

CURRICULUM VITAE

PENGFEEI GUAN

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Education:

Ph.D in Mathematics (1989), Princeton University (advisor: J.J. Kohn).
M.S. in Mathematics (1986), Princeton University.
B.S. in Mathematics (1982), Zhejiang University, China.

Awards:

Alfred P. Sloan Fellowship (1993-1995).

Honors:

Distinguished James McGill Professor (May 2019-)
Canada Research Chair (Tier I, April 2005- March 2019),
Fellow of Royal Society of Canada (inducted in 2008).
Queen Elizabeth II Diamond Jubilee Medal (2012)

Employment:

Assistant Professor (1989-1993, McMaster University)
Associate Professor (1993-1997, McMaster University)
Professor (1997-2004, McMaster University).
Professor (2004-, McGill University)

Research Interest:

Nonlinear Partial Differential Equations and Geometric Analysis.

Research Funding:

I have been supported by NSERC grants since 1989.

Publication:

- (1) C. Chen, P. Guan, J. Li, J. Scheuer, *A fully nonlinear flow and quermass-integral inequalities*, to appear Special Issue for 90th Birthdays of Joseph Kohn, in Pure Applied Math Quarterly.
- (2) P. Guan and L. Li, *Isoperimetric type inequalities and hypersurface flows*, (submitted in 2019, accepted in Jan. 2020) to appear in Special Issue for 70th Birthdays of Alice Chang and Paul Yang, Journal of Mathematical Study.
- (3) P. Guan and X. Zhang, *A class of curvature type equations*, to appear Special Issue for 70th Birthdays of Doung Phong, in Pure Applied Math Quarterly.
- (4) P. Guan and G. Qiu, *Interior C^2 regularity of convex solutions to prescribing scalar curvature equations*, Duke Math. Journal, V. 168 (2019), 1641-1663.
- (5) P. Guan, J. Li and M-T. Wang, *A Volume Preserving Flow and the Isoperimetric Problem in Warped Product Spaces*, Transactions AMS. Vol. 372, (2019), 2777-2798.
- (6) P. Guan and C. Xia, *L^p Christoffel-Minkowski problem: the case $1 < p < k + 1$* , Calculus of Variations and PDEs, 2018.
- (7) P. Guan, *The Weyl and Minkowski Problems, Revisited*, Proceedings of Non-linear Equations, the Harvard University Center of Mathematical Sciences and Applications, 2018.
- (8) P. Guan and J. Li, *A Fully nonlinear flow and quermassintegral inequalities*, Science China Mathematics, V.48, (2018) 147-156.
- (9) P. Guan and L. Ni, *Entropy and a convergence theorem for Gauss curvature flow in high dimension*, Journal of European Mathematical Society, V.19, (2017), 3735-3761.
- (10) P. Guan and S. Lu, *Curvature estimates for immersed hypersurfaces in Riemannian manifolds*, Inventiones Mathematicae, V.208, (2017), 191-215.
- (11) B. Andrews, P. Guan and L. Ni, *Flow by the power of the Gauss curvature*. Advances in Mathematics, V. 299, (2016), 174-201.
- (12) P. Guan, P. Lu and Y. Xu, *A rigidity theorem for codimension one shrinking gradient Ricci solitons in \mathbb{R}^{n+1}* , Calculus of Variations and PDEs, Volume 54, pp 4019-4036, 2015
- (13) P. Guan, Z. Wang and X. Zhang, *A proof of the Alexanderov's uniqueness theorem for convex surfaces in \mathbb{R}^3* , Ann. Inst. H. Poincare Anal. Non Lineaire, V. 33 (2016), 329-336.
- (14) P. Guan and X. Shen, *A Rigidity Theorem for hypersurfaces in higher dimensional space forms*, Contemporary Mathematics, AMS. V.644, 2015. pp. 61-65.
- (15) P. Guan and J. Li, *A mean curvature flow in space form*, International Mathematics Research Notices, Vol. 2015, NO. 13, (2015) 4716-4740.

- (16) P. Guan, C. Ren and Z. Wang, *Global C^2 estimates for convex solutions of curvature equations*, Communications on Pure and Applied Mathematics. V. 68, (2015), 1287-1325,
- (17) P. Guan and L. Xu, *Convexity estimates for level sets of quasiconcave solutions to fully nonlinear elliptic equations*. Journal fur die reine und angewandte Mathematik reine angew.V.680, (2013) 41-67.
- (18) P. Guan and X. Zhang, *Regularity of the geodesic equation in the space of Sasakian metrics*, Advances in Mathematics, Volume 230, (2012) 321-371.
- (19) P. Guan and D. Phong, *A maximum rank problem for degenerate elliptic fully nonlinear equations* , Math. Ann. 354 (2012), 147-168.
- (20) P. Guan, J. Li and Y.Y. Li, *Hypersurfaces of prescribed curvature measures*, Duke Math. Journal, Vol. 161, No. 10 (2012), 1927-1942.
- (21) P. Guan and D. Phong, *Partial Legendre transforms of nonlinear equations*. Proc. AMS. , 140 (2012), 3831-3842.
- (22) B. Bian, P. Guan, X. Ma and L. Xu, *A constant rank theorem for quasiconcave solutions of fully nonlinear partial differential equations*. Indiana University Mathematics Journal, Vol. 60, (2011) 101-120.
- (23) P. Guan and X. Zhang, *A Geodesic equation in the space of Sasakian metrics*, Geometry and Analysis I (2011), pp. 303-318. Ed. Lizhen Ji, Advanced Lectures in Mathematics, International Press.
- (24) P. Guan, *Remarks on the homogeneous complex Monge-Ampère equation*, Complex Analysis, Trends in Mathematics, Spriner Basel AG. (2010), 175-185.
- (25) B. Bian and P. Guan, *A structural condition for microscopic convexity principle*, Discrete and continuous dynamical systems Volume 28, (2010) 789-807.
- (26) P. Guan, Q. Li and X. Zhang, *A uniqueness theorem in Kähler geometry*, Math. Ann. Vol. 345, (2009) 377-393.
- (27) P. Guan and J. Li, *The quermassintegral inequalities for k -convex starshaped domains*, Advances in Mathematics 221 (2009) 1725-1732.
- (28) B. Bian and P. Guan, *A Microscopic Convexity Principle for Nonlinear Partial Differential Equations*, Inventiones Mathematicae, V. 177, (2009), 307-335.
- (29) P. Guan, C.S. Lin and X. Ma, *The Existence of Convex Body with Prescribed Curvature Measures* International Mathematics Research Notices, Vol. 2009, (2009) 1947-1975.
- (30) P. Guan and E. Sawyer, *Regularity of Subelliptic Monge-Ampère Equations in the Plane*, Transactions of American Mathematical Society, Vol. 361, No. 9, (2009), 4581-4591.
- (31) P. Guan, X. Ma, N. Trudinger and X. Zhu, *A form of Alexandrov-Fenchel inequality*, Pure and Applied Mathematics Quarterly, V. 6, (2010), 999-1012.

- (32) B. Bian and P. Guan, *Convexity Preserving for Fully Nonlinear Parabolic Integro-Differential Equations*, Methods and Applications of Analysis, Vol. 15 (2008), 39-51.
- (33) L. Caffarelli, P. Guan and X. Ma, *A constant rank theorem for solutions of fully nonlinear elliptic equations*, Communications on Pure and Applied Mathematics. V. 60, (2007), 1769-1791.
- (34) P. Guan, C.S. Lin and G. Wang, *Local gradient estimates for quotient equations in conformal geometry* International Journal of Mathematics, Vol. 18, No. 4 (2007) 349-361 .
- (35) P. Guan and G. Wang, *Conformal deformations of the smallest eigenvalue of the Ricci tensor*, American Journal of Mathematics, Vol. 129, (2007), 499-526.
- (36) P. Guan, X. Ma and F. Zhou, *The Christoffel-Minkowski problem III: existence and convexity of admissible solutions*, Communications on Pure and Applied Mathematics, V.59, (2006) 1352-1376.
- (37) P. Guan, C.S. Lin and X. Ma, *The Christoffel-Minkowski problem II: Weingarten curvature equations*, Chinese Annals of Mathematics, Series B. Vol. 27B(6), (2006), 595-614.
- (38) P. Guan, C.S. Lin and G. Wang, *Schouten tensor and some topological properties*, Communications in Analysis and Geometry, V.13, No. 5, 2005, pp. 887-902.
- (39) P. Guan and G. Wang, *Geometric inequalities on locally conformally flat manifolds*, Duke Math. Journal, V.124, (2004), 177-212.
- (40) P. Guan and X. Ma, *Convex solutions of elliptic differential equations in classical differential geometry*, C"Geometric Evolution Equations", Workshop on Geometric Evolution Equations, Edited by S. Chang, B. Chow, S. Chu and C.S. Lin, Contemp Math. V.367, AMS. pp. 115-128.
- (41) P. Guan, C.S. Lin and G. Wang, *Application of The Method of Moving Planes to Conformally Invariant Equations*, Mathematische Zeitschrift, V. 247 (2004), pp. 1-19.
- (42) P. Guan and X. Ma, *Christoffel-Minkowski problem I: convexity of solutions of a Hessian equation*, Inventiones Mathematicae, V.151 (2003), 553-577.
- (43) P. Guan and G. Wang, *Local estimates for a class of fully nonlinear equations arising from conformal geometry*, International Mathematics Research Notices, V. 2003, Issue 26(2003), 1413-1432.
- (44) P. Guan, *Nonlinear Degenerate Elliptic Equations*, Proc. of ICCM2001, Taiwan, 2001. Edited by C.S. Lin, L. Yang and S.T. Yau, International Press, (2004), 257-266.

- (45) P. Guan and G. Wang, *A fully nonlinear conformal flow on locally conformally flat manifolds*, Journal fur die reine und angewandte Mathematik, V. 557 (2003), 219-238.
- (46) P. Guan, J. Viaclovsky, G. Wang, , *Some properties of the Schouten tensor and applications to conformal geometry*, Transactions of American Math. Society, V.355 (2003), 925-933.
- (47) P. Guan, *Extremal Function associated to Intrinsic Norms*, Annals of Mathematics, 156(2002), 197-211.
- (48) B. Guan and P. Guan, *Convex Hypersurfaces of Prescribed Curvature*, Annals of Mathematics, 156(2002), 655-674.
- (49) P. Guan, N. Trudinger and X. J. Wang, *Boundary regularity for degenerate Monge-Ampere equations*, Acta Math. 182, (1999), 87-104.
- (50) P. Guan and X. Wang, *On a Monge-Ampere Equations Arising in Geometric Optics*, Journal of Diff. Geometry, 48, (1998), 205-222.
- (51) P. Guan and E. Sawyer, *Oblique Derivative Problem*, CRM Proc. and Lecture Notes, Vol.12 (1997), 145-158.
- (52) P. Guan, *C^2 A Priori Estimates for Degenerate Monge-Ampere Equations*, Duke Math. Journal, 86, (1997), 323-346.
- (53) P. Guan, *Quasilinear Degenerate Elliptic Equations in Divergence Form*, Contemporary Math., AMS, 205, (1997), 93-100.
- (54) P. Guan and Y. Li, *$C^{1,1}$ Regularity for Solutions of a Problem of Alexandrov*, Comm. Pure and Appl. Math., 50, (1997), 789-811.
- (55) P. Guan, *Regularity of a Class of Quasilinear Degenerate Elliptic Equations*, Advances in Mathematics, Vol. 132(1997), 24-45.
- (56) P. Guan and E. Sawyer, *Regularity Estimates for Oblique Derivative Problem on Nonsmooth Domains (II)*, Chinese Ann. Math., Ser. B, 17, (1996), 1-36.
- (57) P. Guan and E. Sawyer, *Regularity Estiamtes for Oblique Derivative Problem on Nonsmooth Domains (I)*, Chinese Ann. Math., Ser. B, 16, (1995), 299-324.
- (58) P. Guan and Y. Li, *On Weyl Problem With Nonnegative Gauss Curvature*, Journal of Differential Geometry, 39 (1994), 331-342.
- (59) P. Guan and E. Sawyer, *Regularity Estimates of Oblique Derivative Problem*, Annals of Mathematics, 137, (1993), 1-70.
- (60) P. Guan, *On An Example of Subelliptic Boundary Value Problem*, Proc Symposia in Pure Math.,AMS, 52 (1991), 173-177.
- (61) P. Guan, *Holder Regularity of Subelliptic Pseudo-differential Operators*, Duke Math. Journal, 60 (1990), 563-598.

Lecture Notes:

- (1) P. Guan, *Monge-Ampère Equations and Related Topics*, Morningside Institute, Academic Sinica, Beijing, China, 1998.
- (2) P. Guan, *Topics Geometric fully nonlinear equations*, lecture notes, 170-page manuscript (2004).
- (3) P. Guan, *Curvature measures, isoperimetric type inequalities and fully nonlinear PDEs*, "Fully Nonlinear PDEs in Real and Complex Geometry and Optics", Springer Lecture notes in Mathematics 2087, CIME, Italy, July (2012).
- (4) P. Guan, *Monge-Ampère Type Equations and Related Geometric Problems*, Lecture notes at Mini-School of Nonlinear Equations, Harvard University, December 3-4, 2016.

Recent Invited Talks 2017–:

- (1) *The Weyl isometric embedding problem to general 3D Riemannian manifolds*, Geometric Analysis Colloquium at Fields, University of Toronto, March 3, 2017.
- (2) *Isometric Embeddings, Geometric Inequalities and Nonlinear PDEs*, Colloquium, University of Miami, April 12, 2017.
- (3) *The isoperimetric problem in general manifolds and a mean curvature type flow*, Colloquium, Florida Central University, April 14, 2017.
- (4) Intermediate L^p -Christoffel-Minkowski problem, seminar, Columbia University, April 20, 2017.
- (5) *Regularity estimates for scalar curvature equations.*, Baltimore-Washington Metro Area Differential Geometry Seminar, April 22, 2017.
- (6) *An isometric embedding problem and related geometric inequalities*, Seminar talk at UBC, October 24, 2017.
- (7) *Isotropic flow by power of the Gauss curvature*, Workshop on Mean Curvature Flow and Ricci Flow, Fields Institute, November 8, 2017.
- (8) *Interior estimate for convex solutions of scalar curvature equation and σ_2 -Hessian equation*, International conference on Nonlinear PDEs and Applications, Zhejiang University, China, December 14, 2017.
- (9) *C^2 Interior estimate for convex solutions of prescribing scalar curvature equation*, Seminar talk, Rutgers University, March 6, 2018.
- (10) *Evolving of convex hypersurfaces according functions of Gauss curvature*, seminar talk, the Vienna University of Technology, July 13, 2018.
- (11) *Regularity estimates for scalar curvature equation*, seminar talk, the Jagiellonian University, July 16, 2018.
- (12) *Interior C^2 estimates for immersed hypersurfaces in R^{n+1}* , Conference on Geometric PDEs in Freiburg 2018, July 27, 2018.

- (13) *Interior curvature estimates for immersed hypersurfaces in R^{n+1}* , seminar talk, Harvard University, November 6, 2018.
- (14) *Interior C^2 estimates for σ_2 -Hessian equation*, Workshop on Nonlinear PDEs, Columbia University, November 30-December 1, 2018.
- (15) *Flows of hypersurfaces by curvatures and applications to sharp geometric inequalities*, Workshop on nonlinear problems in geometry, the City University of New York, April 4, 2019.
- (16) *Entropy and anisotropic flow by power of Gauss curvature*. Special session on Geometric Analysis and Nonlinear PDE's. The AMS Sectional Meeting at University of Connecticut Hartford, April 13, 2019.
- (17) *Constrained hypersurface flows and sharp isoperimetric type inequalities in convex geometry*, workshop on Symmetry and Convexity in Geometric Inequalities, American Institute of Mathematics, San Jose, May 22, 2019.
- (18) *Isometric embedding problems and regularity of scalar curvature equation*, RTG Conference on Geometric Analysis and Diversity in Mathematics Festival, Princeton University, June 19, 2019.
- (19) *Constrained hypersurface flows and isoperimetric type inequalities*, The Fifth Japan-China Geometry Conference, Ritsumeikan University, Biwako-Kusatsu Campus, Japan, September 4, 2019.
- (20) *The Weyl problem and isometric embedding of surfaces in 3-manifolds*, seminar at RIMS, Kyoto University, October 8, 2019.
- (21) *Isoperimetric inequalities and nonlinear geometric evolution equations*, the Hua Loo Keng Lecture, University of Science and Technology of China, HeFei, China October 17, 2019.
- (22) *Minkowski type inequalities in space form: results and open problems*, seminar talk, University of Science and Technology of China, HeFei, China, October 18, 2019.
- (23) *On a class of Hessian type equations*, seminar talk, Fudan University, Shanghai, China, October 21, 2019.
- (24) *Locally constrained hypersurface flows*, 2020 International Conference on PDEs and Geometric Analysis, Shanghai Jiaotong University, July 8, 2020.
- (25) *A mean curvature type flow and isoperimetric problem in warped product spaces*, Geometric and Functional Inequalities and Applications, University of Connecticut, August 31, 2020.

Supervision of the graduate students 2017–:

Ph.D. Completed:

- (1) Siyuan Lu (2017, Hill assistant professor at Rutgers University 2017-2019, tenure-track assistant professor at McMaster University 2019-), On a class of fully nonlinear equations and their applications in geometry

- (2) Shaodong Wang (2019, co-supervisor, a postdoctoral fellow in Shanghai Jiaotong University). Compactness and Noncompactness of Yamabe-type Problems on Manifolds with Boundary

Ph.D. current:

- (1) Fengrui Yang, (2017-, Supervisor, he is completing the degree, has accepted a 6-year position at Freiburg University, German)
- (2) Jinzhou Huang, (2018, Supervisor)
- (3) Bart Syroka (2020,co-supervision)
- (4) Edward Chernysh (2020,co-supervision)

MSc.:

- (1) Edward Chernysh (2018-2020, co-supervision, Ph.D. student at McGill now).
- (2) Bart Syroka (2019-2020, co-supervision)
- (3) Andrew Lavigne (2020-, co-supervision, Ph.D. student at McGill now)

Supervisorships of postdoctoral fellows 2017–:

- (1) Rohit Jain (8-2016 to 8-2018, co-supervisor, now at Lawrence Livermore National Laboratory), Regularity of the obstacle problems
- (2) Guohuan Qiu (8-2016 to 8-2018, now an assistant professor at Chinese university of Hong Kong). interior estimates for convex solutions of scalar curvature equation.
- (3) Saikat Mazumdar (9-2018-5-2019, now in Tata Institute, India), Blow up analysis for nonlinear PDEs.
- (4) Jiawei Liu (1-2020-12-2020), now in University of Magdeburg, German

Supervision of undergraduate students summer research 2017–:

- (1) Dragos Cristian Manta (2018), Basics of nonlinear partial differential equations.
- (2) Maia Darmon (2019), Curve shorting flow.
- (3) Tomer Moran (2020), Isometric embedding problem.

Administrative Responsibilities

internal

- Departmental Graduate Affair Committee (2019–)
- Senate Pool for Statutory Selection Committees, McGill University (2018-)
- Departmental Hiring committee for geometry position (2017-2018)
- Departmental Undergraduate Affair Committee (2014-2019)

external

- Scientific Advisory Committee of Banff International Research Station (2017-)

Scientific Committee, Morningside Center of Mathematics, Chinese Academy of Sciences (2017-)

NSERC grant selection committee (CGA337, 2006-2007, 2014-2017)

Organization of conferences and workshops (as organizer or co-organizer):

Geometric Analysis, Mathematical Congress of Americans, session organizer, July 2017.

Workshop on geometric analysis, CRM, March 23-17, 2018.

A Celebration of Geometry, Analysis and Physics. Conference honouring Niky Kamran on his 60th birthday, CRM, June 10-14, 2019