

Curriculum Vitae of Christine A. Kelley

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Research Interests: Applied discrete mathematics, codes on graphs, iterative and list-decoding algorithms.

Education:

May 2006: Ph.D. in Mathematics, University of Notre Dame, Indiana.
Thesis: *Pseudocodewords, Expander Graphs, and the Algebraic Construction of Low-Density Parity-Check Codes*
Thesis advisor: Professor Joachim Rosenthal.

May 2003: M.S. in Mathematics, University of Notre Dame, Indiana.

June 2001: Certificate of Advanced Study in Mathematics, with Merit.
Part III of the Mathematical Tripos
Cambridge University, England.

May 1999: B.S. in Mathematics, University of Puget Sound, Washington.

Fall 1998: Budapest Semesters in Mathematics program, Budapest, Hungary.

Positions Held:

08/07- Assistant Professor, Department of Mathematics, University of Nebraska-Lincoln.
01/07 - 06/08 VIGRE Arnold Ross Assistant Professor, Department of Mathematics, The Ohio State University, Columbus, Ohio. (On leave from UNL)
07/06 - 12/06 Postdoctoral Fellow, The Fields Institute for Research in the Mathematical Sciences, Toronto, Ontario.
08/05 - 05/06 Teaching and Research Assistant, Department of Mathematics, University of Notre Dame, Indiana.
08/04 - 08/05 Teaching and Research Assistant, Institute of Mathematics, University of Zürich, Switzerland.
08/04 - 07/05 Zürich Graduate Colloquium in Mathematics Co-organizer, University of Zürich and Swiss Federal Institute of Technology (ETH), Zürich, Switzerland.
08/03 - 07/04 Graduate Fellow, Center for Applied Mathematics, University of Notre Dame, Indiana.
08/01 - 07/04 Teaching and Research Assistant, Department of Mathematics, University of Notre Dame, Indiana.
08/99 - 08/00 Research Assistant, Los Alamos National Laboratory, New Mexico.

Publications: (The following publications are all refereed, with the exception of [1],[5], and [14] which were invited)

- [1] C. A. Kelley, On codes designed via algebraic lifts of graphs, Proceedings of the 46th Annual Allerton Conference on Communication, Control, and Computing, 8 pages (electronic), Monticello, IL, September 2008.
- [2] C. Kelley, J.L. Walker. LDPC codes from voltage graphs. Proceedings of International Symposium on Information Theory, 6 pages (electronic), Toronto, Canada, July 2008.
- [3] C. Kelley, D. Sridhara, J. Rosenthal. Zig-zag and replacement product graphs and LDPC codes. To appear in *Advances in Mathematics of Communications*, 26 pages, November 2008.
- [4] C. Kelley, D. Sridhara. Pseudocodewords of Tanner Graphs. *IEEE Transactions on Information Theory*, vol. 53, no. 11, pp. 4013-1038, November 2007.
- [5] J. Rosenthal, C. Kelley, D. Sridhara. Systems theoretic questions in coding theory. Proceedings in Applied Mathematics and Mechanics, ICIAM, 3 pages (electronic), Zürich, Switzerland, October 2007.
- [6] C. Kelley, D. Sridhara. Eigenvalue bounds on the pseudocodeword weights of expander codes. *Advances in Mathematics of Communications*, vol. 1, no. 3, pp. 287-306, August 2007.
- [7] C. Kelley, D. Sridhara. On the pseudocodeword weight and parity-check matrix redundancy of linear codes. Proceedings of Information Theory Workshop, 6 pages (electronic), Lake Tahoe, California, September 2007.
- [8] C. Kelley, D. Sridhara, J. Rosenthal. Tree-based construction of LDPC codes having good pseudocodeword weights. *IEEE Transactions on Information Theory*, vol. 53, no. 4, pp. 1460-1478, April 2007.
- [9] C. Kelley, D. Sridhara. Pseudocodeword weights of non-binary LDPC codes. Proceedings of IEEE International Symposium on Information Theory, 6 pages (electronic), Seattle, Washington, July 2006.
- [10] D. Sridhara, C. Kelley. LDPC coding for the three-terminal erasure relay channel. Proceedings of IEEE International Symposium on Information Theory, 6 pages (electronic), Seattle, Washington, July 2006.
- [11] D. Sridhara, C. Kelley, J. Rosenthal. Tree-based construction of LDPC codes. Proceedings of IEEE International Symposium on Information Theory, Adelaide, Australia, September 2005.
- [12] C. Kelley, D. Sridhara. Structure of pseudocodewords in Tanner graphs. Proceedings of International Symposium on Information Theory and Applications, Italy, October 2004.
- [13] C. Kelley, D. Sridhara, J. Xu, J. Rosenthal. Pseudocodeword weights and stopping sets. Proceedings of IEEE International Symposium on Information Theory, p.150, Chicago, June 2004.
- [14] C. Kelley, J. Rosenthal, D. Sridhara. Some new algebraic constructions of codes from graphs which are good expanders. Proceedings of Allerton Conference on Communication, Control, and Computing, pp.1280-1289, Monticello, IL, October 2003.
- [15] E. Byrne, C. Kelley, C. Monico, J. Rosenthal. Non-linear codes for belief propagation. Proceedings of IEEE International Symposium on Information Theory, p.43, Japan, June 2003.
- [16] D. Pickard, L. Lovatt, M. Novelli, P. Ripley, C. Kelley, I. Bigio, S. Brown. Diagnosis of dysplasia in Barrett's oesophagus with in-situ elastic-scattering spectroscopy. *Optical Biopsy and Tissue Optics*, SPIE vol. 4161, November 2000.
- [17] P. Ripley, I. Rose, C. Kelley, I. Bigio, D. Pickard, G. Briggs, L. Lovatt, S. Brown. A comparison of artificial intelligence techniques for spectral classification in the diagnosis of human pathologies based upon optical biopsy. Optical Society of America Biomedical Topical Meeting, Miami, FL, April 2000.

- [18] I. Bigio, S. Brown, G. Briggs, C. Kelley, S. Lakhani, D. Pickard, P. Ripley, I. Rose, C. Saunders. Diagnosis of breast cancer using elastic-scattering spectroscopy: preliminary clinical results. *Journal of Biomedical Optics*, Opt.5 Vol.5, April 2000.

Invited Talks:

- Special session on Recent Trends in Coding Theory, TBA, AMS Joint Meetings, Washington, D.C., January 2009.
- Special session on Codes over Rings, AMS sectional meeting, “Recent results on codes designed from permutations”, Kalamazoo, MI, October 2008.
- Mini-conference on Discrete Mathematics, Clemson University, “On codes designed via algebraic lifts of graphs”, Clemson, SC, October 2008.
- Special session on Emerging Applications of Coding Theory, Allerton Conference on Communication, Control, and Computing, “On codes designed via algebraic lifts of graphs”, Illinois, September 2008.
- University of Zürich, Applied Algebra Seminar, “A voltage graph framework for LDPC codes”, Zürich, Switzerland, May 2008.
- Ohio University, Department of Mathematics Colloquium, “A voltage graph framework for LDPC codes”, Athens, OH, April 2008.
- University of Kentucky, Algebra and Geometry Seminar, “An introduction to Low-Density Parity-Check codes”, Lexington, KY, April 2008.
- AMS Special Session on Algebraic Coding Theory, “Pseudocodeword weights and the parity-check matrix redundancy of linear codes”, Bloomington, IN, April 2008.
- Mathematisches Forschungsinstitut Oberwolfach, “A voltage assignment approach to the analysis of LDPC codes”, Coding Theory Workshop, Germany, December 2007.
- University of Puget Sound, Science Colloquium, “Codes on graphs and the quest for good codes”, Tacoma, WA, February 2007.
- University of Nebraska - Lincoln, Mathematics Department Colloquium, “Pseudocodeword-based iterative decoding analysis of LDPC codes”, January 2007.
- AMS Joint Mathematics Meetings, “Pseudocodeword weights of codes from expander graphs”, AMS Special Session on Coding Theory and Its Applications, New Orleans, January 2007.
- Workshop on Coding and Systems, “Pseudocodeword weights of expander codes”, Zürich, Switzerland, December 2006.
- University of Zürich, Applied Algebra Seminar, “Pseudocodeword weights of non-binary LDPC codes”, December 2006.
- Occidental College, Mathematics Department Colloquium, “Codes on Graphs”, March 2006.
- University of Texas at Dallas, Mathematics Department Colloquium, “Pseudocodewords and Iterative Decoding of LDPC Codes”, February 2006.
- East Tennessee State University, Mathematics Department Colloquium, “Pseudocodewords and Iterative Decoding of LDPC Codes”, February 2006.
- Virginia Commonwealth University, Mathematics Department Colloquium, “Pseudocodewords and Iterative Decoding of LDPC Codes”, February 2006.
- University of North Florida, Mathematics Department Colloquium, “Pseudocodewords and Iterative Decoding of LDPC Codes”, February 2006.
- University of Dayton, Mathematics Department Colloquium, “Pseudocodewords and Iterative Decoding of LDPC Codes”, February 2006.
- Beloit College, Mathematics Department Colloquium, “Codes on Graphs and Iterative Decoding”, February 2006.
- Buffalo State College, Mathematics Department Colloquium, “Pseudocodewords and Iterative Decoding of LDPC Codes”, February 2006.
- Acadia University, Nova Scotia, Mathematics Department Colloquium, “Pseudocodewords and Iterative Decoding of LDPC Codes”, January 2006.
- North Dakota State University, Mathematics Department Colloquium, “Pseudocodewords and Iterative Decoding of LDPC Codes”, January 2006.

- University of Wyoming, Mathematics Department Colloquium, “A Survey of Coding Theory”, November 2005.
- University of Wyoming, Algebra/Combinatorics/Number Theory Seminar, “Construction of LDPC codes having good pseudocodeword weights”, October 2005.
- University of Notre Dame, Center for Applied Mathematics Colloquium, “Construction of LDPC codes with relatively few low-weight pseudocodewords”, September 2005.
- San Diego State University, Math/Communications Colloquium, “Pseudocodewords and Iterative Decoding on Tanner Graphs”, May 2004.

Contributed Talks and Presentations:

- University of Nebraska-Lincoln, Discrete Math Seminar, “0/1 polytopes and the Hirsch conjecture”, September 2008.
- IEEE International Symposium on Information Theory, “A voltage graph framework for LDPC codes”, Toronto, Canada, July 2008.
- IEEE Information Theory Workshop, “On the pseudocodeword weight and parity-check matrix redundancy of linear codes.”, Lake Tahoe, CA, September 2007.
- IEEE International Symposium on Information Theory, “Pseudocodeword weights of non-binary LDPC codes”, Seattle, Washington, July 2006.
- University of Notre Dame, Expander Graphs Seminar, “LPS Construction of Expander Graphs”, May 2006.
- Swiss Federal Institute of Technology (ETH), Advanced Topics in Discrete Mathematics Seminar, “0/1 Polytopes and the Hirsch Conjecture”, Zürich, Switzerland, November 2004.
- International Symposium on Information Theory and Applications, “Structure of Pseudocodewords in Tanner Graphs”, Parma, Italy, October 2004.
- IEEE International Symposium on Information Theory, “Pseudocodeword Weights and Stopping Sets”, Chicago, June
- University of Notre Dame, Expander Graphs Seminar, “The Zig-Zag Graph Product and Expander Families”, April 2004.
- University of Notre Dame, Center for Applied Mathematics Graduate Student Research Workshop, “Algebraic Constructions of LDPC Codes”, March 2003.
- University of Notre Dame, Graduate Student Seminar, “Algebraic Constructions of LDPC Codes”, March 2003.
- Los Alamos National Laboratory, Bioscience and Biotechnology Division, “Computational Analysis of Tissue Optical Scattering Spectra”, December 1999.

Other Notable Conferences Attended:

- Workshop on the Mathematics of DNA, its structure and interactions, Institute for Mathematics and its Applications, September 2007.
- Tutorial on the Mathematics of Nucleic Acids, Institute for Mathematics and its Applications, September 2007.
- Midwestern Graph Theory Conference (MIGHTY), Wright State University, Dayton, Ohio, May 2007.
- Workshop on Complexity, Coding and Communications, Institute for Mathematics and its Applications, April 2007.
- Cryptography: Underlying Mathematics, Provability and Foundations, The Fields Institute, Toronto, November 2006.
- Computational Challenges Arising in Algorithmic Number Theory and Cryptography, The Fields Institute, Toronto, October 2006.
- Quantum Cryptography and Computing Workshop, The Fields Institute, Toronto, October 2006.
- The 10th Workshop on Elliptic Curve Cryptography (ECC 2006), The Fields Institute, Toronto, September 2006.

- AMS Midwest Sectional Meeting, Notre Dame, Indiana, April 2006.
- AMS/MAA Joint Mathematics Meetings, San Antonio, Texas, January 2006.
- Allerton Conference on Communication, Control, and Computing, Illinois, September 2005.
- Coding Theory and Quantum Computation, University of Virginia, Charlottesville, May 2003.
- Allerton Conference on Communication, Control, and Computing, Monticello, Illinois, October 2002.
- IEEE International Symposium Information Theory, Lausanne, Switzerland, July 2002.

Teaching Experience:

- Courses taught at the University of Nebraska-Lincoln
Contemporary Mathematics, Math 203; Fall 2008
Information Theory, reading course proctor; Fall 2008
- Courses taught at The Ohio State University
Combinatorics and Graph Theory, Math 575, 5 credits; Winter 2008, 2007.
Probability, Math 530, 3 credits; Fall 2007
Algebra and Trigonometry, Math 148, 2 credits; Fall 2007
Graph Theory, independent study proctor; Winter 2008.
Discrete Mathematical Models, independent study proctor; Summer 2007.
- Courses taught at the University of Notre Dame
Finite Mathematics, Math 104, 3 credits; Fall 2005, Summer 2003.
Calculus II for Pre-med, teaching assistant; Spring 2003.
Calculus I for Engineers, teaching assistant; Fall 2002.
Calculus I for Pre-med, teaching assistant; Fall 2002.
- Courses taught at the University of Zürich, Switzerland
Coding Theory, teaching assistant; Spring 2005.
- *Teaching Assistant*, University of Puget Sound. Aided teaching of high school students in Academic Challenge Program, a math and science enrichment program for disadvantaged children. Summer 1999.
- *Math and English as a Second Language Tutor*, Tacoma, Washington, 1997-1999.

Doctoral Supervisory Committee:

I serve on the supervisory committee of Tyler Seacrest (advisor: Stephen Hartke)

Pedagogical Training:

- Project NExT activities at Mathfest 2008.
- Attended *2nd Annual Mini-Conference on Great Teaching*, Ohio State University, April 2008.
- *Teaching Well Using Technology Certificate*, University of Notre Dame, 2005 - 2006.
- *Striving for Excellence in Teaching Certificate*, University of Notre Dame, 2005 - 2006.
- Attended *Teaching Linear Algebra and Its Applications* mini-course, and *Getting Undergraduate Students Involved in Research* mini-course at the AMS Joint Meetings, January 2006.
- Teaching Seminar, Mathematics Department, University of Notre Dame, Spring 2001, 2002.

Other Department Service:

On committee for the *Nebraska Conference for Undergraduate Women in Mathematics*, 2008-2009.

Grants and Awards:

- AWM travel grant (\$1850), July 2008.
- Project NExT Fellow, 2008-2009.
- Fellowship, The Fields Institute, 2006.
- ISIT travel grants 2004, 2006, ITW travel grant 2007, IMA travel awards 2007.
- Notre Dame Graduate Assistantship, 2001-2004, 2005-2006.
- University of Zürich Graduate Assistantship, 2004-2005.
- Graduate Fellow, Center for Applied Mathematics, University of Notre Dame, 2003-2004.
- Cambridge Commonwealth Trust Overseas Bursary, 2000-2001.
- Trustee Scholarship for Academic Achievement, University of Puget Sound, 1995-1999.
- University of Puget Sound Grant, 1997-1999.

Professional Societies and Activities:

- Referee for *IEEE Transactions on Information Theory*, *IEEE Transactions on Communications*, *IEEE Communications Letters*, *Journal of Applied Algebra*, and the special issue on capacity-approaching codes for the *Journal on Selected Areas in Communications*.
- Referee for the following conferences: IEEE International Symposium on Information Theory (2007,2008), IEEE Information Theory Workshops (2006), Turbo Codes Conference (2008), International Symposium on Information Theory and its Applications (2008).
- American Mathematical Society, Institute of Electrical and Electronics Engineers (Information Theory Society and Communications Society.)