

Department of Mathematics
The University of Arizona
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Education

- PhD in Mathematics with minor in Statistics May 2010
University of Arizona, Tucson, Arizona (expected)
Co-advisors: Tom Kennedy, Daniel Ueltschi
- M.A. in Mathematics May 2005
Arizona State University, Tempe, Arizona
Advisor: John Jones
- B.S. in Mathematics and Physics May 1993
University of Arizona, Tucson, Arizona

Employment history

- University of Arizona Department of Mathematics, Tucson, Arizona.
 - Graduate research assistant* Jan. 2009 – Dec. 2009
 - Graduate teaching assistant* Aug. 2008 – Dec. 2008
 - Graduate research assistant* Jan. 2008 – May 2008
 - Graduate computing assistant* Aug. 2007 – Dec. 2007
 - Graduate teaching assistant* Aug. 2005 – May 2007
- Lockheed Martin Integrated Systems and Solutions, Goodyear, Arizona.
 - Senior embedded software engineer* (over academic breaks) Aug. 2004 – Aug. 2007
Simulation and verification of FPGA-accelerated digital signal processing solutions. Design, implementation, documentation, regression testing, and performance analysis of custom logic for vector arithmetic, matrix multiplication, matrix inversion, FFTs, and Householder transformations.
- Avnet Design Services, Phoenix, Arizona.
 - Applications engineer* Oct. 2000 – Jul. 2004
Embedded systems programming (PowerPC, ARM, Xilinx FPGAs), circuit-board verification, device drivers, operating-system ports (Linux, uClinux, uCOS, VxWorks), implementation of networking protocols (TCP/IP, ARP, ICMP, UDP, HTTP, BOOTP).
- Lockheed Martin Reconnaissance Systems, Goodyear, Arizona.
 - Software engineer* Apr. 1998 – Oct. 2000
Implementation and testing of ASIC-accelerated digital signal processing algorithms in a supercomputing environment, with focus on FFTs and digital differential analyzers.
- Motorola Emtex Healthcare Division / Eclipsys, Phoenix, Arizona
 - Software engineer* Apr. 1996 – Apr. 1998

Support engineer

Jun. 1994 – Apr. 1996

Maintenance of database and transaction-processing subsystems of a distributed medical information system.

Research

- Dissertation: *Critical behavior for the model of random spatial permutations.*
VIGRE fellow (NSF-supported research) Summer 2009, fall 2009, spring 2010
Research assistant (NSF-supported research) Spring 2008, Spring 2009
Co-advisors : Daniel Ueltschi, Tom Kennedy.

I utilize methods including Markov chain Monte Carlo, high-performance computing, statistics, and finite-size scaling to determine the critical temperature of phase transitions for a simplified model of the Bose gas. For more information, please see the research statement on my home page: <http://math.arizona.edu/~kerl>.

- Self-avoiding walks and bridges Fall 2009
As a member of Tom Kennedy's vertically integrated research group, I worked with a small group of graduates and undergraduates to quantify the stability of distributions of bridge heights. In particular, I mentored an undergraduate on a project for simulating self-avoiding walks.
- Independent study under Janek Wehr on quantum networks. Spring 2008
Lattice quadrupling for percolation in quantum networks: Hybrid analytical/numerical methods for quantum-teleportation probabilities on 2D and 3D lattices.
- Research tutorial group/paper Fall 2006
The Discrete Berezin Integral
- Master's thesis May 2005
Codes and curves: An exposition of algebraic-geometry codes over finite fields, including Goppa codes and the Skorobogatov-Vladut decoding algorithm.

Teaching

In the University of Arizona Department of Mathematics, graduate students have full responsibility for courses: lesson planning, homework assignment and grading, writing of quizzes and exams, recordkeeping, and office hours.

In all courses, I have used TI-83 graphing calculators for visualization and counterpart to symbolic manipulation, highlighting the uses (and misuses) of technology. As well, I have used the Desire To Learn (D2L) web system for communication of grades with students. In fall 2008 I mixed the WebAssign on-line homework with handwritten homework: my experience with this is described in my teaching statement.

- *Calculus I with applications* Fall 2008, Spring 2007
Concepts of derivative and integral, techniques of derivative and integral. Reform methods using the text of Hughes-Hallett et al.

- *Abstract Algebra super-TA* Fall 2006 – Spring 2007
Led weekly problem sessions for first-year graduate students in the abstract algebra core course, taught by David Savitt.
- *Trigonometry* Fall 2006
Triangles, trig functions and identities, graphs, inverse functions.
- *College algebra* Spring 2006, Fall 2005
Function, domain, range; linear, polynomial, and rational functions; logarithmic and exponential functions; sequences and series.

Service

- *Seminar co-organizer* Fall 2009 – Spring 2010
Co-organized (with Tom Kennedy) the mathematical physics research seminar.
- *Graduate student representative* Fall 2008 – Spring 2009
Represented graduate-student concerns to the department's graduate committee. Organized a weekly tea and weekly graduate-student lunches with the departmental colloquium speaker.
- *Graduate Colloquium coordinator* Fall 2008 – Spring 2009
Coordinated the weekly graduate-student seminar series: acquired speakers, handled refreshments, publicized the talks, and maintained the series web site.
- *Software Interest Group coordinator* Fall 2007 – Spring 2008
Acquired speakers, publicized the talks, and maintained the series web site.
- *Teaching-assistant training instructor* Aug. 2006, Aug. 2007
Co-led (2006) and led (2007) workshops on grading. Took part in panel discussions.

Professional memberships

- American Mathematical Society
- Mathematical Association of America
- Institute for Mathematical Statistics

Conferences

- Stochastic Processes and Their Applications, Berlin, Germany Jul. 2009
Contributed talk: *Numerical methods for random spatial permutations.*
- Workshop on quantum spin systems and applications Jun. 2009
in quantum computation, Tucson, Arizona
Contributed talk: *Lattice quadrupling for percolation in quantum networks.*
- Entropy and the Quantum, Tucson, Arizona Mar. 2009

- AMS/MAA Joint Meetings, Washington, D.C. Jan. 2009
- Current Topics in Mathematical Physics summer school, Jul. 2008
Erwin Schrödinger Institute
- AMS/MAA Joint Meetings, San Diego Jan. 2008
- AMS/MAA Joint Meetings, Phoenix Jan. 2004

Talks

Abstract and slides are available at my website, <http://math.arizona.edu/~kerl>.

<u>Title</u>	<u>Series/conference</u>	<u>Date</u>
<i>Critical behavior for the model of random spatial permutations</i>	UA Math. Phys. Seminar	Sep. 2009
<i>Markov Jabberwocky: fesh, excenture, and the like</i>	UA Grad. Colloquium	Aug. 2009
<i>Numerical methods for random spatial permutations</i>	Stochastic processes and their applications (Berlin)	Jul. 2009
<i>Lattice quadrupling for percolation in quantum networks</i>	Workshop on quantum spin systems and applications in quantum computation (Tucson)	Jun. 2009
<i>Remarks on interacting spatial permutations and the Bose gas</i>	Comprehensive examination	Jan. 2009
<i>Computational methods in percolation</i>	UA Grad. Colloquium	Oct. 2008
<i>High-performance arithmetic</i>	UA Applied Brown Bag	Oct. 2008
<i>Lattice quadrupling for percolation in quantum networks</i>	UA Math. Phys. Seminar	Oct. 2008
<i>C for math folks</i>	UA Software Interest Group	Apr. 2008
<i>Monte Carlo methods for interacting spatial permutations</i>	UA Math. Phys. Seminar	Apr. 2008
<i>Quantum mechanics for math grads</i>	UA Grad. Colloquium	Mar. 2008
<i>The Metropolis-Hastings algorithm by example</i>	UA Grad. Probability Seminar	Feb. 2008
<i>Numerical Differential Geometry in Matlab</i>	UA Grad. Colloquium	Jan. 2008
<i>Is 2 a random number?</i>	UA Grad. Colloquium	Sep. 2007
<i>The Householder transformation, Swiss Army knife of numerical linear algebra</i>	UA Grad. Colloquium	Feb. 2007
<i>Perl for the working (or aspiring) mathematician</i>	UA Software Interest Group	Oct. 2006
<i>Tensorama</i>	UA Grad. Colloquium	Sep. 2006
<i>Concrete abstract algebra in Python</i>	UA Software Interest Group	Apr. 2006
<i>A walking tour through projective spaces</i>	UA Grad. Colloquium	Mar. 2006
<i>Computation in finite fields</i>	UA Grad. Colloquium	Jan. 2006

<i>Introduction to the vim text editor</i>	UA Software Interest Group	Sep. 2005
<i>Linear feedback shift registers</i>	UA Grad. Colloquium	Sep. 2005
<i>Codes and Curves</i>	Master's thesis defense	Apr. 2005
<i>High-performance arithmetic</i>	ASU/Lockheed Martin Seminar Series	Oct. 2004
<i>An introduction to coding theory for mathematics students</i>	ASU Grad. Seminar	Sep. 2004
<i>Linear feedback shift registers</i>	ASU Grad. Seminar	Apr. 2004
<i>A reference design for FPGA-based Linux applications</i>	DesignCon	Feb. 2004
<i>A reference design for embedded ucLinux on a Motorola ColdFire processor</i>	DesignCon	Feb. 2004
<i>Computation in finite fields</i>	ASU Grad. Seminar	Dec. 2003

Computing skills

Languages, platforms, and algorithms:

- Languages including C, C++, Python, Matlab, Perl, Bourne and C shells, Unix toolkit (`sed`, `awk`, etc.), PowerPC assembler, ARM assembler, Sparc assembler, Java, HTML.
- Linux, Windows, Solaris, AIX, and IRIX platforms; POSIX threads.
- Intimate knowledge of computer arithmetic (IEEE floating point, fixed point, digital differential analyzers, fast Fourier transforms).
- Custom implementations of software for Markov chain Monte Carlo methods, stochastic processes, statistics, abstract algebra, finite fields, real tensor algebras, numerical linear algebra, and numerical integration/differentiation.

Software management:

- Development tools including `gcc/make`, MetroWerks CodeWarrior and Green Hills.
- Configuration management tools including Clearcase, Razor and SCCS.
- Symbolic debuggers including `dbx` and `gdb`.
- Performance-analysis tools including Quantify, SpeedShop and `gprof`.

Systems programming:

- Intimate knowledge of ARP, IP, ICMP, UDP, TFTP, TCP, and HTTP protocols.
- OS interface including system calls, signals and sockets.

Hardware interface:

- Tektronix oscilloscopes and logic analyzers.
- Reading proficiency in Verilog.
- Extensive experience collaborating with electrical engineers for design and test of hardware implementation of algorithms.