Josef B. Spjut

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Josef Spjut is an academic researcher interested in the areas of Computer Graphics and Computer Architecture and any related fields.

Josef is particularly interested in opportunities that will lead towards the adoption of ray tracing for real-time applications, such as video games.

Research Interests

Computer Architecture: GPUs, Application Specific Architectures, Embedded Systems.

Computer Graphics: Rendering, Real Time Ray Tracing, Global Illumination.

Education

University of Utah Ph.D. Computer Engineering 2013

Advisor: Erik Brunvand

Dissertation: Efficient Ray Tracing Architectures

University of California Riverside B.S. Computer Engineering 2006

Emphasis: Embedded Systems

Professional Experience

Harvey Mudd College Claremont, CA, USA

Visiting Professor July 2012 - Present

Taught courses in Digital Design, Parallel Computer Architecture, and Microprocessor and Embedded System Design. Advised research students in the area of computer architecture.

NVIDIA Santa Clara, CA, USA

Research Intern/Consultant June 2013 - Present

Power and performance modeling for future graphics hardware.

University of Utah Salt Lake City, UT, USA

Graduate Research Assistant June 2007 - August 2012

Developed a variety of architectures for real-time ray tracing, a cycle accurate simulator for perfor- mance studies, and a compiler back-end for the architectures.

Teaching Assistant August 2006 - May 2007

Assisted Dr. John Carter and Dr. Peter Shirley with courses in Operating Systems, Computer Graphics and Network Game Design.

University of California, Riverside Riverside, CA, USA

Undergraduate Research Assistant June 2005 - March 2006

Analyzed the performance of soft-core microprocessors on Xilinx FPGAs to develop tools for in- creased performance with reduced development effort. Advisor: Dr. Frank Vahid.

Skills

Languages : C, C++, Python, SystemVerilog, VHDL, Assembly, Javascript.

System simulators : Simics, TRaX Simulator

CAD Tools : Cadence SOC Encounter, Virtuoso, Spectre; Synopsys Design Compiler; Altera Quartus II; Microchips MPLAB; Xilinx ISE, EDK

Misc. : LLVM, OpenGL, GLSL, Unity3D, PyOpenGL, Pyglet, SDL, Google App Engine, Django, MySQL, LATEX, Git, Subversion, Mac, Linux, Windows

Refereed Publications

1. Daniel Kopta, Konstantin Shkurko, **Josef Spjut**, Erik Brunvand, and Al Davis; **An Energy and Bandwidth Efficient Ray Tracing Architecture**, *High-Performance Graphics (HPG 2013)*, Anaheim, July 10-21, 2013. paper

2. Daniel Kopta, Thiago Ize, **Josef Spjut**, Erik Brunvand, Al Davis and Andrew Kensler; **Fast, Effective BVH Updates for Animated Scenes**, *ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games (I3D 2012)*, Irvine, March 2012. paper

3. **Josef Spjut**, Daniel Kopta, Erik Brunvand and Al Davis; **A Mobile Accelerator Architecture for Ray Tracing**, *3rd Workshop on SoCs, Heterogeneous Architectures and Workloads (SHAW-3)*, New Orleans, February 2012. paper slides

4. Daniel Kopta, **Josef Spjut**, Al Davis and Erik Brunvand; **Efficient MIMD Architectures for High-Performance Ray Tracing**, *IEEE International Conference on Computer Design (ICCD 2010)*, Amsterdam, October 2010. paper

5. Seth Pugsley, **Josef Spjut**, David Nellans and Rajeev Balasubramonian; **SWEL: Hardware Cache Coherence Protocols to Map Shared Data onto Shared Caches**, *19th International Conference on Parallel Architectures and Compilation Techniques (PACT-19)*, Vienna, September 2010.

6. **Josef Spjut**, Andrew Kensler, Daniel Kopta and Erik Brunvand; **TRaX: A Multicore Architecture for Real-Time Ray Tracing**, *IEEE Transactions on Computer Aided Design of Integrated Circuits and Systems (TCAD)*, December 2009. paper

7. **Josef Spjut**, Andrew Kensler and Erik Brunvand; **Hardware-accelerated gradient noise for graphics**, *Proceedings of the 19th ACM Great Lakes Symposium on VLSI (GLSVLSI'09)*, Boston, May 10-12, 2009.

8. Niladrish Chatterjee, Seth Pugsley, **Josef Spjut** and Rajeev Balasubramonian; **Optimizing a Multi-Core Processor for Message-Passing Workloads**, *5th Workshop on Unique Chips and Systems (UCAS-5)*, Boston, April 2009.

9. **Josef Spjut**, Solomon Boulos, Daniel Kopta, Erik Brunvand and Spencer Kellis; **TRaX: A Multi-Threaded Architecture for Real-Time Ray Tracing** *Symposium on Application Specific Processors (SASP)*, Anaheim, June 8-9, 2008. **(Best paper award)** paper

Tech Reports

1. Daniel Kopta, Andrew Kensler, Thiago Ize, **Josef Spjut**, Erik Brunvand, Al Davis; **Fast, Effective BVH Updates for Dynamic Ray-Traced Scenes Using Tree Rotations** *Tech Report, UUCS 11-002*, University of Utah, July 2011. paper

Refereed Posters

1. Daniel Kopta, **Josef Spjut**, Erik Brunvand; **Grid-Based Ray Tracing for a Parallel Computing Architecture**, *High Performance Graphics (HPG'09)*, New Orleans, August 1-3, 2009.
2. Daniel Kopta, **Josef Spjut**, Erik Brunvand and Steven Parker; **Comparing Incoherent Ray Performance of TRaX vs. Manta**, *IEEE Symposium on Interactive Ray Tracing, 2008 (RT08)*, August 9-10, 2008.

Research Students Advised

- Andrew Carter, HMC CS B.S. 2013 (at LinkedIn)
- Max Korbel, HMC Engineering B.S. 2013 (at Intel)
- Paula Ning, HMC Engineering B.S. 2013 (at Intel)
- Jingbin Yang, HMC Engineering B.S. 2015 (expected)
- Dong-hyeon Park, HMC Engineering B.S. 2014 (expected)
- Eric Storm, HMC Engineering B.S. 2015 (expected)
- Paul Jolly, HMC Engineering B.S. 2016 (expected)
- Fabiha Hannan, HMC Engineering B.S. 2016 (expected)
- Akhil Bagaria, HMC Engineering B.S. 2016 (expected)

Funding and Donations

$1440 FPGA Donation from Altera. July 2013.

$2100 Microcontroller and Programmer Donation from Microchip.

May-October 2013. University Teaching Assistant Award. Fall 2010

Awards and Honors

- Tau Beta Pi member since 2005
- University Teaching Assistant Award, Utah 2010-2011
- Best Paper Award, SASP 2008
- Chancellor's Scholorship, UCR 2000-2001
- University Honors Program, UCR 2000-2004

Professional Activities

- Member, IEEE
- Member, ACM
- Reviewer, Computers and Graphics (CAG) 2012, 2013
- Reviewer, High Performance Graphics (HPG) 2012, 2011, 2009
- Reviewer, Transactions on Circuits and Systems (TCAS) 2010

Teaching

- Digital Design and Computer Architecture; HMC E85; F2012, S2013, F2013, S2014
- Microprocessor Design; HMC E155; F2012, F2013
- Advanced Parallel Computer Architecture; HMC E190O (new class); S2013

- Advanced Embedded Systems; HMC E190P (heavy revision); S2014
- Parallel Hardware Ray Tracing; Utah CS6965; F2011

As a teaching assistant:

- Kinetic Sculpture and Engineering; Utah CS5968/Art4455; F2010
- Introduction to Computer Graphics; Utah CS5600; S2007 Network GameDesign; Utah CS59XX; S2007
- Operating Systems; Utah CS5460/6460; F2006

Game Projects

PyGauntlet Open Source Game

PyGauntlet is a game project in Python from an undergraduate software engineering course where a group of 7 students developed a game over 8 weeks. After the course finished, I took over the lead of it and obtained permission to release the source code and continue development. I added an OpenGL based renderer to the engine and introduced engine optimizations to allow the game to run well even on slower processors. (Source code available at http://code.google.com/p/pygauntlet/).

72-Hour Game Development

Led a group of four contributors in developing a game from scratch using the Unity game engine. This project was meant to see what a group of relatively inexperienced developers could do in comparison to other 72-hour game development projects that more well-established game devel- opers participate in. (Executable downloads available at https://sites.google.com/site/72hourgame/download).

References

Dr. Erik Brunvand School of Computing University of Utah elb@cs.utah.edu

Dr. Al Davis School of Computing University of Utah ald@cs.utah.edu

Dr. Rajeev Balasubramonian School of Computing University of Utah rajeev@cs.utah.edu

Dr. Peter Shirley shirley@cs.utah.edu

Dr. David McAllister NVIDIA davemc@nvidia.com