NathanMitchell

Personal Information

Nathan Mitchell
B.S, M.S. Computer Science
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Contact

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Programming Languages

C++, **C**, **Python**, x86 Assembly, Bash/Zsh Scripting, Java, Cobol

Tools

Electron, LaTeX, Blender, Renderman, Adobe Illustrator, Adobe Premiere, Intel VTune

Miscellaneous Technologies

Ubuntu/Debian, RabbitMQ, Git/Mercurial Version Control, SQL, NodeJS, OpenGL

Résumé

My name is Nathan Mitchell and I am a finishing PhD student at the University of Wisconsin - Madison and a member of the UW Visual Computing Lab. My primary academic interests include physics simulation for deformable objects, software optimization for heterogeneous hardware, and rendering. I enjoy working on large software systems, particularly in the design of elegant APIs for long term maintainability.

My advisor at the University of Wisconsin is Dr. Eftychios Sifakis. Before I began my graduate program, I attended the University of Edinboro in Pennsylvania for my undergraduate degree in computer science. I have also worked with the Math and Computer Science division of Argonne National Labs, where I helped develop software for managing cluster provisioning.

Education

2013–Today	**PhD. Computer Sciences** (est. completion: May. 2017)	University of Wisconsin - Madison
2010–2013	**Masters of Computer Sciences**	University of Wisconsin - Madison
2005–2009	**Bachelors of Computer Science**	University of Edinboro

Publications

2017

In Submission

H. Liu, N. Mitchell, M. Aanjaneya, J. Lowe-Power, M. Aanjaneya, E. Sifakis **A Hierarchical Domain Decomposition Preconditioner for the Poisson Equation Optimized for Heterogeneous Platforms** in proceedings of Supercomputing, 2017

2016

Presented at SIGGRAPH Asia 2016

H. Liu, N. Mitchell, M. Aanjaneya, E. Sifakis **A scalable Schur-complement fluids solver for heterogeneous compute platforms** in proceedings of ACM SIGGRAPH Asia, 2016

N. Mitchell, C. Cutting, T. King, A. Oliker, E. Sifakis **A Real-Time Local Flaps Surgical Simulator Based on Advances in Computational Algorithms for Finite Element Models** Plastic & Reconstructive Surgery. 137(2):445e-452e, February 2016., 2016

Presented at SCA 2016

N. Mitchell, M. Doescher, E. Sifakis **A Macroblock Optimization for Grid-Based Nonlinear Elasticity** Eurographics/ACM SIGGRAPH Symposium on Computer Animation, 2016

2015

Presented at SIGGRAPH 2015

N. Mitchell, C. Cutting, E. Sifakis **GRIDiron: An Interactive Authoring and Cognitive Training Foundation for Reconstructive Plastic Surgery Procedures** in proceedings of ACM SIGGRAPH, 2015

Presented at SIGGRAPH Asia 2015

N. Mitchell, M. Aanjaneya, R. Setaluri, E. Sifakis **Non-manifold Level Sets: A multi-valued implicit surface representation with applications to self-collision processing** in proceedings of ACM SIGGRAPH Asia, 2015

2014

Presented at SCA 2014

R. Setaluri, Y. Wang, N. Mitchell, L. Kavan, E. Sifakis **Fast Grid-Based Nonlinear Elasticity for 2D Deformations** Eurographics/ACM SIGGRAPH Symposium on Computer Animation, 2014

Presented at SCA 2014

M. Gao, N. Mitchell, E. Sifakis **Steklov-Poincaré Skinning** Eurographics/ACM SIGGRAPH Symposium on Computer Animation, 2014

2012 Presented at SIGGRAPH Asia 2012

T. Patterson, N. Mitchell, E. Sifakis **Simulation of Complex Nonlinear Elastic Bodies using Lattice Deformers** in proceedings of ACM SIGGRAPH Asia, 2012

Experience

2012–Today **University of Wisconsin - Madison** Madison, Wisconsin - USA
Research Assistant
For the past several years, I have been the lead developer on a virtual surgery project, which aims to provide a virtual authoring and practice tool for plastic surgeons.

2008-2010 **Argonne National Laboratory** Lemont, Illinois - USA
Intern
I spent three summers developing management software for the Mathematics and Computer Science Group at Argonne National Laboratory. The first software package was a web form deployment system to assist the help desk support staff. The second project, named **Heckle**, was a cluster hardware provisioning system designed to provide on-demand operating system installations tailored to user requirements.

2005-2006 **Intel** Hillsboro, Oregon - USA
Intern - Technician
For two summers I worked in the Intel's Hillsboro fabrication plant as a manufacturing technician for their 200mm production line. The experience provided me first hand insight into modern integrated circuit manufacturing processes.

Research Interests

Simulation I am very interested in pursuing further work regarding the pairing of bio-medical topics and real-time simulation, particularly in the areas of deformable solids and plastic surgery. I consider my work at Wisconsin to be a solid first step, but with a large potential for future work.

Parallel Computing While there have been many different approaches taken over the years to make parallel computing easier for programmers to make use of, my experience has shown that there are still many hurdles to overcome, especially in the areas of hardware vectorization and optimal use of memory bandwidth on highly parallel heterogeneous systems. I remain interested in pursing new frameworks and design patterns for improving a programmer's quality of life when dealing with these problems.

Framework Design Designing and building system frameworks, while not typically considered glamorous from a academic research perspective, is something that I feel is critical to designing useful software. I have spent a great deal of effort during my prior projects to build maintainable and reusable components, which have paid dividends in later research efforts.

Rendering My experience here is mostly due to the needs of presenting the results of high resolution simulations through publications. However, the challenges in this area have caught my attention and I have a continued interest in how highly complex simulated scenes can still be rendered efficiently.

Game Design I have a fascination with game mechanics and how interesting design choices make for engaging entertainment for players. While recently my medium has been boardgames, I believe many aspects of good game design are shared between the physical and electronic realms.

Projects

Plastic Surgery Simulation For the past five years, I have been developing a simulation system for performing plastic surgery operations virtually in a collaborative environment. Over the course of the project, I developed a new SIMD abstraction library for efficiently optimizing finite element numerical kernels, a novel strategy for storing level set geometry in non-manifold topology, and explored approaches for remote simulation, including using modern web technolo-

gies as front-end clients. My efforts, beyond the production of the software artifacts, resulted in five publications, local news coverage, and a currently active exploration of commercialization opportunities.

Heckle During the spring and summer of 2010, I was the lead developer for a cluster provisioning system named Heckle for Argonne National Laboratories. Heckle was designed to manage a collection of potentially heterogeneous compute nodes. The problem being addressed was that researchers often needed custom hardware (specific CPU, memory capacity, accelerator cards) for their projects, but didn't need it long enough to warrant a dedicated machine. Heckle provided users with a single point of access to request nodes matching specific requirements and dynamically provision the nodes with custom operating system images. By interacting with out-of-band management services, Heckle could remotely power cycle nodes and initiate re-installations without administrator intervention.

References

PhD. Advisor — **Eftychios Sifakis, PhD** — Madison, WI - USA
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