

Faith Ekstrand

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Education

- 2010–2015 **Doctor of Philosophy, Mathematics**, *Iowa State University*, Ames, IA, GPA: 3.98/4.0.
Dissertation: *Positivity in Function Algebras*
Honors: Brown Fellowship, Graduate Teaching Award, Wolfe Research Fellowship
- 2006–2010 **Bachelor of Science, Computer Engineering and Mathematics**, *Iowa State University*, Ames, IA, GPA: 3.92/4.0.
Honors: Summa Cum Laude, Phi Beta Kappa, Phi Kappa Phi, Mathematics Scholarship

Teaching Experience

- 2010 – 2014 **Undergraduate Classroom Education**, *ISU Math Department*, Ames, IA.
 - Recitation TA for Math 165, Calculus I, Fall 2013
 - Stand-alone Course instructor for Math 265, Multivariate Calculus, Spring 2012
 - Recitation TA for Math 265, Multivariate Calculus, Fall 2011
 - Grader for Math 265, Differential Equations, Spring 2011
 - Grader for Math 104, Introduction to Probability and Matrices, Spring 2011
 - Recitation TA for Math 140, College Algebra, Fall 2010
- Summer 2013 **Graduate Student Programming Course**, *ISU Math Department*, Ames, IA.
Designed from scratch and taught a course in computer programming for graduate mathematics students. The course assumed no prior programming experience and covered many topics including: C language, basic UNIX command line, pointers and memory management, the compiling/linking process, object oriented programming principles, data structures, and algorithm analysis.
- 2012 – 2013 **Math Help Room Coordinator**, *ISU Math Department*, Ames, IA.
Organized a team of 40+ graduate and undergraduate students to provide 40 hr/week walk-in help for undergraduate math classes. Supported classes included: Algebra, Calculus (introductory through multivariate), Differential Equations, and Linear Algebra.
- Summer 2011 **Graduate Student Mentor for Summer REU**, *ISU Math Department*, Ames, IA.
Helped lead a group of three undergraduate students in their research of the space $\mathcal{M}_n(C[a, b])$ of matrices of continuous functions on an interval. Edited and helped to submit the final paper [4].

Publications

- [1] J. Ekstrand, *Positive Elements in Function Algebras*, Complex Analysis and Operator Theory, DOI 10.1007/s11785-014-0423-x.
- [2] S. Butler, J. Ekstrand, and S. Osborne, *Tiling Tetris Boards*, in preparation.
- [3] J. Ekstrand, C. Erickson, H. T. Hall, D. Hay, L. Hogben, R. Johnson, N. Kingsley, S. Osborne, T. Peters, J. Roat, A. Ross, D. D. Row, N. Warnberg, and M. Young, *Positive semidefinite zero forcing*, Linear Algebra Appl. **439** (2013), no. 7, 1862–1874, DOI 10.1016/j.laa.2013.05.020. MR3090441
- [4] J. Cyr, J. Ekstrand, N. Meyers, C. Peoples, and J. Peters, *Diagonalizing Hermitian matrices of continuous functions*, Int. J. Contemp. Math. Sci. **8** (2013), no. 5-8, 227–234. MR3040827
- [5] J. Ekstrand, C. Erickson, D. Hay, L. Hogben, and J. Roat, *Note on positive semidefinite maximum nullity and positive semidefinite zero forcing number of partial 2-trees*, Electron. J. Linear Algebra **23** (2012), 79–87. MR2889573

Experience

Vocational

2014–present **Graphics Software Engineer**, *Intel Corporation*, Hillsboro, OR.

- Led Intel's Linux Vulkan driver development efforts since the release of the Vulkan 1.0 API
 - Co-designed and co-developed the initial Intel Linux Vulkan driver with two other Intel engineers
 - Represent Intel in the Khronos Vulkan and SPIR-V working groups
 - Developed extensions which enhance the Linux graphics ecosystem, improve the Vulkan API, and boost the performance of Vulkan applications on Intel hardware
 - Worked with game vendors to debug issues and get their games working well on our Vulkan driver.
 - Oversaw and organized development efforts of all new Vulkan features within the Intel Linux Vulkan driver
 - Personally implemented about half of the new features in Vulkan versions 1.1 and 1.2
 - Implemented ray-tracing support in the Intel Linux shader compiler and Vulkan driver
- Co-developed and now maintain NIR, the optimizing compiler core in Mesa.
 - Took NIR from data structures and a few very basic passes to a full SSA-based optimizing compiler
 - Implemented dozens of optimization and lowering passes
 - Designed and implemented the SPIR-V front-end for NIR
 - Worked with engineers at Red Hat, Collabora, and Microsoft to bring OpenCL-style kernel support to NIR
 - Implemented ray-tracing support in NIR, including shader splitting and resume shader handling
- Participated in the development of the Vulkan and SPIR-V specifications within Khronos
- Maintained and extended our surface memory layout calculation library to handle additional tiling formats and compression features available on Intel hardware
- Rewrote, modernized, and generalized the Intel blit and resolve framework for use with both GL and Vulkan
- Rewrote all of the color format conversion code in Mesa to be more accurate and efficient

2010–2014 **Teaching Assistant**, *Iowa State University*, Ames, IA.

- Taught both recitation and stand-alone sections of Algebra and Calculus
- Mentored three undergraduate students as part of a summer REU
- Coordinated the mathematics help room
- Designed and taught a computer programming course for graduate students

Summer 2010 **Engineering Intern**, *METECS*, Houston, TX.

- Designed and implemented a demonstration of the mREST automated testing framework operating simultaneously with software, hardware, and a simulated physical environment.

2008–2010 **Undergraduate Research Assistant**, *Scalable Computing Laboratory*, Ames Laboratory, Ames, IA.

- Wrote GamessQ, a job queuing program for better management of local GAMESS simulations.
- Rewrote Goanna, an InfiniBand network monitoring tool, to use the Qt toolkit for better maintainability and cross-platform usability.

Open-Source Software

2013–present **Volunteer Software Developer**, *Wayland Project*.

Helped with code review of both protocols and implementations, participated in online discussions, answered other developers' questions about the Wayland protocol, and made several additions to libwayland and weston.

- Prepared the server-side libwayland API for ABI stability
- Wrote bindings for using libwayland with the Java programming language
- Rewrote Weston's nested Wayland backend for full feature parity with its nested X11 backend
- Reworked the Weston scenegraph and core rendering code to support displaying a single client surface in multiple on-screen locations simultaneously
- Currently developing a protocol for use in screen sharing and other input/output abstractions

Presentations

- "Ray-tracing in Vulkan: A brief overview of the provisional VK_KHR_ray_tracing API", X Developers Conference, Virtual, October 17, 2020
- "How to not write a back-end compiler" X Developers Conference, Montréal CA, October 2, 2019
- "What can Vulkan do for You?" Embedded Linux Conference, Portland, OR USA, February 22, 2017
- "The Anatomy of a Vulkan Driver", X Developers Conference, Helsinki, Finland, September 22, 2016
- "Vulkan in Open-Source," FOSDEM, Brussels, Belgium, February 30, 2016.
- "Wayland Full-Screen Shells" X Developers Conference, Bordeaux, France, October 9, 2014.
- "Continuous Diagonalization;" Combinatorics, Algebra, and Number Theory Seminar; ISU Math Department; November 28, 2011.
- "Positive Semidefinite Maximum Nullity and Positive Semidefinite Zero Forcing Number of Multigraphs with Tree-width at most 2," SACNAS National Conference, San José, California, October 27, 2011.

Societal affiliations

- American Mathematical Society (AMS), Student Member
- Society of Industrial and Applied Mathematics (SIAM), Student Member
- Iowa State University student chapter of SIAM, 2013–present
- Phi Beta Kappa, Zeta Chapter of Iowa, 2010
- Phi Kappa Phi, 2009.

Honors, Awards, and Fellowships

- Iowa State University Department of Mathematics Wolfe Research Fellowship, 2013
- Iowa State University Graduate Teaching Award, 2013
- Iowa State University Brown Fellowship, 2011
- Mathematics Scholarship, 2010
- Dean's List, Iowa State University, 2006–2010.

Other Coursework and Experience

- Understanding of digital fringe projection techniques for optical 3-D profilometry through assisting with research efforts in Dr. Song Zhang's 3-D Machine Vision Laboratory
- Took a course on the theory and applications of NURBS curves and surfaces from Dr. James Oliver
- Courses on probability theory from the ISU Statistics Department

Computer Skills

- Languages (in order of fluency): C, C++, Python, Java, GLSL, JavaScript, Ruby, UNIX Shell, Perl
- Graphics libraries: OpenGL 1–3, OpenGL ES 1 & 2, Pixman, Cairo
- Toolkits: Qt 4 & 5, Android, GTK+ (Python), wxWidgets
- Parallel programming: pthreads, C++ 2011 threads, OpenGL shaders, TBB, MPI
- Markup & documentation: $\text{\LaTeX}$, Doxygen/JavaDoc, HTML & CSS
- Operating Systems: Linux, Windows (7 & XP), MacOS