Ken W. Smith

Professor of Mathematics, Sam Houston State University

2017

Education

- Ph.D. (Mathematics) Colorado State University, Fort Collins, Colorado, May 1985
- M.S. (Mathematics) University of Illinois, Urbana, Illinois, May 1977
- B.S. (Mathematics) Western Illinois University, Macomb, Illinois, May 1975

Professional Experience

- August 2007 – present: Professor, Sam Houston State University
- August 2007 – August 2008: Department Chair, Sam Houston State University
- July 1994 – 2007: Professor, Central Michigan University
- August 2005 – June 2006: Visiting Scholar, University of Richmond
- Spring 1999: Visiting Professor, Colorado State University
- October 1995 – August 1997: Assistant Vice-Provost for Institutional Research & Planning, CMU
- August 1989 – July 1994: Associate Professor, Central Michigan University
- May 1992 – July 1992: Technical Director, National Security Agency,
- June 1990 – June 1991: Senior Cryptologic Mathematician, National Security Agency
- April 1985 – August 1989: Assistant Professor, Central Michigan University
- August 1984 – April 1985: Instructor, Central Michigan University
- August 1980 – May 1984: Graduate Teaching Assistant, Colorado State University
- August 1979 – May 1980: Graduate Teaching Assistant, University of Illinois
- August 1978 – May 1979: Instructor, Millikin University, Decatur, Illinois
- August 1975 – May 1978: Graduate Teaching Assistant, University of Illinois

Administrative Experience

- Graduate Coordinator, MS in Mathematics, Sam Houston State University (SHSU) 2010 to present.
- Chair, Department of Mathematics and Statistics, SHSU, 2007 - 2008
- Math Area Coordinator, Mathematics Department, CMU, 2000 - 2004
- Interim Assistant Vice-Provost, CMU, 1995 – 1997
- Interim Director, Office of Institutional Research, CMU, 1995 – 1997
- Graduate Coordinator, Mathematics Department, CMU, 1992 –1995
- Mathematics Department Executive Committee, CMU, 1992 – 1995, 2000 – 2004

- Executive Committee of the University Graduate Council, CMU, 1993 – 1995
- Academic Senate Executive Board, CMU, 1987, 1988 (2 terms)

Teaching Experience & Curricular Development

In addition to the standard entry-level undergraduate mathematics course (including honors classes in calculus and linear algebra) I have taught the following upper level and graduate classes at Central Michigan University and Sam Houston State University:

- **Upper undergraduate level classes taught (above calculus):**

  Introduction to Analysis, Differential Equations,
  College Geometry, Discrete Structures,
  Elem. Statistical Analysis, Theory of Numbers,
  Math of Cryptology, Modern Algebra,
  Modern Algebra II, Mathematical Logic,
  History of Mathematics, Applied Combinatorics

- **Masters level classes taught:**

  Advanced Calculus I & II, Abstract Algebra I & II,
  Coding Theory, Theory of Groups,
  Theory of Associative Rings Linear Algebra
  Fourier Analysis

- **Doctoral level classes taught:**

  Topics in Geometry (Non-Euclidean)
  History of Advanced Math (Calculus to the present)
  Combinatorics, II
  Seminar in Coding Theory
  Topics in Algebra
  Topics in Combinatorics
  Algebraic Number Theory

- I directed four doctoral dissertations in combinatorial mathematics at Central Michigan University (Paul Becker, 2000, Omar AbuGhneim, 2005, Solomon Osifodunrin, 2008, Jordan Webster, 2009.)
- I directed masters theses at both Central Michigan University and Sam Houston State University. I supervised numerous Masters Plan B papers on character theory, number theory, cryptanalysis, graph theory and functional analysis and a senior thesis on matrix theory.
- I taught geometry and precalculus in CAMP (for gifted and talented high school students.) I created and taught an introductory statistics class (CMU MTH 382) on the internet.
- I created (with Arnold Hammel, CMU) MTH 522, The Mathematics of Cryptology and created (with Doug Lapp, CMU) MTH 261, Problem-based Algebra and Calculus for Secondary Teachers.
- I have directed approximately 40 undergraduate students on projects in matrix analysis, graph theory and algebraic combinatorics.

  Many of these students have presented posters at regional meetings and at national meetings of the AMS/MAA. Of special notices are:

  – Christine Berkesch, a student in the 2002 NSF-REU at CMU, won a prize for her poster presentation at a national meeting of the American Math Society. Her work was published in the Rose-Hulman Undergraduate Mathematics Journal. Lisa Driskell worked with me on an undergraduate project in graph theory, got excited about mathematics research and was then

accepted into the Grand Valley State University NSF-REU. Her work in that program won her the Greg Mellen prize for best undergraduate paper in Cryptology, published in the journal Cryptologia. Lisa continued on to complete a Ph.D. in math at Purdue. Jeff Ginn worked on a project in difference sets under my guidance; he then won a prestigious appointment to Penn State Universitys Mathematics Advanced Study Semesters (MASS) Program.

  - My suggested research problem on (160, 54, 18) difference sets was pursued by Matt Ong, who subsequently won the 1999 Mathematics Prize at the Westinghouse Science Fair.

- I was a technical director for an NSA Summer Program in 1992, working with approximately 15 undergraduate students on classified research problems in Algebra and Combinatorics.

Professional Growth Activities and Awards (Selected)

- I received an award as Distinguished Alumnus, Colorado State University, November 2008.
- I was a Visiting Scholar (Sabbatical), University of Richmond, Fall 2005-Spring 2006.
- I received the President's Research Investment Fund (CMU grant) with Don Marks, Arnold Hammel, on Cryptography Toolkit, 2002 and coordinated, with Arnold Hammel (MTH) and Don Marks (CPS), The CrytptoTools student research group, 2002.
- I received the Central Michigan University Research Professor award, Spring 2000.
- I received a Sabbatical Leave to visit Colorado State University, Spring 1999.
- I was a technical director for the National Security Agency, mentoring undergraduate research projects with students in the NSA's summer program (Summer 1992).
- I led a seminar on difference sets at the National Security Agency (1990 – 91).
- I coordinated a two-semester class on Coding Theory, Information & Cryptanalysis (1989 – 90).
- I am a regular contributor to the Mathematical Reviews. I referee for a variety of journals in combinatorics, including the Journal of Combinatorial Mathematics and Combinatorial Computing, the Journal of Combinatorial Designs. the Journal of Designs, Codes and Cryptography, etc.

External Grants funded

- Co-PI (PI Scott Chapman) NSF-REU 2014-2016 $388,000.
- Co-PI (PI Luis Garcia) with Martin Malandro and Daniela Ferrero, NSF conference grant for CombinaTexas, $9,100.
- Co-PI (PI Martin Malandro) with Luis Garcia and Daniela Ferrero, NSA conference grant for CombinaTexas, $10,100.
- Co-PI with Luis Garcia, Catherine Yan, Daniela Ferrero, NSA conference grant for CombinaTexas 2016, about $10,000.
- Co-PI NSF MCTP grant, approx. $1,500,000, 2007-2011 (This grant, on Longterm Undergraduate Research Experiences, is a collaborative project with CMU, the University of Richmond, Coppin State University and Olin College.)
- Co-PI NSF grant, $1,065,000 (PI: Doug Lapp & Azita Manouchehri), 2005-2009.
- Co-PI NSF-REU grant, approx. $185,000 (with Sivaram Narayan), 2006-2008.

- Co-PI REU grant for $165,000 from the NSF (with Sivaram Narayan), 2003-2005.
- SUMMA seed grant of $5,000 for minority intervention in mathematics, 1996.
- NSA grant of $17,700, summer 1995, for research on nonabelian difference sets.

External Grants submitted

- With co-PIs from the first LURE grant, I submitted the grant proposal "LURE2" to the National Science Foundation as part of the Mentoring through Critical Transition Points (MCTP) program. This grant requested approximately $750,000 for undergraduate research at Sam Houston. This grant was not funded in 2010. It was revised and resubmitted in 2011 where it was ranked as "Highly Recommended for Funding" but was still unfunded, It was resubmitted in 2013.

Refereed Publications

- The Representation Theory of Tactical Configurations, Congressus Numerantium, v. 60, 1987, 151-162.
- Flag Algebras of a Symmetric Design, Journal of Combinatorial Theory, Series A, v. 48, no. 2, 1988, 209-228.
- Teaching Number Theory with ZBASIC, Proceedings of the Second Annual Conference on Technology in Collegiate Mathematics, 1989, 294-297.
- In Search of a $(495, 39, 3)$ Difference Set, Congressus Numerantium, v. 73, 1990, 77-88.
- Reconstruction of Sequences, with B. Manvel, A. Meyerowitz, A. J. Schwenk, P. K. Stockmeyer, Discrete Mathematics, v. 94, 1991, 209-219.
- On difference sets in certain 2-groups, with R. A. Liebler, in Coding Theory, Design Theory, Group Theory: Proceedings of the Marshall Hall Conference, ed. by D. Jungnickel, John Wiley & Sons, 1993.
- A construction of difference sets in high exponent 2-groups, with J. A. Davis, Journal of Algebraic Combinatorics, 1994.
- Nonabelian hadamard difference sets, Journal of Combinatorial Theory, Series A, v. 70, 1995, 144-156.
- Difference Sets in Nilpotent Groups with Large Frattini Quotient: Geometric Methods and (375, 34, 3), with J. Iiams, R. A. Liebler, Proceedings of a Special Research Quarter at the Ohio State University, Spring 1993 (published by Walter de Gruyter, 1996.)
- Nonabelian difference sets, chapter IV.13 in The CRC Handbook on Combinatorial Designs, 1996.
- (27, 13, 6) designs with automorphisms of order 3, with K. Fleming, Proceedings of the Ninth Midwest Conference on Combinatorics, Cryptography and Computing, special edition of Journal of Combinatorial Mathematics and Combinatorial Computing, 1996.
- An infinite family on nonembeddable quasi-residual designs, with K. Fleming, Journal of Statistical Planning and Inference, v. 73, 1998.
- The Two-Path Conjecture, with H. Fleischner. R. Molina, D. West, Electronic Journal of Combinatorics, 2002.

- Characterizing Randomly P_k Decomposable Graphs for $k < 9$, with McNally, R. Molina, Congressus Numerantium 156, 2003, 211-221.
- (I supervised the undergraduate research which led to the publication: Christine Berkesch, Jeff Ginn, Erin Haller, Erin Militzer. A Survey of Relative Difference Sets, Rose-Hulman Undergraduate Mathematics Journal, v. 4, Fall 2003.)
- The Subgraph Summability Number of a Biclique, with S. Narayan, J. (Eustice) Russell, Congressus Numerantium 171, 2004, 3-11.
- On Hadamard Difference Sets in groups of order $4p^2$, O. AbuGhneim, P. Becker, J. Mendez, Congressus Numerantium 172, 2005, 97-121.
- Proof of the Barker array conjecture, with J. A. Davis, J. Jedwab, Proc. Amer. Math. Soc., 2006.
- Difference sets, with D. Jungnickel, A. Pott, a chapter in The CRC Handbook on Combinatorial Designs, (2nd ed.) 2006.
- Tightening Turyn's Bound for Hadamard Difference Sets, with O. AbuGhneim, Journal of Algebraic Combinatorics, 2007.
- Nonabelian Groups with (96,20,4) Difference Sets, with O. AbuGhneim, Electronic Journal of Combinatorics, R8 in Volume 14, January 3, 2007,
- Factoring (16,6,2) Hadamard Difference Sets, with C. Bhattacharya, Electronic Journal of Combinatorics, Aug 2008.
- Semigroups and the zero divisor graph, with Lisa Demeyer, Michel D'Sa, Inessa Epstein, Amanda Geiser, Bulletin of the Institute for Combinatorics and its Applications, Sep 2008.
- Delving into limits of sequences, with B. Cory, Mathematics Teacher, August, 2011.
- A new product construction for partial difference sets, with Jim Davis and John Polhill, Journal of Designs, Codes and Cryptography, February 2012.
- Algebraic and combinatorial aspects of sandpile monoids on directed graphs, with Scott Chapman, Luis Garcia-Puente, Rebecca Garcia and Martin Malandro, Journal of Combinatorial Theory (Series A), v. 120, no 1, 245-265, January 2013.
- Circulant weighing matrices whose order and weight are products of powers of 2 and 3, with Bernhard Schmidt, Journal of Combinatorial Theory (Series A), v. 120, no 1, 275–287, January 2013.
- Hadamard Difference Sets Related to Lander's Conjecture, with Bernhard Schmidt, Tao Feng; Ka Hin Leung, *Journal of Algebra*, January 2014.

Other Publications

- Roland Dreier, K. W. Smith, Exhaustive Determination of (1023, 511, 255)-Cyclic Difference Sets, 1992, unpublished preprint cited in other publications
- Preprint with Jerald Kabell, unpublished preprint on randomly decomposable graphs, cited in other publications
- The NSF REU at Central Michigan University, with S. Narayan, Proceedings, AMS/NSA conference on Promoting Undergraduate Research in Mathematics, 2006.

- The Long-term Undergraduate Research (LURE) Model, with Adams, J. Davis, N. Eugene, K. Hoke, S. Narayan, Proceedings, AMS/NSA conference on Promoting Undergraduate Research in Mathematics, 2006.,
- Rational Idempotents of the Integral Group Ring, preprint with J. A. Davis, unpublished preprint cited in other publications

Recent Presentations (last five years)

- Rational idempotents and the integral group ring, Coding, Cryptology and Combinatorial Designs Workshop in Singapore, May 2011.
- Rational idempotents and the integral group ring, Algebraic Combinatorics Conference in Memory of Bob Liebler, Fort Collins, Colorado, November 2011.
- Discrete Fourier Analysis and New Circulant Weighing Matrices, Texas A&M University at Galveston, November 2011.
- Discrete Fourier Analysis and New Circulant Weighing Matrices, Stephen F. Austin University, December 2011.
- Discrete Fourier Analysis and New Circulant Weighing Matrices, Univ. of Richmond, March 2012.
- Rational Idempotents and Combinatorial Configurations, CombinaTexas 2012, Georgetown, TX, April 2012.
- Undergraduate Research Problems in Mathematics (UTEP Math Dept Colloquium), October 2014
- Strongly Regular Cayley Graphs (UTEP Math Dept Colloquium), October 2014
- MERiT (Mathematics Education Research in Texas) conference panelist, Undergraduate Research in Mathematics Education, October 2014.
- Strongly Regular Cayley Graphs (VCU Discrete Mathematics Seminar), October 2014.
- Strongly Regular Cayley Graphs (TAMU-G Math Dept Colloquium), November 2014.
- On Strongly Regular Cayley Graphs (invited talk at AMS Special Session on Studies in Interconnections among Parameters in Graph Theory, Combinatorics, and Discrete Geometry), January 2015.
- Reversible Hadamard Difference Sets in Rank Two 2-Groups, Combinatorial Workshop, Mt. Pleasant, Michigan, October 2015.
- Three Problems in Graph Theory, LoneStar conference on Undergraduate Research, April 2016.
- Reversible Hadamard Difference Sets in Rank Two 2-Groups, TAMU-G Math Dept Colloquium, April 2016.
- The Mathematical Life of Kiran Chilakamarri, CombinaTexas 2016, April 2016.
- Reversible Hadamard Difference Sets in Rank Two 2-Groups, New Directions in Combinatorics, Singapore, May 2016.

Professional and Academic Affiliations

- Member, American Mathematics Society

- Member, Mathematical Association of America
- Institutional Representative, Council on Undergraduate Research (CUR)
- Member, National Alliance for Doctoral Studies in Mathematics