. González-Linares, N. Guil and W.-m. Hwu, "In-Place Matrix Transposition on GPUs," **IEEE TPDS**, 27(3), Mar. 2015
- J. A. Stratton, C. Rodrigues, I.-J. Sung, **L.-W. Chang**, N. Ansari, G. D. Liu, W.-m. W. Hwu and N. Obeid, "Algorithm and Data Optimization Techniques for Scaling to Massively Threaded Systems," **IEEE Computer**, 45(8), Aug. 2012
- **L.-Wen Chang**, Ke-Hsin Hsu, Pai-Chi Li, "Graphics Processing Unit-Based High-Frame-Rate Color Doppler Ultrasound Processing," **IEEE TUFFC**, 56(9), Oct. 2009
- Chia-Kai Liang, **L.-Wen Chang** and Homer H. Chen, "Analysis and Compensation of Rolling Shutter Effect," **IEEE TIP**, 17(8), Aug. 2008

Proceeding:

- J. Gómez-Luna, I. El Hajj, **L.-W. Chang**, V. Garcia-Flores, S. Garcia de Gonzalo, T. B. Jablin, A. J. Peña and W.-M. Hwu, "**Chai**: Collaborative Heterogeneous Applications for Integrated-architectures," **ISPASS**, 2017
- **L.-W. Chang**, I. El Hajj, C. Rodrigues, J. Gómez-Luna and W.-m. W. Hwu, "Efficient Kernel Synthesis for Performance Portable Programming," **MICRO**, 2016
- Izzat El Hajj, Juan Gómez-Luna, Cheng Li, **L.-Wen Chang**, Dejan Milojicic and Wen-mei W. Hwu, "KLAP: Kernel Launch Aggregation and Promotion for Optimizing Dynamic Parallelism," **MICRO**, 2016
- **L.-Wen Chang**, Hee-Seok Kim and Wen-mei W. Hwu, "DySel: Lightweight Dynamic Selection for Kernel-based Data-Parallel Programming Model," **ASPLOS**, 2016
- **L.-Wen Chang**, Izzat El Hajj, Hee-Seok Kim, Juan Gómez-Luna, Abdul Dakkak and Wen-mei W. Hwu, "A Programming System for Future Proofing Performance Critical Libraries," **PPoPP**, 2016
- X. Chen, **L.-W. Chang**, C. I. Rodrigues, L. Jie, Z. Wang and W.-m. W. Hwu, "Adaptive Cache Management for Energy-efficient GPU Computing," **MICRO**, 2014
- **L.-W. Chang**, J. A. Stratton, H.-S. Kim and W.-m. W. Hwu, "A Scalable, Numerically Stable High-Performance Tridiagonal Solver using GPUs," **SC**, 2012
- **L.-W. Chang**, M.-T. Lo, N. Ansari, K.-H. Hsu, N. Huang and W.-m. W. Hwu, "Parallel Implementation of Multi-Dimensional Ensemble Empirical Mode Decomposition," **ICASSP**, 2011

SELECTED HONORS

Dan Vivoli Endowed Fellowship, ECE, UIUC, 2012-2013

Integrative Graduate Education and Research Traineeship (IGERT): Neuroengineering, NSF, USA, 2009-2011

Taiwan Merit Scholarship, Taiwan, 2006-2007

Undergraduate Student Research Fellowship, National Science Council, Taiwan, 2005

Pan Wen-Yuan Scholarship, 2005

Presidential Awards, 3 times, NTU

Gold medal in Asian Pacific Mathematics Olympiad (APMO), 2001

SELECTED RESEARCH

TANGRAM — High-level Language for Heterogeneous Computing (Ph.D. Thesis)	Fall 2012-present
– Developed a pioneering high-level performance portable programming system for CPUs, GPUs, FPGAs and clusters	
Heterogeneous Benchmark Suite and Characteristics Study	Fall 2015-present
– Developed a benchmark suite with collaborative computing patterns for studying integrated CPU-GPU or CPU-FGPA	
Dynamic Parallelism Optimization for GPUs	Fall 2015-present
– Developed optimization techniques for GPU dynamic parallelism, significantly boosting the efficiency of dynamic parallelism on current GPUs	
GPU Data Sliding	Fall 2014-present
– Developed a set of data manipulation algorithms for GPUs with corresponding optimization techniques minimizing global memory accesses	
Accelerator Benchmark Suites (Parboil and SPEC ACCEL)	Fall 2009-present
– Built GPU benchmarks to help the community study characteristics of GPU architectures, optimizations and performance portability	
GPU Cache and Scheduler Design	Fall 2012-Fall 2014
– Characterized cache sensitivity of applications on GPU and developed cache bypass and thread throttling to maximize throughput	
GPU Tridiagonal Solver Library (MS Thesis)	Fall 2010-Summer 2014
– Built the first GPU pivoting tridiagonal solver , included as the standard gtsv in NVIDIA CUSPARSE 5.5 or later version	
Parallel Empirical Mode Decomposition Library	Fall 2010-Fall 2013
– Built the first parallel library for multi-dimensional Empirical Mode Decomposition on GPU and CPU	
Light Field Photography	Fall 2005-Spring 2006
– Explored light-field camera designs and studied visual effects of light field	
Rolling Shutter Effect	Spring 2005-Fall 2005
– Presented a pioneering analysis of Rolling Shutter effect in CMOS cameras and an efficient compensation algorithm	
Other Projects:	
GPU I/O Optimization, GPU Sharing Tracker, Speech Adaptation, Voice Segmentation, Stock Portfolio Selection, 3D Object Recognition, Face Detection	

REFERENCES

Dr. Wen-mei W. Hwu (Advisor), w-hwu@illinois.edu, Professor, ECE, UIUC

Dr. Deming Chen, dchen@illinois.edu, Professor, ECE, UIUC

Dr. Juan Gómez-Luna, el1goluj@uco.es, Assistant Professor, Depart. of Computer Architecture, Electronics and Electronic Technology, University of Córdoba, Spain

FULL PUBLICATION LIST

Thesis:

- **Li-Wen Chang**, "Scalable Parallel Tridiagonal Algorithms with Diagonal Pivoting and Their Optimization for Many-core Architectures," **MS Thesis**, ECE UIUC, 2014

Journal:

- J. Gómez-Luna, I.-J. Sung, **L.-W. Chang**, J. M. González-Linares, N. Gui and W.-m. Hwu, "In-Place Matrix Transposition on GPUs," **IEEE TPDS**, 27(3), Mar. 2015
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- **Li-Wen Chang**, Ke-Hsin Hsu, Pai-Chi Li, "Graphics Processing Unit-Based High-Frame-Rate Color Doppler Ultrasound Processing," **IEEE TUFFC**, 56(9), Oct. 2009
- Chia-Kai Liang, **Li-Wen Chang** and Homer H. Chen, "Analysis and Compensation of Rolling Shutter Effect," **IEEE TIP**, 17(8), Aug. 2008

Proceeding:

- J. Gómez-Luna, I. El Hajj, **L.-W. Chang**, V. Garcia-Flores, S. Garcia de Gonzalo, T. B. Jablin, A. J. Peña and W.-M. Hwu, "Chai: Collaborative Heterogeneous Applications for Integrated-architectures," **ISPASS**, 2017
- **L.-W. Chang**, J. Gómez-Luna, I. El Hajj, S. Huang, D. Chen and W.-m. W. Hwu, "Collaborative Computing for Heterogeneous Integrated Systems," **ICPE**, 2017
- **L.-W. Chang**, I. El Hajj, C. Rodrigues, J. Gómez-Luna and W.-m. W. Hwu, "Efficient Kernel Synthesis for Performance Portable Programming," **MICRO**, 2016
- Izzat El Hajj, Juan Gómez-Luna, Cheng Li, **Li-Wen Chang**, Dejan Milojevic and Wen-mei W. Hwu, "KLAP: Kernel Launch Aggregation and Promotion for Optimizing Dynamic Parallelism," **MICRO**, 2016
- **Li-Wen Chang**, Hee-Seok Kim and Wen-mei W. Hwu, "DySel: Lightweight Dynamic Selection for Kernel-based Data-Parallel Programming Model," **ASPLOS**, 2016
- **Li-Wen Chang**, Izzat El Hajj, Hee-Seok Kim, Juan Gómez-Luna, Abdul Dakkak and Wen-mei W. Hwu, "A Programming System for Future Proofing Performance Critical Libraries," **PPoPP**, 2016
- J. Gómez-Luna, **L.-W. Chang**, I.-J. Sung, W.-M. Hwu and N. Gui, "In-Place Data Sliding Algorithms for Many-Core Architectures," **ICPP**, 2015
- **L.-W. Chang**, A. Dakkak, C. I. Rodrigues and W.-m. Hwu, "Tangram: a High-level Language for Performance Portable Code Synthesis," **MULTIPROG**, 2015
- **L.-W. Chang**, H.-S. Kim and W.-m. Hwu, "Toward Application Performance Portability for Heterogeneous Computing," **TECHCON**, 2015
- W.-M. Hwu, **L.-W. Chang**, H.-S. Kim, A. Dakkak and I. El Hajj, "Transitioning HPC Software to Exascale Heterogeneous Computing," **CEM**, 2015
- X. Chen, **L.-W. Chang**, C. I. Rodrigues, L. Jie, Z. Wang and W.-m. W. Hwu, "Adaptive Cache Management for Energy-efficient GPU Computing," **MICRO**, 2014
- X. Chen, S. Wu, **L.-W. Chang**, W.-S. Huang, C. Pearson, Z. Wang and W.-M. W. Hwu, "Adaptive Cache Bypass and Insertion for Many-core Accelerators," **MES**, 2014
- J. M. Cecilia, A. Llanes, **L.-W. Chang**, J. M. Garcia, N. Navarro and W.-M. Hwu, "V-ACO: A Vectorization Approach for High-performance Ant Colony Optimization," **META**, 2014
- **Li-Wen Chang**, John A. Stratton, Hee-Seok Kim and Wen-mei W. Hwu, "A Scalable, Numerically Stable High-Performance Tridiagonal Solver using GPUs," **SC**, 2012
- J. A. Stratton, N. Anssari, C. Rodrigues, I.-J. Sung, N. Obeid, **L.-W. Chang**, G. Liu and W.-m. Hwu, "Optimization and Architecture Effects on GPU Computing Workload Performance," **InPar**, 2012
- **L.-W. Chang**, M.-T. Lo, N. Anssari, K.-H. Hsu, N. Huang and W.-m. W. Hwu, "Parallel Implementation of Multi-Dimensional Ensemble Empirical Mode Decomposition," **ICASSP**, 2011
- H.-S. Kim, S. Wu, **L.-W. Chang** and W.-m. Hwu, "A Scalable Tridiagonal Solver for GPUs," **ICPP**, 2011
- C.-S. Lin, W.-L. Liu, W.-T. Yeh, **L.-W. Chang**, W.-M. Hwu, S.-J. Chen and P.-A. Hsiung, "A Tiling-Scheme Viterbi Decoder in Software-Defined Radio for GPUs," **WiCOM**, 2011
- **Li-Wen Chang**, Men-Tzung Lo, Nasser Anssari, Ke-Hsin Hsu, Norden E Huang and Wen-mei W. Hwu, "Parallel Implementation of Empirical Mode Decomposition," **HHT**, 2011
- **Li-Wen Chang**, Ke-Hsin Hsu and Pai-Chi Li, "GPU-Based Color Doppler Ultrasound Processing," **IUS**, 2009
- **Li-Wen Chang**, Ke-Hsin Hsu and Pai-Chi Li, "Color Doppler Ultrasound on GPU: An Ultra-High Frame Rate Implementation," **IFMIA**, 2009
- Yi-Hao Kao, Chia-Kai Liang, **Li-Wen Chang** and Homer H. Chen, "Depth Detection of Light Field," **ICASSP**, 2007
- **L.-W. Chang**, C.-K. Liang and H. H. Chen, "Analysis and Compensation of Rolling Shutter Effect for CMOS Image Sensors," **ISCOM**, 2005

Book Chapter:

- **Li-Wen Chang**, Juan Gómez-Luna, David B. Kirk and Wen-mei W Hwu, "Parallel Patterns: Prefix Sum," **Programming Massively Parallel Processors: A Hands-on Approach**, Ch. 8, 2016
- **Li-Wen Chang**, Jie Lv, David B. Kirk and Wen-mei W Hwu, "Parallel Patterns: Merge Sort," **Programming Massively Parallel Processors: A Hands-on Approach**, Ch. 11, 2016
- **L.-W. Chang** and W.-m. W. Hwu, "A Guide for Implementing Tridiagonal Solvers on GPUs," **Numerical Computations with GPUs**, Ch. 2, 2014

Technical Report:

- **Li-Wen Chang** and Wen-mei W Hwu, "Mapping Tridiagonal Solvers to Linear Recurrences," **IMPACT Technical Report**, 2013
- J. A. Stratton, C. Rodrigues, I.-J. Sung, N. Obeid, **L.-W. Chang**, N. Anssari, G. D. Liu and W.-m. W. Hwu, "**Parboil**: A Revised Benchmark Suite for Scientific and Commercial Throughput Computing," **IMPACT Technical Report**, 2012

Invited Talk:

- **Li-Wen Chang** and Wen-mei W Hwu, "High-performance Linear Recurrence, and Its Applications," **IWCSE**, 2013
- **Li-Wen Chang**, John A. Stratton, Hee-Seok Kim and Wen-mei W. Hwu, "A Scalable, Numerically Stable High-Performance Tridiagonal Solver for GPUs," **GTC**, 2013
- **Li-Wen Chang**, Hee-Seok Kim, Shengzhao Wu and Wen-mei Hwu, "A Scalable Tridiagonal Solver for GPUs," **Private talk, INRIA**, 2011
- **L.-W. Chang**, M.-T. Lo, N. Anssari, K.-H. Hsu, N. Huang and W.-m. Hwu, "Parallel Empirical Mode Decomposition for GPUs," **HHT Tutorial**, 2011