

Karen L. Shuman

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Education and Employment

Associate Professor, Grinnell College, Grinnell, IA	2009 - present
Assistant Professor, Grinnell College, Grinnell, IA	2003 - 2009
VIGRE Research Assistant Professor, UIUC, Urbana, IL	2000 - 2003
A.M. and Ph.D., Dartmouth College, Hanover, NH	1997, 2000
B.A., Agnes Scott College, Decatur, GA, with highest college honors	1995

Teaching

Assistant/Associate Professor, Grinnell College

- **Tutorial** F'05, F'08, F'12
- **Math 123**, Functions and differential calculus F'03, F'04
- **Math 131**, Calculus I F'05, F'06, F'08, F'09
- **Math 133**, Calculus II F'03, F'04, S'06, S'07, S'09
- **Math 215**, Linear algebra F'03, S'04, F'04, F'10, F'12, S'13
- **Math 220**, Differential equations F'06, S'07, S'08, F'08, S'10, S'11
- **Math 222**, Geometry* F'10
- **Math 314**, Topics in applied mathematics* S'09, S'11
- **Math 316**, Mathematical analysis S'04, S'05, S'06, S'08, S'10, S'13
- **Math 338**, Complex analysis* F'09
- **Math 397**, Functional analysis S'07

* indicates development of a new or significantly different course

VIGRE REU Orthogonal Polynomials Workshop, University of Iowa	June 4 - July 6, 2007
Mathematical Association of America Project NExT Fellow	2003 - 2004
VIGRE Research Assistant Professor, UIUC	2000 - 2002
Lecturer in Mathematics, Dartmouth College	1997 - 1999
Graduate Teaching Seminar, Dartmouth College	1997
Teaching Assistant, Dartmouth College	1995 - 1997
Mathematics Tutor, Agnes Scott College	1992 - 1995

Recent Research with Undergraduates

Iterated Function Systems Summer 2011

Undergraduates: Ethan Edl '12 and Klevi Xhaxho '12. Pure mathematics research; Klevi and Ethan found formulas for the measure of the overlap for iterated function systems associated with $0, \pm 1$ polynomials. Klevi also studied measure theory as an even more advanced component of the MAP. Ethan presented his work at the University of Wisconsin-Eau Claire's Undergraduate Research Conference in August 2011, and Klevi presented at the Midstates Consortium for Mathematics and Science Conference in November 2011.

Wren: Aesthetics and Geometry (MAP 499) Summer 2010

Undergraduates: Fatemah Elahi '12, Cyrus Smith '12, Paloma Velazquez '12. Interdisciplinary research on Sir Christopher Wren's geometry and architecture in selected London churches. Included research component in London, UK with Shuman, Smith, and Velazquez, July 9 - 17, 2010.

Iterated Function Systems Summer 2010

Undergraduate: Klevi Xhaxho '12. Pure mathematics research resulting in the successful calculation of the measure of the overlap for two Bernoulli iterated function systems associated with third degree Pisot numbers.

Iterated Function Systems Summer 2008

Undergraduates: Ernest Boateng-Abebrese '10, Pengjun Shen '11, Talent Takundwa '10, Fai Tosuratana '10. My students discovered and proved several new theorems about the equilibrium measure of the overlap of an iterated function system. Pengjun, Talent, and Fai presented their work at the University of Iowa Fractals Miniconference in June 2008.

Publications

(Authors in mathematics publications are listed alphabetically.)

“Scalar spectral measures associated with an Operator-Fractal.” With Palle E.T. Jorgensen and Keri A. Kornelson. 34 pp. Submitted.

“Scaling by 5 on a $\frac{1}{4}$ -Cantor Measure.” With Palle E.T. Jorgensen and Keri A. Kornelson. 34 pp. Submitted.

“An operator-fractal.” With Palle E.T. Jorgensen and Keri A. Kornelson. *Numerical Functional Analysis and Optimization*, **33**(7 – 9), 1070-1094. DOI 10.1080/01630563.2012.682127 (refereed)

Iterated function systems, moments, and transformations of infinite matrices. With Palle E.T. Jorgensen and Keri A. Kornelson. *Memoirs of the American Mathematical Society*, **213**(1003), x + 105 pages. (refereed monograph)

“Families of spectral sets for Bernoulli convolutions.” With Palle E.T. Jorgensen and Keri A. Kornelson. *Journal of Fourier Analysis and Applications*, **17**(2011) no. 3, 431-456. DOI 10.1007/s00041-010-9158-x (refereed)

“Weak Convergence of Greedy Algorithms in Banach Spaces.” With Stephen Dilworth, Denka Kutzarova, Vladimir Temlyakov, and Przemyslaw Wojtaszczyk. *Journal of Fourier Analysis and Applications*, **14**(2008) no. 5-6, 609-62. (refereed)

“Affine systems: asymptotics at infinity for fractal measures.” With Palle E.T. Jorgensen and Keri A. Kornelson. *Acta Applicandae Mathematicae*. **98** (2007) 181-222. (refereed)

“Harmonic analysis of iterated function systems with overlap.” With Palle E.T. Jorgensen and Keri A. Kornelson. *Journal of Mathematical Physics*. **48**(8) (2007) 083511. (refereed)

“Orthogonal Exponentials for Bernoulli Iterated Function Systems.” With Palle E.T. Jorgensen and Keri A. Kornelson. In *Representations, wavelets, and frames: A celebration of the work of Lawrence W. Baggett*, Birkhäuser, 2008. (refereed)

“The Weak Chebyshev X-Greedy Algorithm in the Unweighted Bergman Space.” With Stephen Dilworth and Denka Kutzarova. *Journal of Mathematical Analysis and Applications*. **318** (2006) 692 – 706. (refereed)

“Cyclic Functions in $L^p(\mathbb{R})$, $1 \leq p < \infty$.” With Joseph M. Rosenblatt. *Journal of Fourier Analysis and Applications* **9** (2003) no. 3, 289 – 300. (refereed)

“Complete Signal Processing Bases and the Jacobi Group.” *Journal of Mathematical Analysis and Applications* **278** (2003) 203 – 213. (refereed)

“Tests of a New Basis for Signal Processing.” With Emily Cornell. *Mathematical and Computer Modelling* **33** (2001) 265 – 271. (refereed)

Works in Progress

“Spectra of the $\frac{1}{4}$ -Cantor measure.” With Palle E.T. Jorgensen and Keri A. Kornelson. In preparation. 16 pages.

Grants and Honors

Grinnell College Study Leave to supplement one-semester sabbatical, 2011-2012.

Invited participant: Mathematisches Forschungsinstitut Oberwolfach—Workshop on Operator Algebras and Representation Theory: Frames, Wavelets and Fractals. Oberwolfach, Germany, March 27 - April 2, 2011.

RUI: Orthonormal Fourier Bases and Iterated Function Systems. With Keri A. Kornelson. National Science Foundation Department of Mathematical Sciences 0701164; amount: \$183,938; duration: 3 years with 1 year no-cost extension.

Honorable Mention, Association of Women in Mathematics Alice T. Shafer Prize, 1995

Recent Selected Presentations

Some properties of an operator-fractal (invited)

American Mathematical Society Spring Eastern Sectional Meeting, Special Session on Analysis of Wavelets, Frames and Fractals, George Washington University, Washington, D.C., March 17-18, 2012.

Iterated function systems and moment matrices: differences between the affine and non-affine cases (invited)

American Mathematical Society Sectional Meeting, Special Session on Fractals and Tilings, Georgia Southern University, Statesboro, GA, March 12-13, 2011.

Iterated function systems with overlap (invited; international conference)

Workshop on Fractals and Tilings, Strobl, Austria, July 7, 2009. Partially supported by the Austrian Science Foundation.

Moments and iterated function systems (invited)

Center for Applied Mathematics Colloquium, University of St. Thomas, April 15, 2009.

Bernoulli measures and Fourier transforms (invited)

Fractals Miniconference, University of Iowa, June 28 - 29, 2008.

Moments and iterated function systems (invited)

Joint AMS-MAA Meetings, Special Session on Wavelet Sets and Tilings, San Diego, CA, January 8, 2008.

Recent Grinnell College Committees

Tutorial and Advising Committee	2010 - 2013
Rosenfield Planning Committee	2010 - 2011; 2012 - present
Instructional Support Committee (ISC)	2008 - 2010, Chair 2009 - 2010
Ecocampus Committee	Spring 2005 - 2007

Recent Service to Grinnell College

Grinnell Science Project (GSP) Codirector	2008 - 2009
Scholarly Women's Achievement Group (SWAG) Coconvener	2008 - 2009
Science Division Secretary	2005 - 2007
Departmental representative to Heartland Mathematics Partnership	2003 - present

Recent Service to Mathematical Community

Referee for the <i>Rocky Mountain Journal of Mathematics</i>	2011
Coorganizer, with Keri Kornelson, AMS Special Session "Fractals, Convolution Measures, and Frames", Spring Central American Mathematical Society Meeting, Macalester College, St. Paul, Minnesota, April 10-11, 2010.	2010
Treasurer, Iowa Section of the Mathematical Association of America	2006 - 2009
REU Selection Committee, Heartland Mathematics Partnership	2007 - 2009
Textbook reviewer, various publishers	2004 - 2009