Karthik Sangaiah

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RESEARCH INTERESTS

Design and evaluation of network-on-chips, power-efficient computer architecture, accelerators, reconfigurable interpolating filters, and mixed-signal embedded systems.

EDUCATION

- **Ph.D., Computer Engineering**, (September 2013 – current).
  Drexel University, Philadelphia, PA.
  Topic: Design of Network-on-Chip Architectures
- **M.S., Computer Engineering**, GPA: 3.95, (June 2012).
  Drexel University, Philadelphia, PA.
  Concentration: Digital Design, Mixed-signal Embedded Systems, Computer Architecture
- **B.S., Electrical and Electronics Engineering**, GPA: 3.95 (summa cum laude), (June 2012).
  Drexel University, Philadelphia, PA.
  Concentration: Digital Design, Mixed-signal Embedded Systems, Computer Architecture

PROFESSIONAL EXPERIENCE

- **Research Assistant**, (September 2013 – current)
  VLSI Laboratory, Department of Electrical and Computer Engineering
  Drexel University, Philadelphia, PA, USA

  – Design of Network-on-Chip (NoC) architectures
  – Application-aware memory and NoC co-design
  – Multi-threaded trace-based system simulation for evaluating many-core architectures and NoCs

- **Teaching Assistant**, (September 2013 – current)
  Department of Electrical and Computer Engineering & College of Engineering
  Drexel University, Philadelphia, PA, USA

  – ECEC 302, Digital Systems Projects (Fall 2013, Spring 2014)
  – ECEC 304, Design with Microcontrollers (Winter 2014)
  – ECEC 355, Computer Architecture (Summer 2014)

- **Combat Systems Engineer**, (July 2012 – Sept. 2013)
  Lockheed Martin MST
  Moorestown, NJ

  – Designed a commercial-off-the-shelf (COTS) FPGA-based solution for replacing an internally-produced VME sensor monitor embedded computer
  – Evaluated the application compatibility and performance impact of upgrading to a 64-bit Red Hawk OS
  – Performed a full system capacity analysis for optimizing application performance on large-scale CMPs

- **R&D and Information Assurance (IA) Co-op**, (March 2011 - Sept. 2011)
  Lockheed Martin MST
  Moorestown, NJ

  – Examined the impact of future radar parameters on Ballistic Missile Defense performance
  – Performed an R&D evaluation of the Cisco Unified Computing System product line for combat ship system processing
  – Executed vulnerability investigations and administered hardening of combat systems on a 60 node network

◇ **Computing and Network Infrastructure (CNI) Co-op**, (Sept. 2008 - Sept. 2010)
Lockheed Martin MST
Moorestown, NJ

– Wrote five trade studies for the customer based on research of advances in COTS hardware
– Provided network support during 12–hour and 24–hour stress and endurance tests of the Combat System Ship Qualification Testing of a 60 node network
– Evaluated a network management software for three assets and presented the findings to the customer
– Acted as the primary contact between the CNI team and three COTS vendors
– Trained two new team members in troubleshooting and designing components of the combat system

ACADEMIC HONORS AND AWARDS

◇ NSF Graduate Research Fellowship Program Recipient, 2014.
◇ George Hill, Jr. Fellow, Drexel University, 2013 – 2014.
◇ Graduated summa cum laude from the Department of Electrical and Computer Engineering, Drexel University, 2012.
◇ Boeing Company Scholarship, Fall 2012.
◇ Tau Beta Pi Scholar, Spring 2011.
◇ Harry E. Muchnic Scholarship, Spring 2011.
◇ Dean's List, Drexel University, 2007 – 2012.
◇ Eta Kappa Nu Vice President, Spring 2011 – Spring 2012.
◇ Tau Beta Pi Vice President, Fall 2010 – Fall 2011.

SELECTED PROJECTS

◇ **SynchroTrace**
– Architecture-agnostic, event-based network-on-chip simulator framework
– Synchronization and dependency-aware event traces to generate real application traffic on a network-on-chip simulator
– Static and Dynamic Thread Mapping based on application communication characterization

◇ **Master's Thesis on Variable Fractional Delay (VFD) Filters on Reconfigurable Hardware**
– Based on order-scalable and modular FIR filters
– Developed hardware and software-based Lagrange coefficient computational unit
– Tested and verified on Xilinx Virtex-6 and Spartan-6 FPGAs

◇ **Evaluation of an Accelerator Architecture for Speckle Reducing Anisotropic Diffusion (SRAD)**
– Accelerator proof of concept for SRAD medical imaging algorithm
– Compared performance of in-lab developed SRAD accelerator with a massively parallel GPU and multi-threaded CPU SRAD algorithm

◇ **Statistical Power Analysis for Estimating GPU Power Consumption via Machine Learning**
– Online statistical model-learning of power utilization of GPU functional units to estimate power utilization in real-time
– Empirical data generated by GPGPU benchmarks and GPU intensive applications

SKILLS

◇ Xilinx FPGAs (Spartan-3 & 6, Virtex-6), Cypress PSoC 1 & 3, Intel 8051
◇ C, C++, VHDL, Perl, Python, Basic Java
◇ Pthread, OpenMP, CUDA
◇ Cadence – Virtuoso Suite, PSpice
◇ ModelSim, Xilinx ISE, EDK, & System Generator, Matlab, Gem5, WireShark

- ◇ LaTeX, vi, Office Suites
- ◇ Unix, Linux, Windows, DOS

RELEVANT GRADUATE COURSEWORK

- ◇ Network-on-a-Chip (NoC), High Performance Computer Architecture, Parallel Computer Architecture, VLSI Design with FPGAs, Data Structures and Algorithms, Advanced Programming Techniques, Embedded Systems, Performance Analysis of Computer Networking, CMOS VLSI Circuit and Systems Design, Fundamentals of Systems I & II.

PUBLICATIONS

- ◇ Nilakantan, S.; Sangaiah, K.; More A.; Salvador, G.; Taskin, B.; Hempstead, M., "SynchroTrace: Synchronization-aware Architecture-agnostic Traces for Light-Weight Multi-core Simulation", to appear in *Proceedings of IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS 2015)*, 29-31 March 2015.
- ◇ Sangaiah, K. and Nagvajara, P., "Variable fractional digital delay filter on reconfigurable hardware", *Proceedings of IEEE 55th International Midwest Symposium on Circuits and Systems (MWSCAS 2012)*, 5-8 August 2012, pages 430-433.
- ◇ Nilakantan, S.; Annangi, S.; Gulati, N.; Sangaiah, K.; Hempstead, M., "Evaluation of an accelerator architecture for Speckle Reducing Anisotropic Diffusion", *Proceedings of ACM International Conference on Compilers, Architectures and Synthesis for Embedded Systems (CASES)*, 9-14 Oct. 2011, pp.185-194.

REFERENCES

- ◇ **Dr. Baris Taskin**
  Associate Professor, Department of Electrical and Computer Engineering
  Drexel University, Philadelphia, PA
  E-mail: taskin@coe.drexel.edu
- ◇ **Dr. Mark Hempstead**
  Junior Colehower Chair Assistant Professor, Department of Electrical and Computer Engineering
  Drexel University, Philadelphia, PA
  E-mail: mhempstead@coe.drexel.edu
- ◇ **Dr. Prawat Nagvajara**
  Associate Professor, Department of Electrical and Computer Engineering
  Drexel University, Philadelphia, PA
  E-mail: nagvajara@ece.drexel.edu