

Peter Dukes

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Research Interests

discrete structures in mathematics, specifically: block designs, error-correcting codes, sequences over finite fields, combinatorial matrix theory, finite geometries, hypergraphs, and extremal combinatorics

Education

Ph.D. Mathematics, California Institute of Technology, June 2003.

M.Sc. Mathematics, University of Toronto, June 1998.

B.Sc. Mathematics, University of Victoria, June 1997.

Employment

University of Victoria: professor, 2004–present, and interim department chair, 2022–2023.

University of Toronto: postdoc, 2003–2004.

Arizona State University: postdoc, 2002–2003.

Awards and Grants

NSERC Discovery Grant, 2005–present. (current annual amount \$24,000)

ICA Hall Medal, 2014.

Craigdarroch Silver Medal, University of Victoria, 2014.

ICA Kirkman Medal, 2007.

NSERC Postdoctoral Fellowship, 2003.

Scott Russell Johnson Prize for distinguished dissertation in mathematics, Caltech, 2002.

Publications

Submitted

C. del Valle and P.J. Dukes, [Balancing permuted copies of multigraphs and integer matrices](#).

Journal Articles

- P.J. Dukes, M. Liu and J. Zhou, [Graph decomposition methods for variance balanced block designs with correlated errors](#). *J. Statist. Plann. Infer.* 222 (2023), 252–260.
- P.J. Dukes and J. Niezen, [Constructions of Sarvate-Beam group divisible designs](#). *Graphs and Combinatorics* 38 (2022), Paper #109, 15 pp.
- P.J. Dukes and E.R. Lamken, [An update on the existence of Kirkman triple systems with subdesigns](#). *J. Combin. Des.* 30 (2022), 581–608.
- P.J. Dukes and J. Niezen, [Number cubes with consecutive line sums](#). *Amer. Math Monthly*, 129 (2022), 336–343.
- F.C. Bowditch and P.J. Dukes, [Local balance in graph decompositions](#). *Graphs and Combinatorics* 38 (2022), Paper #27, 17 pp.
- P.J. Dukes and X. Martinez-Rivera, [Combinatorial properties of the enhanced principal rank characteristic sequence over finite fields](#). *Special Matrices* 10 (2022), 166–179.
- M. Bailey, C. del Valle and P.J. Dukes, [A lower bound on HMOLS with equal-sized holes](#). *Finite Fields Appl.* 74 (2021), Paper #101866, 16 pp.
- Y. Chang, P.J. Dukes and T. Feng, [Leaves for packings with block size four](#). *Australasian J. Combin.* 80 (2021), 281–304.
- P.J. Dukes, F. Ihringer and N. Lindzey, [On the algebraic combinatorics of injections and its applications to injection codes](#). *IEEE Trans. Inform. Theory* 66 (2020), 6898–6907.
- C. del Valle, P.J. Dukes and K. Garaschuk, [The cone of weighted graphs generated by triangles](#). *J. Combin. Math. Combin. Comput.* 116 (2021), 245–268.
- P.J. Dukes and K. Iwasaki, [Incidence structures near configurations of type \$\(n_3\)\$](#) . *Ars Math. Contemporanea* 19 (2020), 17–23.
- P.J. Dukes and D. Horsley, [On the minimum degree required for a fractional triangle decomposition](#). *SIAM J. Discrete Math* 34 (2020), 597–610.
- S. Berge and P.J. Dukes, [A lower bound on permutation codes of distance \$n - 1\$](#) . *Des. Codes Cryptography* 88 (2020), 63–72.
- C. del Valle and P.J. Dukes, [Some new block designs of dimension three](#). *Bull. Inst. Combin. Appl.* 87 (2019), 85–102.
- P.J. Dukes and E.R. Lamken, [Constructions and uses of incomplete pairwise balanced designs](#). *Des. Codes Cryptography* 87 (2019), 2729–2751.
- F.C. Bowditch and P.J. Dukes, [Fractional triangle decompositions of dense 3-partite graphs](#). *J. Combinatorics* 10 (2019), 255–282.
- P.J. Dukes and G. Flowers, [Configurations containing a given linear hypergraph](#). *J. Graph Theory* 87 (2018), 356–361.
- P.J. Dukes and A.C.H. Ling, [Relative difference sets partitioned by cosets](#). *Electronic J. Combin.* 24 (2017), #P3.64.
- N.M.A. Benson and P.J. Dukes, [Pairwise balanced designs covered by bounded flats](#). *Annals of Combinatorics* 20 (2016), 419–431.

- P.J. Dukes, E.R. Lamken and A.C.H. Ling, RGDDs with large groups. *Electronic J. Combin.* 23 (2016), #P4.24.
- P.J. Dukes, A.C.H. Ling and A. Malloch, Thickly-resolvable block designs. *Australasian J. Combin.* 64 (2016), 379–391.
- P.J. Dukes, E.R. Lamken and A.C.H. Ling, An existence theory for incomplete designs. *Canad. Math. Bull.* 59 (2016), 287–302.
- P.J. Dukes, T. Feng and A.C.H. Ling, Matching divisible designs with block size four. *Discrete Math.* 339 (2016), 790–799.
- P.J. Dukes and A.C.H. Ling, Graph divisible designs and packing constructions. *Graphs and Combinatorics* 31 (2015), 2181–2191.
- P.J. Dukes, Generalized laminar families and forbidden configurations. *Order* 32 (2015), 401–408.
- P.J. Dukes and K. Garaschuk, Threefold triple systems with nonsingular N_2 . *Discrete Math.* 338 (2015), 835–838.
- P.J. Dukes and C.M. van Bommel, Mutually orthogonal latin squares with large holes. *J. Statist. Plann. Infer.* 189 (2015), 81–89.
- P.J. Dukes, T. Feng and A.C.H. Ling, A finite embedding theorem for partial Steiner 3-designs. *Finite Fields Appl.* 33 (2015), 29–36.
- P.J. Dukes and J. Niezen, Pairwise balanced designs of dimension three. *Australasian J. Combin.* 61 (2015), 98–113.
- P.J. Dukes and A.C.H. Ling, A three factor product construction for mutually orthogonal latin squares. *J. Combin. Des.* 23 (2015), 229–232.
- M. Bogaerts and P.J. Dukes, Semidefinite programming for permutation codes. *Discrete Math.* 326 (2014), 34–43.
- P.J. Dukes and A.C.H. Ling, Pairwise balanced designs with prescribed minimum dimension. *Discrete Comput. Geom.* 51 (2014), 485–494.
- P.J. Dukes and L. Howard, Group divisible designs in MOLS of order ten. *Des. Codes Cryptography* 71 (2014), 283–291.
- P.J. Dukes, S. Lowdon and G. MacGillivray, Conditional colourings with given template. *Discrete Math. Theoret. Comp. Sci.* 16 (2014), 61–76.
- P.J. Dukes and J. Wodlinger, A Sidon-type condition on set systems. *Journal of Combinatorics* 4 (2013), 449–456.
- P.J. Dukes and J. Short–Gershman, Nonexistence results for tight block designs. *J. Algebraic Combinatorics* 38 (2013), 103–119.
- J.H. Chan, P.J. Dukes, E.R. Lamken and A.C.H. Ling, Asymptotic existence of resolvable group divisible designs. *J. Combin. Des.* 21 (2013), 112–126.
- P.J. Dukes and J. Howell, The orthogonality spectrum for latin squares of different orders. *Graphs and Combinatorics* 29 (2013), 71–78.
- P.J. Dukes and J. Short–Gershman, A complete existence theory for Sarvate-Beam triple systems. *Australasian J. Combin.* 54 (2012), 261–272.

- P.J. Dukes, Coding with injections. *Des. Codes Cryptography* 65 (2012), 213–222.
- P.J. Dukes and J. Howell, Solution to the intersection problem for latin squares of different orders. *J. Combin. Math. Combin. Comput.* 80 (2012), 289–298.
- P.J. Dukes, Rational decomposition of dense hypergraphs and some related eigenvalue estimates. *Linear Algebra Appl.* 436 (2012), 3736–3746.
- P.J. Dukes and A. Malloch, An existence theory for loopy graph decompositions. *J. Combin. Des.* 19 (2011), 280–289.
- P.J. Dukes, P. Hegarty and S. Herke, On the possible orders of a basis for a finite cyclic group. *Electronic J. Combin.* 17 (2010), #R79.
- P.J. Dukes, S. Hurd, and D. Sarvate, It’s hard to be different. *Bull. Inst. Combin. Appl.* 60 (2010), 86–90.
- P.J. Dukes and N. Sawchuck, Bounds on permutation codes of distance four. *J. Algebraic Combinatorics* 31 (2010), 143–158.
- P.J. Dukes and A.C.H. Ling, Linear spaces with small generated subspaces: constructions and applications. *J. Combin. Theory Ser. A.* 116 (2009), 485–493.
- P.J. Dukes and A.C.H. Ling, Existence of balanced sampling plans avoiding cyclic distances. *Metrika* 70 (2009), 131–140.
- P.J. Dukes and E. Mendelsohn, Quasi-embeddings and intersections of latin squares of different orders. *Australasian J. Combin.* 43 (2009), 197–209.
- P.J. Dukes, 2008. PBD closure for adesigns and asymptotic existence of Sarvate-Beam triple systems. *Bull. Inst. Combin. Appl.* 54 (2008), 5–10.
- P.J. Dukes and L. Howard, Small maximally disjoint union-free families. *Discrete Math.* 308 (2008), 4272–4275.
- P.J. Dukes and A.C.H. Ling, Edge-colourings of $K_{n,n}$ with no long two-coloured cycles. *Combinatorica* 28 (2008), 373–738.
- C.J. Colbourn, P.J. Dukes and V. Syrotiuk, Directed complete bipartite graph decompositions: indirect constructions. *Discrete Math.* 308 (2008), 367–374.
- P.J. Dukes, C.J. Colbourn and V. Syrotiuk, Ternary schedules for energy-limited sensor networks. *IEEE Trans. Inform. Theory* 53 (2007), 2791–2798.
- P.J. Dukes and A.C.H. Ling, Asymptotic existence of resolvable graph designs. *Canad. Math. Bull.* 50 (2007), 504–518.
- P.J. Dukes and R.M. Wilson, The cone condition and t -designs. *European J. Combin.* 28 (2007), 1610–1625.
- P.J. Dukes, G. MacGillivray and K. Parton, Bounds on the achromatic number of partial triple systems. *Contrib. Discrete Math.* 2 (2007), 1–12.
- P.J. Dukes and A.C.H. Ling, Linear programming bounds for balanced arrays. *J. Statist. Plann. Inference* 137 (2007), 324–330.
- P. Danziger, P.J. Dukes, E. Mendelsohn and T.S. Griggs, On the intersection problem for Steiner triple systems of different orders. *Graphs Combin.* 22 (2006), 311–329.

- P.J. Dukes, Disjoint partial triple systems of different orders. *Ars Combin.* 80 (2006), 243–246.
- W. Chu, C.J. Colbourn and P.J. Dukes, On constant composition codes. *Discrete Appl. Math.* 154 (2006), 912–929.
- J.H. Dinitz and P.J. Dukes, On the structure of uniform one-factorizations from starters in finite fields. *Finite Fields Appl.* 12 (2006), 283–300.
- P.J. Dukes and A.C.H. Ling, Disjoint union-free designs with block size three. *Bull. Inst. Combin. Appl.* 45 (2005), 5–10.
- J.H. Dinitz, P.J. Dukes and D.R. Stinson, Sequentially perfect and uniform one-factorizations of the complete graph. *Electronic J. Combin.* 12 (2005), #R1.
- P.J. Dukes and E. Mendelsohn, Quasi-embeddings of Steiner triple systems, or Steiner triple systems of different orders with maximum intersection. *J. Combin. Des.* 13 (2005), 120–138.
- W. Chu, C.J. Colbourn and P.J. Dukes, Constructions for permutation codes in powerline communications. *Des. Codes Cryptography* 32 (2004), 51–64.
- P.J. Dukes and A.C.H. Ling, A combinatorial error bound for t -point based sampling. *Theoret. Comp. Sci.* 310 (2004), 479–488.
- J.H. Dinitz, P.J. Dukes and A.C.H. Ling, Sets of three pairwise orthogonal Steiner triple systems. *J. Combin. Theory Ser. A.* 101 (2003), 90–116.
- P.J. Dukes, Orthogonal $\{3\}$ -GDDs with four groups. *Australasian J. Combin.* 26 (2002), 225–232.
- P.J. Dukes, On opposite orthogonal Steiner triple systems of non-prime-power order. *Discrete Math.* 252 (2002), 215–218.
- P.J. Dukes and E. Mendelsohn, Skew-orthogonal Steiner triple systems. *J. Combin. Des.* 7 (1999), 431–440.

Dissertation

- P.J. Dukes, [Convex cone conditions on the structure of designs](#), Caltech, 2003.

Book chapters

- P.J. Dukes and R.M. Wilson, Linear algebra and designs, in: *Handbook of Combinatorial Designs*, 2nd ed., (C.J. Colbourn and J.H. Dinitz, eds.), CRC Press, 2007.
- P.J. Dukes, Permutation codes and arrays, in: *Handbook of Combinatorial Designs*, 2nd ed., (C.J. Colbourn and J.H. Dinitz, eds.), CRC Press, 2007.
- P.J. Dukes and J.H. Dinitz, New lower bounds on the maximum number of mutually orthogonal Steiner triple systems, in: *Designs 2002: Further Combinatorial and Constructive Design Theory*, (W.D. Wallis, ed.), pp. 81–101, Kluwer Academic Publishers, 2002.

Proceedings

C.J. Colbourn, P.J. Dukes and V. Syrotiuk, Generalized cover-free families for topology-transparent channel assignment. *IEEE Pacific Rim Conference on Communications, Computers and Signal Processing* Victoria, BC, Canada (2007), 379–382.

P.J. Dukes, C.J. Colbourn and V.R. Syrotiuk, Topology-Transparent Schedules for Energy Limited Ad hoc Networks. *Proceedings of the IEEE International Workshop on Foundations and Algorithms for Wireless Networking* Pisa, Italy (2006), 85–90.

W. Chu, P.J. Dukes and C.J. Colbourn, Tables for constant composition codes. *Proceedings of the 17th Midwest Conference on Combinatorics, Cryptography and Computing*, *J. Combin. Math. Combin. Comput.* 54 (2005), 57–65.

Expository articles

P.J. Dukes, Latin squares and Sudoku. *Crux Mathematicorum* 42 (2016), 308–312.

P.J. Dukes, On the dimension of finite linear spaces. *CMS Notes* 46 (2014), 14–15.

Presentations*Invited or keynote conference talks*

British Combinatorial Conference, Durham, UK (online), 2021.

Midwest Conference on Combinatorics and Combinatorial Computing, Carrollton, GA, 2017.

Canadian Undergraduate Mathematics Conference, Victoria, BC, 2017.

Combinatorics 2016, Maratea, Italy, 2016.

Conference in Honour of Chris Godsil, Waterloo, ON, 2014.

Coast Combinatorics Conference, Victoria, BC, 2014.

Shanghai Conference on Algebraic Combinatorics, Shanghai, China, 2012.

Other talks

Algebraic graph theory seminar, Waterloo, ON (online), 2021.

Canadian Mathematical Society minisymposium on graph decompositions (online), 2021.

European Congress of Mathematics design theory session, Slovenia (online), 2021.

CanADAM minisymposium on design theory, Vancouver, BC, 2019.

Beijing Jiaotong University, Beijing, China, 2017.

University of Bristol, Bristol, UK, 2017.

Design theory special session, Joint Math Meeting, Seattle, WA, 2016.

Design theory minisymposium, CMS Summer Meeting, Charlottetown, PEI, 2015.

SIAM Discrete Math Conference, Minneapolis, MN, 2014.

Memberships/Fellowships

Association for Women in Mathematics
American Mathematical Society
Canadian Mathematical Society
Mathematical Association of America
Combinatorial Mathematics Society of Australasia
Institute of Combinatorics and its Applications

Academic Service

Putnam math competition grader, 2021.
Graduate director, Mathematics and Statistics, University of Victoria, 2012-2017.
Undergraduate service (advising, curriculum, awards, contests), University of Victoria, 2004-present.
Volunteer textbook narrator, Canadian National Institute for the Blind, 2003-2004.
Various math outreach events with local schools
Conference organization work
Grant reviews
Doctoral external examining assignments
Refereeing and published reviews for several manuscripts

Editorships

Journal of Combinatorial Designs, 2019-present.
Bulletin of the Institute of Combinatorics and its Applications, 2016-present.
Discrete Mathematics, 2012-present.

Teaching experience

Various mathematics courses, University of Victoria, 2004-present
(matrix and linear algebra, introduction to logic and proofs, introductory discrete mathematics, geometry, algebraic coding theory, combinatorial designs, enumeration and Ramsey theory)
Computer science courses, Arizona State University, 2002-2003
(logic, formal languages)
Teaching assistantships at Caltech, University of Toronto, and University of Victoria, 1996-2002.

Supervision

Graduate students

Tao Gaede, M.Sc., 2022.
Abel Romer, M.Sc., 2022.
Joanna Niezen, Ph.D., 2021.
Flora Bowditch, M.Sc., 2019.
Meixin Liu, M.Sc., 2019.
Amanda Malloch, M.Sc. and Ph.D., 2016.
Christopher van Bommell, M.Sc., 2015.
Garret Flowers, Ph.D., 2015.
Kseniya Garaschuk, Ph.D., 2014.
Joanna Niezen, M.Sc., 2014.
Jared Howell, Ph.D., 2010.
Justin Chan, M.Sc., 2010.
Lea Howard, M.Sc. and Ph.D., 2009.

Undergraduate research students

Gabriel Crudele, Undergraduate Research Award, 2022.
Coen del Valle, SURA, 2019, and USRA, 2020.
Jonathan Skinnider, NSERC USRA, 2019.
Yakov Shklarov, NSERC USRA, 2018.
Songfeng Wu, Jamie Cassels Undergraduate Research Award, 2017-2018.
Jake Zimmerman, Jamie Cassels Undergraduate Research Award, 2016-2017.
Flora Bowditch, NSERC USRA, 2016.
Nicholas Benson, NSERC USRA, 2014.