

# Peter Sin

## Present Position

Professor, Associate Chair

## Degrees

1986 D.Phil in Mathematics, Oxford University

1983 B.Sc in Mathematics (First class hon.), Warwick University

## Prizes, Awards

Mathematics Prize, Warwick University, 1983.

UF Term Professor 2018-21.

## Memberships

American Mathematical Society

Mathematical Association of America.

## Editorial Boards

Communications in Algebra

## Professional Experience

2002–present Professor at University of Florida  
Department of Mathematics

2000 Research Visitor, Indian Statistical Institute

1997 National Board of Higher Mathematics (India)  
visiting lecturer, Indian Statistical Institute

1994–95 Visiting Scholar, University of Utah

1993 – 2002 Associate Professor at University of Florida  
Department of Mathematics

1989 – 1993 Assistant Professor at University of Florida  
Department of Mathematics

1987,1988, Deutsche Forschungsgemeinschaft exchange  
visitor at U. Mainz and U. Essen

1986 – 1988 L. E. Dickson Instructor at University of Chicago  
Department of Mathematics

**Ph.D. Students**

Michael F. Dowd (1994), Some 1-Cohomology Computations for Groups of Lie Type.

Jeffrey M. Lataille (2001), The Elementary Divisors of Incidence Matrices between Certain Subspaces of a Finite Symplectic Space.

Ogul Arslan, (2009) Some Algebraic Problems from Coding Theory.

Josh Ducey, (2011) Problems in Algebraic Combinatorics

Liz Wiggins (2015) Some Weyl modules for algebraic groups of type  $B_4$  and  $D_4$

Raghu Tej Pantangi (2019) Smith and critical groups of graphs

Current students: Marly Cormar, Julien Sorci

**Grants**

1987–88 NSF DMS 8421367 (Postdoc)

1990–93 NSF DMS 9001273 (Co-PI)

1997–2000 NSF DMS 9701065 (Principal Investigator)

2000–2003 NSF DMS 0071060 (Principal Investigator)

2009 BIRS Workshop (Joint organizer)

2011-2016 Collaboration Grant for Mathematicians, Simons Foundation

2019-2024 Collaboration Grant for Mathematicians, Simons Foundation.

**Conferences Organized**

AMS special session, sectional meeting, Gainesville 1999 (joint organizer)

Finite Groups 2003, U. of Florida, 2003 (joint organizer)

Group Representations and Combinatorics, U. of Florida, 2007 (joint organizer)

Invariants of Incidence Matrices, Banff International Research station 5-day workshop, March 2009 (joint organizer).

ICM satellite conference, Buildings, Finite Geometries and Groups, Bangalore, India, August 29-31, 2010 (organizing committee member)

**Invited Lectures and Talks at Meetings**

Conference on Representation Theory, Athens, Georgia, 1988.

Special Session, AMS meeting, Kent State, Ohio, 1987.

Special Session, AMS meeting, E. Lansing, Michigan, 1988.

International Conference on Representation Theory, Manchester, England, 1988.

Deutsche Forschungs Gemeinschaft Conference, Bad Honnef, Germany, June 1989.

Program on Representations of Finite Groups, MSRI, Berkeley, California, October 1990.

Special Session, AMS meeting, U.C. Irvine, California, 1990.

Special Session, AMS meeting, Tampa, FL, March 1991.

AMS Summer Institute on Algebraic Groups, Penn. State, July 1991.

AMS/SIAM Research Conference, Mt. Holyoke College, MA, June 1992.

Special Session on Algebraic Groups and Finite Groups, AMS meeting, Los Angeles, November 1992.

Special Session on Algebraic Groups and Quantum groups, AMS meeting, Manhattan, Kansas, March 1994.

Special Session on Finite groups and Related Topics, AMS meeting, Orlando, Florida, March 1995.

Special Session on Algebraic Groups and Finite Groups, AMS meeting, Baton Rouge, Louisiana, April 1996.

AMS Summer Institute on Group Actions and Cohomology, Seattle, Washington, July 1996.

Millican Lecture, University of N. Texas, Denton, February 1995.

Special Session on Groups and Geometry, AMS meeting Detroit, April 1997.

Colloquium at Indian Statistical Inst., 1997.

Colloquium at Indian Inst. of Science, 1997.

Colloquium at Math. Sciences Inst., Madras, 1997.

Mini-course: Modular Representations and Cohomology, ISI, Bangalore, 1997.

Symposium on Representation Theory, U.of Virginia, May 1998.

Special Session on Finite groups and Geometries, AMS meeting, Manhattan KS

CBMS Conference on Cross Characteristic Representation Theory, Denton, Texas, June 1998.

Special Session on Finite Groups and Geometries, AMS meeting, Detroit, Mi,

Conference in honour of E. Shult, Manhattan, Kansas, March 2001.

U. Of South Alabama, Colloquium, November 2004.

Special Session on Designs and Codes, AMS meeting, Newark, Delaware, April 2005.

AMS/MAA joint annual meeting, Atlanta, January 2005.

Group Representations and Combinatorics, U. of Florida, September 2007.

Chat Yin Ho Memorial Conference on Combinatorics, U. of Florida, February 2008.

Local Methods in Group Theory, conference in honor of George Glauberman, U. of Chicago March 2008.

Institute of Advanced Study/ Princeton University Number Theory Seminar, May 2008.

London Mathematical Society Triangle Conference, U. Birmingham, June 2008.

Workshop on Invariants of Incidence Matrices, Banff International Research Station, Canada, March 30th, 2009

Universiti Sains Malaysia, Penang, Malaysia, June 9th, 2009.

Southwestern Group Theory Day, University of Arizona, November 7th, 2009.

Conference on Designs, Codes and Geometries, Lewes, Delaware, March 30th, 2010.

ICM satellite conference on Buildings, Finite Geometries and Groups, Bangalore, India, August 30th, 2010.

AMS special session Tampa, March 10th, 2012

Finite Groups, Representations and Related Topics, Conference in honor of Michael J. Collins, Oxford, August 23rd, 2012.

Workshop and Conference on Groups and Geometries, Indian Statistical Institute, Bangalore, India, December 10-21 2012 (three lectures).

The Mathematics of John Thompson, Cambridge, UK, September 9-11 2013 .

Millican Lecture, University of N. Texas, Denton, March 2014.

Colloquium, James Madison U, February, 2016.

Gainesville Conference on Number Theory, March 2016.

New Directions in Combinatorics, Institute for Mathematical Sciences, NUS Singapore, May 2016.

Conference in Finite Groups and Vertex Algebras, Taipei, August 2016.

Seminar talks given at: U.Chicago, U.Illinois, Chicago Circle, U. Illinois, Urbana, U. Oxford, U. Mainz, U. Essen, CalTech, Northwestern U., Institute of Theoretical and Applied Mathematics, U. Utah, Indian Statistical Institute, U. Leicester, Colorado State U., U. Delaware, U. South Alabama, Texas State University, and U. Florida, Peking U.

#### **Other Meetings Attended**

Conference in honour of John Thompson, Cambridge, September 2002

Finite Groups 2003, Gainesville, FL March 2003

Conference in honour of Walter Feit, Yale, September 2003

## Publications

- [1] Josh Ducey, Ian Hill and Peter Sin, “The critical group of the Kneser graph on 2-element subsets of an  $n$ -element set”, *Lin. Algebra. Appl.* **546** (2018), 154–168.
- [2] Venkata Raghu Tej Pantangi and Peter Sin, “Smith and critical groups of polar graphs” Preprint. arxiv.org:1706.08175
- [3] J. Ducey and P. Sin, “The Smith and critical groups of graphs defined by lines in  $PG(n-1, q)$ ,” To appear, *Bulletin of the Institute of Mathematics, Academia Sinica*, 2018.
- [4] L. Long, R. Plaza, P. Sin, and Q. Xiang, “Characterization of intersecting families of maximum size in  $PSL(2, q)$ ,” *J. Comb. Theory A* **157** (2018) 461–499.
- [5] P. Sin, “The critical groups of the Peisert graphs,” *J. Alg. Combinatorics* **48** (2018), 227–245.
- [6] F. Ihringer, P. Sin, and Q. Xiang, “New bounds for partial spreads in  $H(2d-1, q^2)$  and partial ovoids of the Ree-Tits octagon.,” 2016. *J. Comb. Theory A* **153** (2018) 46–53.
- [7] D. Chandler, P. Sin, and Q. Xiang, “The Smith group of the hypercube graph,” *Designs, Codes and Cryptography* **84** (1-2) (2017), 283–294.
- [8] Alexander Kleshchev, Peter Sin, Pham Huu Tiep, “Representations of alternating groups that are irreducible over subgroups,” *Amer. J. Math.* **138** (5) (2016), 1383–1423.
- [9] D. P. Brozovic, P. Sin, “A Note on point stabilizers in sharp permutation groups of type  $\{0, k\}$ ,” *Comm. Algebra* **44** (2016), 3324–3339.
- [10] O. Arslan, P. Sin, “A Remark on Grassmann and Veronese embeddings of  $\mathbf{P}^3$  in characteristic 2”, *Innovations in Incidence Geometry* **14** (2015), 111–117.
- [11] D. Chandler, P. Sin, Q. Xiang “The Smith and critical groups of Paley graphs,” 2014. *J. Algebraic Combinatorics* **41** (2015), 1013–1022.
- [12] P. Sin, “Smith normal forms of incidence matrices,” *Science China Mathematics*, V.56, No. 7, 1359–1371, 2013.
- [13] P. Sin, “Some Weyl modules of the algebraic groups of type  $E_6$ ,” Chapter 15 in: “Groups of Exceptional Type, Coxeter Groups and Related Geometries”, vol. 82 of *Proceedings in Mathematics and Statistics*, pp. 279–300, Springer, 2014.
- [14] P. Sin and J. G. Thompson, “Some uniserial modules for certain special linear groups,” *Journal of Algebra* **398** (2014) pp. 448–460 To appear.
- [15] P. Sin, “On codes that are invariant under the affine group,” *Elec. J. Combinatorics*, vol. 19, no. P20, pp. 1–14, 2012.
- [16] A. E. Brouwer, J. E. Ducey, and P. Sin, “The elementary divisors of the incidence matrix of skew lines in  $PG(3, q)$ ,” *Proc. Amer. Math. Soc.*, vol. 140, no. 8, pp. 2561–2573, 2012.
- [17] P. Sin, “Oppositeness in buildings and simple modules for finite groups of lie type,” in *Buildings, Finite Geometries and Groups*, vol. 10 of *Proceedings in Mathematics*, pp. 273–286, New York: Springer, 2011.
- [18] P. Sin, J. Wu, and Q. Xiang, “Dimensions of some binary codes arising from a conic in  $PG(2, q)$ ,” *J. Combin. Theory Ser. A*, vol. 118, no. 3, pp. 853–878, 2011.

- [19] O. Arslan and P. Sin, “Some simple modules for classical groups and  $p$ -ranks of orthogonal and Hermitian geometries,” *J. Algebra*, vol. 327, pp. 141–169, 2011.
- [20] P. Sin and J. G. Thompson, “The divisor matrix, Dirichlet series, and  $\mathrm{SL}(2, \mathbf{Z})$ ,” in *The legacy of Alladi Ramakrishnan in the mathematical sciences*, pp. 299–327, New York: Springer, 2010.
- [21] P. Sin, Book review of “*Finite group theory*, by I. M. Isaacs,” *Amer. Math. Monthly*, vol. 117, no. 7, pp. 657–660, 2010.
- [22] D. B. Chandler, P. Sin, and Q. Xiang, “Incidence modules for symplectic spaces in characteristic two,” *J. Algebra*, vol. 323, no. 12, pp. 3157–3181, 2010.
- [23] J. Carillo, Y. Chen, P. Sin, and A. Vakharia, “Fusion product planning: A market offering perspective,” *Decision Sciences Journal*, vol. 41, no. 2, pp. 235–253, 2010.
- [24] D. B. Chandler, P. Sin, and Q. Xiang, “The permutation action of finite symplectic groups of odd characteristic on their standard modules,” *J. Algebra*, vol. 318, no. 2, pp. 871–892, 2007.
- [25] P. Sin and Q. Xiang, “On the dimension of certain LDPC codes based on  $q$ -regular bipartite graphs,” *IEEE Trans. Inform. Theory*, vol. 52, no. 8, pp. 3735–3737, 2006.
- [26] D. B. Chandler, P. Sin, and Q. Xiang, “The invariant factors of the incidence matrices of points and subspaces in  $\mathrm{PG}(n, q)$  and  $\mathrm{AG}(n, q)$ ,” *Trans. Amer. Math. Soc.*, vol. 358, no. 11, pp. 4935–4957, 2006.
- [27] P. Sin and P. H. Tiep, “Rank 3 permutation modules of the finite classical groups,” *J. Algebra*, vol. 291, no. 2, pp. 551–606, 2005.
- [28] C.-Y. Ho, P. Sin, P. Tiep, and A. E. Turull, vol. 63 of *Proc. Sympos. Pure Math.* Amsterdam: De Gruyter, 2004.
- [29] P. Sin, “The  $p$ -rank of the incidence matrix of intersecting linear subspaces,” *Des. Codes Cryptogr.*, vol. 31, no. 3, pp. 213–220, 2004.
- [30] J. M. Lataille, P. Sin, and P. H. Tiep, “The modulo 2 structure of rank 3 permutation modules for odd characteristic symplectic groups,” *J. Algebra*, vol. 268, no. 2, pp. 463–483, 2003.
- [31] N. S. N. Sastry and P. Sin, “On the doubly transitive permutation representations of  $\mathrm{Sp}(2n, \mathbf{F}_2)$ ,” *J. Algebra*, vol. 257, no. 2, pp. 509–527, 2002.
- [32] P. Sin, “The permutation representation of  $\mathrm{Sp}(2m, \mathbf{F}_p)$  acting on the vectors of its standard module,” *J. Algebra*, vol. 241, no. 2, pp. 578–591, 2001.
- [33] N. S. Narasimha Sastry and P. Sin, “Codes associated with nondegenerate quadrics of a symplectic space of even order,” *J. Combin. Theory Ser. A*, vol. 94, no. 1, pp. 1–14, 2001.
- [34] P. Sin, “The elementary divisors of the incidence matrices of points and linear subspaces in  $\mathbf{P}^n(\mathbf{F}_p)$ ,” *J. Algebra*, vol. 232, no. 1, pp. 76–85, 2000.
- [35] M. Bardoe and P. Sin, “The permutation modules for  $\mathrm{GL}(n + 1, \mathbf{F}_q)$  acting on  $\mathbf{P}^n(\mathbf{F}_q)$  and  $\mathbf{F}_q^{n-1}$ ,” *J. London Math. Soc. (2)*, vol. 61, no. 1, pp. 58–80, 2000.
- [36] N. S. N. Sastry and P. Sin, “The code of a regular generalized quadrangle of even order,” in *Group representations: cohomology, group actions and topology (Seattle, WA, 1996)*, vol. 63 of *Proc. Sympos. Pure Math.*, pp. 485–496, Providence, RI: Amer. Math. Soc., 1998.

- [37] P. Sin, “Modular representations of the Hall-Janko group,” *Comm. Algebra*, vol. 24, no. 14, pp. 4513–4547, 1996.
- [38] M. F. Dowd and P. Sin, “On representations of algebraic groups in characteristic two,” *Comm. Algebra*, vol. 24, no. 8, pp. 2597–2686, 1996.
- [39] P. Sin, “Extensions of simple modules for special algebraic groups,” *J. Algebra*, vol. 170, no. 3, pp. 1011–1034, 1994.
- [40] P. Sin, “The cohomology in degree 1 of the group  $F_4$  in characteristic 2 with coefficients in a simple module,” *J. Algebra*, vol. 164, no. 3, pp. 695–717, 1994.
- [41] G. R. Robinson and P. Sin, “A note on Brauer’s induction theorem,” *J. Algebra*, vol. 162, no. 1, pp. 92–94, 1993.
- [42] P. Sin, “Extensions of simple modules for  $G_2(3^n)$  and  ${}^2G_2(3^m)$ ,” *Proc. London Math. Soc. (3)*, vol. 66, no. 2, pp. 327–357, 1993.
- [43] P. Sin, “On the 1-cohomology of the groups  $G_2(2^n)$ ,” *Comm. Algebra*, vol. 20, no. 9, pp. 2653–2662, 1992.
- [44] P. Sin, “Extensions of simple modules for  $SL_3(2^n)$  and  $SU_3(2^n)$ ,” *Proc. London Math. Soc. (3)*, vol. 65, no. 2, pp. 265–296, 1992.
- [45] P. Sin, “On the representation theory of modular Hecke algebras,” *J. Algebra*, vol. 146, no. 2, pp. 267–277, 1992.
- [46] P. Sin, “Extensions of simple modules for  $Sp_4(2^n)$  and  $Suz(2^m)$ ,” *Bull. London Math. Soc.*, vol. 24, no. 2, pp. 159–164, 1992.
- [47] P. Sin and W. Willems, “ $G$ -invariant quadratic forms,” *J. Reine Angew. Math.*, vol. 420, pp. 45–59, 1991.
- [48] P. Sin, “The Green ring and modular representations of finite groups of Lie type,” *J. Algebra*, vol. 123, no. 1, pp. 185–192, 1989.
- [49] P. Sin and W. Willems, “On induced projective indecomposable modules,” *Proc. Amer. Math. Soc.*, vol. 105, no. 4, pp. 793–801, 1989.
- [50] P. K. W. Sin, “A Green ring version of the Brauer induction theorem,” *J. Algebra*, vol. 111, no. 2, pp. 528–535, 1987.