

PAUL MATTHEW NIALL FEEHAN

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RESEARCH INTERESTS

Non-linear elliptic and parabolic partial differential equations; differential geometry; mathematical physics; Yang-Mills gauge theory; harmonic maps; relationship between Yang-Mills and Seiberg-Witten Floer homologies of three-manifolds; four-dimensional manifolds; geometric flows and applications to low-dimensional topology

EDUCATION

- **Columbia University**, New York, New York
Doctor of Philosophy in Mathematics 1992
(*Advisor*: Duong Hong Phong)
- Master of Philosophy in Mathematics 1988
- **University of Southern California**, Los Angeles, California
Master of Arts in Mathematics 1987
- **University of Missouri**, Rolla, Missouri
Master of Science in Electrical Engineering 1984
- **University College Dublin**, Dublin, Ireland
Bachelor of Engineering in Electronic Engineering (First class honors) 1982

EXPERIENCE

Full-time positions

- **Rutgers, The State University of New Jersey**, New Brunswick, New Jersey
Professor of Mathematics July 2014–
Associate Professor of Mathematics 2001–June 2014
- **University of Dublin (Trinity College)**, Dublin, Ireland
Professor of Mathematics (1762 Erasmus Smith Chair) 2000–2001
- **Ohio State University**, Columbus, Ohio
Associate Professor of Mathematics (with tenure) 2000–2001
Assistant Professor of Mathematics 1997–2000
- **Harvard University**, Cambridge, Massachusetts
National Science Foundation Postdoctoral Fellow 1993–1997
(*Mentor*: Clifford Henry Taubes)
- **Mathematical Sciences Research Institute**, Berkeley, California
Postdoctoral Research Fellow 1992–1993

Courtesy positions

- **Dublin Institute for Advanced Study**, Ireland 2016–
Research Associate

Visiting positions and invited short research visits

- Institute for Mathematical Sciences, Chinese University of Hong Kong January 2018
- Institute for Advanced Study, Princeton (Summer Collaborator Program) July 2017
- Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette June 2017
- Simons Center for Geometry and Physics, Stony Brook January-April, 2017
- Mathematisches Forschungsinstitut, Oberwolfach (Research in Pairs) August 2016
- Institute for Advanced Study, Princeton (Competitive Fellowship Leave) 2015–2016
- Mathematisches Forschungsinstitut, Oberwolfach (Partial Differential Equations) August 2015
- Isaac Newton Institute for Mathematical Sciences, Cambridge July 2015
- Max Planck Institut für Mathematik, Bonn June–August 2015
- Max Planck Institut für Mathematik, Bonn January 2015
- Centre for Quantum Geometry of Moduli Spaces, Aarhus August 2014
- Hausdorff Research Institute for Mathematics, Bonn July 2014
- Isaac Newton Institute for Mathematical Sciences, Cambridge June 2014
- Mittag-Leffler Institute, Stockholm January 2014
- Max Planck Institut für Mathematik, Bonn June–August 2013
- Columbia University, Visiting Associate Professor of Mathematics 2012–2013
- Max Planck Institut für Mathematik, Leipzig January 2013
- Max Planck Institut für Mathematik, Leipzig May–August 2012
- JP Morgan, New York Mar 2005–2006
- NSF academic-industry cooperation program
- Bloomberg, New York Jun 2004–Feb 2005
- NSF academic-industry cooperation program
- Max Planck Institut für Mathematik, Bonn January 2005
- Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette August 2004
- Max Planck Institut für Mathematik, Bonn January 2004
- Max Planck Institut für Mathematik, Bonn July 2003
- Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette August 2003
- Max Planck Institut für Mathematik, Bonn January 2003
- Max Planck Institut für Mathematik, Bonn June–September 2001
- Max Planck Institut für Mathematik, Bonn March–September 2000
- Max Planck Institut für Mathematik, Bonn September 1999
- Institute for Advanced Study, Princeton 1998–1999
- Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette July–September 1998
- Max Planck Institut für Mathematik, Bonn April–June 1998

HONORS

- Fellow of the American Mathematical Society, class of 2019

RESEARCH GRANTS

External research grants pending

- NSF DMS-1906363, Geometric Analysis program, “Collaborative Research: Instantons, monopoles, and low-dimensional manifolds”, July 1, 2019 through June 30, 2022, \$240,650 (principal investigator)
- NSF DMS-1840300, Geometric Analysis program, “RTG: Integrative Career Development in Geometric Analysis at Rutgers”, July 1, 2019 through June 30, 2024, \$1,340,786 (co-principal investigator)
- Simons Foundation, Simons Fellows in Mathematics program, July 1, 2019 through June 30, 2020, \$65,201 (principal investigator)

External research grants awarded

- NSF DMS-1713013, Probability program, “Mathematical Finance, Probability, and Partial Differential Equations Conference”, May 1, 2017 through April 30, 2018, \$20,000 (principal investigator)
- NSF DMS-1611717, Geometric Analysis program, “Geometric Analysis Conferences and Seminars: October 27-28, 2016, 2017, and 2018”, July 1, 2016 through June 30, 2019, \$30,000 (principal investigator)
- Simons Foundation Collaboration Grants for Mathematicians, “Partial Differential Equations in Geometric Analysis”, September 1, 2015 through August 31, 2020, \$35,000 (principal investigator)
- NSF DMS-1510064, Geometric Analysis program, “Collaborative research: instantons, monopoles, and relations among their Invariants”, June 1, 2015 through May 31, 2018, \$211,158 (principal investigator)
- NSF DMS-1266145, Analysis program, conference grant, “Analysis, complex geometry, and mathematical physics”, January 1, 2013 through December 31, 2013, \$49,990 (co-principal investigator)
- NSF DMS-1237722, Applied mathematics program, conference grant, “AMC-SS: mathematical finance and partial differential equations conference”, September 1, 2012 through August 31, 2013, \$25,000 (principal investigator)
- NSF DMS-1059206, Applied mathematics program, conference grant, “Conference on mathematical finance and partial differential equations”, December 1, 2010 through May 31, 2012, \$20,000 (principal investigator)
- NSF DMS-0408269, Interdisciplinary grants in mathematical sciences program, “Mathematical finance”, June 1, 2004 through May 31, 2008, \$100,000 (principal investigator)
- NSF DMS 0125170, Geometric analysis program, “Gauge theory and low-dimensional topology”, July 1, 2001 through June 30, 2004, \$95,550,000 (principal investigator)
- Enterprise Ireland basic research grant (Mathematics), 2001, €100,000 (principal investigator)
- NSF DMS 9704174, Geometric analysis program, “Gauge theory and the topology of smooth four-manifolds”, June 1, 1997 through May 31, 2000, \$75,000 (principal investigator)
- NSF Mathematical Sciences Postdoctoral Fellowship, July 1, 1993 through June 30, 1997

Internal research grants awarded

- Academic Initiatives Program award, Department of Mathematics, Rutgers University, May 2016, \$3,000 to support Mathematical Finance, Probability, and Partial Differential Equations Conference, May 2017
- Academic Initiatives Program award, Department of Mathematics, Rutgers University, May 2016, \$3,000 to support a collaborator visit to Rutgers
- Academic Initiatives Program award, Department of Mathematics, Rutgers University, May 2015, \$4,300 for research travel
- Academic Initiatives Program award, Department of Mathematics, Rutgers University, November 2014, \$3,800 for research travel
- Academic Initiatives Program award, Department of Mathematics, Rutgers University, April 2014, \$4,800 for research travel
- Academic Initiatives Program award, Department of Mathematics, Rutgers University, December 2013, \$6,500 for research travel

- Academic Initiatives Program award, Department of Mathematics, Rutgers University, June 2013, \$4,500 for research travel
- Academic Initiatives Program award (with Daniel Ocone), Department of Mathematics, Rutgers University, 2013, \$1,300 for postdoctoral researcher travel
- Academic Initiatives Program award, Department of Mathematics, Rutgers University, 2012, \$4,000 for research travel
- Academic Initiatives Program award, Department of Mathematics, Rutgers University, 2011, \$2,500 for research travel and \$4,500 for Ph.D. student research support
- Academic Initiatives Program award, Department of Mathematics, Rutgers University, 2009, \$2,000 for research travel
- Ohio State University Research Foundation Seed Grant Award, Ohio State University, 1998, \$2,000

ACADEMIC SERVICE

Conferences co-organized

- “Geometric analysis”, Rutgers University, New Brunswick, New Jersey, November 14-16, 2018
- “Geometric analysis”, Rutgers University, New Brunswick, New Jersey, November 16-17, 2017
- “Mathematical finance, probability, and partial differential equations”, May 17-19, 2017
- “Geometric analysis”, Rutgers University, New Brunswick, New Jersey, October 27-28, 2016
- “Partial differential equations and geometric analysis”, mini-symposium, SIAM conference on analysis of partial differential equations, Scottsdale, Arizona, December 2015
- “Geometric analysis”, special session, AMS Fall Eastern Sectional Meeting, New Brunswick, New Jersey, November 14-15, 2015
- “Geometric analysis”, Rutgers University, New Brunswick, New Jersey, November 12-13, 2015
- “Free boundary and obstacle problems for nonlinear and non-local operators”, mini-symposium, SIAM conference on analysis of partial differential equations, Lake Buena Vista, Florida, December 2013
- “Partial differential equations, stochastic analysis, and applications to mathematical finance”, special session, AMS Fall Eastern Sectional Meeting, Philadelphia, Pennsylvania, October 2013
- “Martingale and stochastic representation problems for degenerate differential operators”, special session, 36th Conference on Stochastic Processes and their Applications, Boulder, Colorado, July 2013
- “Mathematical finance, stochastic analysis, and partial differential equations”, special session, Joint International Meeting of the AMS and the Romanian Mathematical Society, Alba Iulia, Romania, June 2013
- “Analysis, complex geometry, and mathematical physics: a conference in honor of D. Phong”, Columbia University, New York, May 2013
- “Mathematical Finance, stochastic analysis, and degenerate partial differential equations”, SIAM conference on financial mathematics and engineering, Minnesota, Minnesota, July 2012
- “Mathematical finance and partial differential equations”, New Brunswick, New Jersey, 2009-2016
- SIAM conference on financial mathematics and engineering, New Brunswick, New Jersey, 2008

Seminars organized

- “Geometric analysis” (with Natasa Sesum), Rutgers University 2014–present
- “Mathematical finance, probability, and PDE seminar”, Rutgers University 2007–2014
- “Gauge theory and topology seminar”, University of Dublin, Ireland 2000–2001
- “Analysis and geometry seminar”, Ohio State University, Columbus 1997–2000

Professional activities

- *Reviewer for various journals and agencies:* Annals of Global Analysis and Geometry, Bulletin of the Iranian Mathematical Society, Commentarii Mathematici Helvetici, Communications in Analysis and Geometry, Communications in Mathematical Physics, Crelle's Journal, Forum Mathematicum, Indiana University Journal of Mathematics, Journal of Differential Geometry, Journal of Geometric Analysis,

Mathematics Research Letters, NSF-DMS panelist and external reviewer, Pacific Journal of Mathematics, Simons Foundation, Topology and its Applications.

- Mathematics doctoral defense committees: Columbia University 2002–2003
- NSF Division of Mathematical Sciences, reviewer 1992
- NSF Division of Mathematical Sciences, panelist 2015
- SIAM Financial Mathematics Activity Group, program director 2006–2008
- Simons Foundation Collaboration Grants Review Committee 2013

Membership on doctoral dissertation defense committees

- Phi Long Nguyen Thanh (Advisor: Professor Duong H. Phong, Department of Mathematics, Columbia University, New York, New York) April 2003
- Adrian Clingher (Advisor: Professor John W. Morgan, Department of Mathematics, Columbia University, New York, New York) April 2002

Membership on Ph.D. oral exam committees

- Alexander Zarechnak (Advisor: Professor Sheldon Goldstein, Department of Mathematics, Rutgers University, New Brunswick) May 2003
- Qinian Jin (Advisor: Professor Yanyan Li, Department of Mathematics, Rutgers University, New Brunswick) February 2003

Department of Mathematics, Rutgers University

- Graduate Committee (Geometry & Topology) 2018–2020
- Personnel Planning and Policy Committee (Geometry & Topology) 2017–2019
- Personnel Planning and Policy Committee (At Large) 2016–2017
- Personnel Planning and Policy Committee (Geometry & Topology) 2014–2015
- Search Committee Chair, Mathematical finance and stochastic analysis 2012–2016
- Program director and founder, mathematical finance master’s program 2005–present
- Computer Advisory Committee 2002–2004
- Written Qualifying Exam Committee 2001–2003
- Colloquium Committee 2001–2004

Graduate School, Rutgers University

- Mathematics and Physical Sciences Area Committee 2007–2009

School of Arts and Sciences, Rutgers University

- A&P Committee for Promotion to Rank of Professor I 2015–2017

Association of Members of the Institute for Advanced Study (AMIAS), Princeton

- Member of the Board of Trustees 2016–2019

PROFESSIONAL SOCIETY MEMBERSHIPS

- American Mathematical Society
- Association for Women in Mathematics
- Society for Industrial and Applied Mathematics

PUBLICATIONS

Articles published in refereed journals

1. P. Daskalopoulos and P. M. N. Feehan, $C^{1,1}$ regularity for degenerate elliptic obstacle problems, *Journal of Differential Equations* **260** (2016), 5043-5074, <http://dx.doi.org/10.1016/j.jde.2015.11.037>, arXiv:1206.0831.
2. P. M. N. Feehan, *Geometry of the ends of the moduli space of anti-self-dual connections*, *Journal of Differential Geometry* **43** (1995), 465-553, <http://projecteuclid.org/euclid.jdg/1214457548>, arXiv:1504.05741.
3. P. M. N. Feehan, *Generic metrics, irreducible rank-one $PU(2)$ monopoles, and transversality*, *Communications in Analysis & Geometry* **8** (2000), 905-967, <http://dx.doi.org/10.4310/CAG.2000.v8.n5.a1>, arXiv:math/9809001.
4. P. M. N. Feehan, *Critical-exponent Sobolev norms and the slice theorem for the quotient space of connections*, *Pacific Journal of Mathematics* **200** (2001), 71-118, <http://dx.doi.org/10.2140/pjm.2001.200.71>, arXiv:dg-ga/9711004.
5. P. M. N. Feehan, *A Kato-Yau inequality and decay estimate for eigenspinors*, *Journal of Geometric Analysis* **11** (2001), 469-489, <http://dx.doi.org/10.1007/BF02922015>, arXiv:math/9903021.
6. P. M. N. Feehan, *Maximum principles for boundary-degenerate second-order linear elliptic differential operators*, *Communications in Partial Differential Equations* **38** (2013), 1863-1935, <http://dx.doi.org/10.1080/03605302.2013.831446>, arXiv:1204.6613.
7. P. M. N. Feehan, *Energy gap for Yang-Mills connections, I: Four-dimensional closed Riemannian manifolds*, *Advances in Mathematics* **264** (2016), 55-84, <http://dx.doi.org/10.1016/j.aim.2016.03.034>, arXiv:1412.4114.
8. P. M. N. Feehan, *Energy gap for Yang-Mills connections, II: Arbitrary closed Riemannian manifolds*, *Advances in Mathematics* **312** (2017), 547-587, <http://dx.doi.org/10.1016/j.aim.2017.03.023>, arXiv:1502.00668.
9. P. M. N. Feehan, *A classical Perron method for existence of smooth solutions to boundary value and obstacle problems for degenerate-elliptic operators via holomorphic maps*, *Journal of Differential Equations* **263** (2017), 2481-2553, <http://dx.doi.org/10.1016/j.jde.2017.04.003>, arXiv:1302.1849.
10. P. M. N. Feehan, *Relative energy gap for harmonic maps of Riemann surfaces into real analytic Riemannian manifolds*, *Proceedings of the American Mathematical Society* **146** (2018), no. 7, pp. 3179-3190, <http://dx.doi.org/10.1090/proc/14013>, arXiv:1609.04668.
11. P. M. N. Feehan, P. B. Kronheimer, T. G. Leness, and T. S. Mrowka, *$PU(2)$ monopoles and a conjecture of Mariño, Moore, and Peradze*, *Mathematical Research Letters* **6** (1999), 169-182, <http://dx.doi.org/10.4310/MRL.1999.v6.n2.a5>, arXiv:math/9812125.
12. P. M. N. Feehan and T. G. Leness, *$PU(2)$ monopoles. I: Regularity, compactness and transversality*, *Journal of Differential Geometry* **49** (1998), 265-410, <http://projecteuclid.org/euclid.jdg/1214461020>, arXiv:dg-ga/9710032.
13. P. M. N. Feehan and T. G. Leness, *$PU(2)$ monopoles and relations between four-manifold invariants*, *Topology and its Applications* **88** (1998), 111-145, [http://dx.doi.org/10.1016/S0166-8641\(97\)00201-0](http://dx.doi.org/10.1016/S0166-8641(97)00201-0), arXiv:dg-ga/9709022.
14. P. M. N. Feehan and T. G. Leness, *$PU(2)$ monopoles and links of top-level Seiberg-Witten moduli spaces*, *Journal für die Reine und Angewandte Mathematik* **538** (2001), 57-133, <http://dx.doi.org/10.1515/crll.2001.069>, arXiv:math/0007190.
15. P. M. N. Feehan and T. G. Leness, *$PU(2)$ monopoles. II: Top-level Seiberg-Witten moduli spaces and Witten's conjecture in low degrees*, *Journal für die Reine und Angewandte Mathematik* **538** (2001), 135-212, <http://dx.doi.org/10.1515/crll.2001.064>, arXiv:dg-ga/9712005.
16. P. M. N. Feehan and T. G. Leness, *$SO(3)$ monopoles, level-one Seiberg-Witten moduli spaces, and Witten's conjecture in low degrees*, *Topology and its Applications* **124** (2002), 221-326, [http://dx.doi.org/10.1016/S0166-8641\(01\)00233-4](http://dx.doi.org/10.1016/S0166-8641(01)00233-4), arXiv:math/0106238.
17. P. M. N. Feehan and T. G. Leness, *Witten's conjecture for many four-manifolds of simple type*, *Journal of the European Mathematical Society* **17** (2015), Issue 4, pp. 899-923, <http://dx.doi.org/10.4171/JEMS/521>, arXiv:math/0609530.
18. P. M. N. Feehan and C. A. Pop, *A Schauder approach to degenerate-parabolic partial differential equations with unbounded coefficients*, *Journal of Differential Equations* **254** (2013), 4401-4445, <http://dx.doi.org/10.1016/j.jde.2013.03.006>, arXiv.org:1112.4824.

19. P. M. N. Feehan and C. A. Pop, *Schauder a priori estimates and regularity of solutions to degenerate-elliptic linear second-order partial differential equations*, Journal of Differential Equations **256** (2014), 895-956, <http://dx.doi.org/10.1016/j.jde.2013.08.012>, arXiv:1210.6727.
20. P. M. N. Feehan and C. A. Pop, *Stochastic representation of solutions to degenerate elliptic and parabolic boundary value and obstacle problems with Dirichlet boundary conditions*, Transactions of the American Mathematical Society **367** (2015), 981-1031, <http://dx.doi.org/10.1090/S0002-9947-2014-06043-1>, arXiv.org:1204.1317.
21. P. M. N. Feehan and C. A. Pop, *Degenerate-elliptic operators in mathematical finance and higher-order regularity for solutions to variational equations*, Advances in Differential Equations **20** (2015), no. 3/4, 361-432, <http://projecteuclid.org/euclid.ade/1423055204>, arXiv:1208.2658.
22. P. M. N. Feehan and C. A. Pop, *On the martingale problem for degenerate-parabolic partial differential operators with unbounded coefficients and a mimicking theorem for Itô processes*, Transactions of the American Mathematical Society **367** (2015), 7565-7593, <http://dx.doi.org/10.1090/tran/6243>, arXiv.org:1211.4636.
23. P. M. N. Feehan and C. A. Pop, *Boundary-degenerate elliptic operators and Hölder continuity for solutions to variational equations and inequalities*, Annales de l'Institut Henri Poincaré (C) Analyse Non Linéaire **34** (2017), no. 5, pp. 1075–1129, <http://dx.doi.org/10.1016/j.anihpc.2016.07.005>, arXiv:1110.5594.

Articles published in refereed conference proceedings

1. P. M. N. Feehan and T. G. Leness, *SO(3) monopoles: the overlap problem*, Fields Institute Communications **47**, American Mathematical Society, Providence, RI, 2005, pp. 97-118, arXiv:1211.0480.
2. P. M. N. Feehan and T. G. Leness, *On Donaldson and Seiberg-Witten Invariants*, in Topology and Geometry of Manifolds (Athens, GA 2001), Proceedings of Symposia in Pure Mathematics **71**, American Mathematical Society, Providence, RI, 2003, pp. 237-248, <http://dx.doi.org/10.1090/pspum/071>, arXiv:math/0106221.

Books published

1. P. M. N. Feehan, J. Song, B. Weinkove, and R. A. Wentworth (editors), *Analysis, Complex Geometry, and Mathematical Physics: A Conference in Honor of Duong H. Phong*. Contemporary Mathematics Series, volume 644, American Mathematical Society, Providence, RI, 2015, <http://dx.doi.org/10.1090/conm/644>.

Articles accepted for publication in refereed journals

1. P. M. N. Feehan, *Perturbations of local maxima and comparison principles for boundary-degenerate linear differential equations*, Transactions of the American Mathematical Society, 54 pages, <https://doi.org/10.1090/tran/7246>, arXiv:1305.5098. (Accepted, March 30, 2017.)

Books accepted for publication in refereed series

1. P. M. N. Feehan and T. G. Leness, *A general SO(3)-monopole cobordism formula relating Donaldson and Seiberg-Witten invariants*, Memoirs of the American Mathematical Society, xviii+181 pages, arXiv:math/0203047. (Accepted September 9, 2013.)
2. P. M. N. Feehan and M. Maridakis, *Lojasiewicz-Simon gradient inequalities for gradient inequalities for coupled Yang-Mills energy functionals*, Memoirs of the American Mathematical Society, 95 pages, arXiv:1510.03815. (Accepted September 28, 2017.)

Articles submitted to refereed journals

1. P. M. N. Feehan, *Maximum principles for boundary-degenerate second-order linear parabolic differential operators*, 34 pages, arXiv:1306.5197. (Submitted, June 20, 2013.)
2. P. M. N. Feehan, *Discreteness for energies of Yang-Mills connections over four-dimensional manifolds*, 89 pages, arXiv:1505.06995. (Submitted May 27, 2015.)
3. P. M. N. Feehan, *Optimal Lojasiewicz-Simon inequalities and Morse-Bott Yang-Mills energy functions*, 52 pages, arXiv:1706.09349. (Submitted June 28, 2017.)

4. P. M. N. Feehan, *Resolution of singularities and geometric proofs of the Lojasiewicz inequalities*, 21 pages, arXiv:1708.09775. (Submitted August 31, 2017.)
5. P. M. N. Feehan, *On the Morse-Bott property of analytic functions on Banach spaces with Lojasiewicz exponent one half*, arXiv: 1803.11319. (Submitted March 29, 2018.)
6. P. M. N. Feehan and T. G. Leness, *Superconformal simple type and Witten's conjecture*, 30 pages, arXiv:1408.5085. (Submitted, October 17, 2014.)
7. P. M. N. Feehan and T. G. Leness, *The $SO(3)$ monopole cobordism and superconformal simple type*, 31 pages, arXiv:1408.5307. (Submitted, October 17, 2014.)
8. P. M. N. Feehan and M. Maridakis, *Lojasiewicz-Simon gradient inequalities for analytic and Morse-Bott functionals on Banach spaces and applications to harmonic maps*, 60 pages, arXiv:1510.03817. (Submitted, October 13, 2015.)

Books submitted

1. P. M. N. Feehan, *Global existence and convergence of solutions to gradient systems and applications to Yang-Mills gradient flow*, xx+475 pages, arXiv:1409.1525. (Submitted, September 4, 2014.)

Articles in preparation

1. P. M. N. Feehan, *A classical Perron method for existence of smooth solutions to boundary value and obstacle problems for degenerate-parabolic operators via holomorphic maps.*
2. P. M. N. Feehan, *Bubble tree compactness for the space of harmonic maps from Riemann surfaces.*
3. P. M. N. Feehan, *Bubble tree compactness for the moduli space of Yang-Mills connections over four-dimensional manifolds.*
4. P. M. N. Feehan, *Discreteness for the energy spectrum of harmonic maps from Riemann surfaces and energy gaps for pseudoholomorphic curves.*
5. P. M. N. Feehan, R. Gong, and J. Song, *Feynman-Kac formulae for solutions to degenerate elliptic and parabolic boundary value and obstacle problems with Dirichlet boundary conditions.*

Books in preparation

1. P. M. N. Feehan and T. G. Leness, *Gluing maps for $SO(3)$ monopoles and invariants of smooth four-manifolds*, based in part on arXiv:math/9812060 (86 pages) and arXiv:math/9907107 (91 pages), listed under "Unpublished manuscripts".
2. P. M. N. Feehan and T. G. Leness, *$SO(3)$ monopoles and relations between Yang-Mills and Seiberg-Witten Floer homologies of three-manifolds.*

Unpublished manuscripts

1. P. Daskalopoulos and P. M. N. Feehan, *Existence, uniqueness, and global regularity for variational inequalities and obstacle problems for degenerate elliptic partial differential operators in mathematical finance*, 115 pages, arxiv.org:1109.1075
2. P. M. N. Feehan and T. G. Leness, *$PU(2)$ monopoles. III: Existence of gluing and obstruction maps*, 91 pages, arXiv:math/9907107.
3. P. M. N. Feehan and T. G. Leness, *Donaldson invariants and wall-crossing formulas. I: Continuity of gluing maps*, 86 pages, arXiv:math/9812060.
4. P. M. N. Feehan and T. G. Leness, *Uhlenbeck compactness and transversality for the moduli space of $PU(2)$ monopoles*, 15 pages, arXiv:dg-ga/9710012.

Doctoral thesis

1. P. M. N. Feehan, *Geometry of the moduli space of self-dual connections over the four-sphere*, Ph.D. thesis, Columbia University, New York, New York, 1992, 150 pages.

TEACHING

Doctoral students supervised

- Ruofan Yan
 - Thesis: “Risk filtering and risk-averse control of partially observable Markov jump processes”, Rutgers University, January 2018
 - First position after graduation: Goldman Sachs, New York
- Vladimir Lubyshev
 - Thesis: “Non-linear PDEs and an application to high-frequency trading”, Rutgers University, May 2015
 - First position after graduation: Hedge Fund
- Eduardo Osorio
 - Thesis: “Finite difference and finite element solution of boundary value and obstacle problems for degenerate partial differential operators in mathematical finance”, Rutgers University, May 2014
 - First position after graduation: Associate, Bloomberg, New York
- Camelia Pop
 - Thesis: “Degenerate partial differential equations and applications to probability theory and foundations of mathematical finance”, Rutgers University, May 2012
 - First position after graduation: Lecturer in Mathematics, University of Pennsylvania
- Jin Wang
 - Thesis: “Semimartingales, Markov processes and their applications in mathematical finance”, Rutgers University, October 2010
 - First position after graduation: Associate, Ernst and Young, New York
- Jawon Koo
 - Thesis: “Singular perturbation methods in credit derivative modeling”, Rutgers University, January 2010
 - First position after graduation: Associate, Ernst and Young, New York
- Ming Shi
 - Thesis: “Local intensity and its dynamics in multi-name credit derivatives modeling”, Rutgers University, January 2010
 - First position after graduation: Associate, Ernst and Young, New York

Postgraduate researchers supervised

- Ruoting Gong, Assistant professor (non-tenure track) 2012–2014
 - Position after leaving Rutgers: Assistant professor (tenure track), Illinois Institute of Technology, Chicago
- Manousos Maridakis, Assistant professor (non-tenure track) 2014–2017
 - Position after leaving Rutgers: Army service, Greece
- Kihun Nam, Assistant professor (non-tenure track) 2014–2017
 - Position after leaving Rutgers: Assistant professor (tenure track), Monash University, Australia
- Brendan Owens, Lecturer 2000–2001
 - Current position: Senior Lecturer, University of Glasgow, Scotland
- Triet Pham, Assistant professor (non-tenure track) 2013–2017
 - Position after leaving Rutgers: Assistant professor (tenure track), Misericordia College, Pennsylvania
- Jesus Rodriguez, Assistant professor (non-tenure track) 2007–2010
 - Position after leaving Rutgers: Applied research mathematician, United States Federal Government
- Jian V. Song, Assistant professor (non-tenure track) 2010–2012
 - Position after leaving Rutgers: Assistant professor (tenure track), University of Hong Kong, China

New graduate courses developed at Rutgers University

- Math 611. Topics in applied mathematics: variational inequalities, obstacle problems, and free boundary problems in mathematical finance
- Math 621. Mathematical finance I
- Math 622. Mathematical finance II
- Math 623. Computational finance
- Math 624. Credit risk modeling
- Math 625. Portfolio theory and applications
- Math 626. Fixed income securities and derivative modeling
- Math 627. High-frequency finance and stochastic control
- Math 628. Topics in mathematical finance: quantitative risk management
- Math 628. Topics in mathematical finance: energy risk, commodities, and derivative modeling

Courses taught

Columbia University, New York, New York

- Math G4077. Computational finance Fall 2012
- Math G6190. Variational inequalities, obstacle problems, and free boundary problems in mathematical finance Spring 2013

Rutgers University, New Brunswick, New Jersey

- Math 575. Numerical analysis II Spring 2019
- Math 549. Lie groups Fall 2018
- Math 518. Partial differential equations II Spring 2018
- Math 575. Numerical solution of partial differential equations Spring 2018
- No teaching Fall 2017
- Math 612. Topics in applied mathematics: obstacle problems Spring 2017
- Math 517. Partial differential equations I Fall 2016
- Competitive fellowship leave Spring 2016
- Competitive fellowship leave Fall 2015
- Math 519. Topics in differential equations: gradient flow Spring 2015
- Math 575. Numerical solution of partial differential equations Spring 2014
- Math 623. Computational finance Spring 2009, 2010, 2011, 2012, 2013
- Math 622. Mathematical finance II Spring 2007, 2008
- Math 621. Mathematical finance I Fall 2006, 2007, 2008, 2009, 2010
- Math 612. Topics in applied mathematics: mathematical finance II Spring 2004
- Math 611. Topics in applied mathematics: obstacle problems Fall 2011, 2013, 2014, Spring 2017
- Math 611. Topics in applied mathematics: mathematical finance I Fall 2003
- Math 244. Differential equations for engineering and physics Fall 2003
- Math 244. Differential equations for engineering and physics – 2 sections Spring 2003
- Math 534. Topics in differential geometry Fall 2002
- Math 532. Differential geometry Spring 2002
- Math 151. Calculus I Fall 2001
- Math 250. Introduction to linear algebra Fall 2001

University of Dublin (Trinity College), Dublin, Ireland

- Math 131. Mathematical methods and linear algebra Spring 2001
- Math 421. Algebraic topology Spring 2001
- Math 131. Mathematical methods and linear algebra Fall 2000
- Math 421. Algebraic topology Fall 2000

Ohio State University, Columbus, Ohio

- Math 867. Differential topology II Winter 2000
- Math 254. Multivariable calculus Winter 2000
- Math 866. Differential topology I Fall 1999
- Math 151. Calculus I Fall 1999
- Math 254. Multivariable calculus – 2 sections Winter 1998
- Math 254. Multivariable calculus – 2 sections Fall 1997

Harvard University, Cambridge, Massachusetts

- Math 21A. Multivariable calculus – 2 sections Fall 1993
- Math 21A. Multivariable calculus – 2 sections Fall 1994
- Math 21A. Multivariable calculus – 2 sections Fall 1995

Columbia University, New York, New York

- Math W1003. College algebra and analytic geometry Summer 1992
- Math W1003. College algebra and analytic geometry Spring 1992
- Math W1003. College algebra and analytic geometry Fall 1991
- Math V1201. Calculus III Summer 1991
- Math V1101. Calculus I Summer 1991
- Math V1101. Calculus I Summer 1990
- Math V1102. Calculus II Summer 1989
- Math V1101. Calculus I Summer 1988
- Teaching assistant for undergraduate mathematics courses 1988–1991

University of Southern California, Los Angeles

- Teaching assistant for undergraduate mathematics courses 1985–1987
- Teaching assistant for undergraduate electrical engineering courses 1984–1985

University of Missouri, Rolla, Missouri

- Electrical Engineering 243. Communication systems Summer 1984
- Teaching assistant for undergraduate electrical engineering courses 1982–1984

PRESENTATIONS

Invited participant at conferences outside the United States of America

- Symplectic geometry - Celebrating the work of Simon Donaldson, Newton Institute, (2017)
- Workshop on metric and analytic aspects of moduli spaces, Newton Institute, Cambridge, (2015)

Invited presentations at conferences outside the United States of America

- Low Dimensional Topology and Gauge Theory, Banff Workshop, Oaxaca, Mexico (2017)
- Workshop on metric and analytic aspects of moduli spaces, Newton Institute, Cambridge, (2015)
- EquaDiff, Lyons, France (2015)
- Workshop on free boundary and obstacle problems, Newton Institute, Cambridge, (2014)
- PDE and Mathematical Finance V, Stockholm, Sweden (2013)
- Research in options, Rio de Janeiro, Brazil (2012)
- Kolmogorov equations in physics and finance, Modena, Italy (2010)
- Analysis, stochastics, and applications, Vienna, Austria (2010)
- 12th annual global derivatives and risk management conference, Paris, France (2006)
- Conference on geometry and topology of manifolds, McMaster University, Hamilton, Ontario, Canada (2004)

- Conference on topology and group actions, Centre de Recherche Mathématiques, Montréal, Canada (2001)
- Mathematisches Forschungsinstitut Oberwolfach, Four-manifolds workshop, Oberwolfach Germany (2001)
- Mathematische Arbeitstagung, Max Planck Institut für Mathematik, Bonn, and Mathematisches Institut der Universität Bonn, Bonn, Germany (2001)
- Symposium on geometry and topology, University of Warwick, Coventry, England (2000)
- Seventh Gökova geometry/topology conference, Gökova, Turkey (2000)
- Conference on geometry, analysis, and mathematical physics, European Science Foundation, Strasbourg, France (1999)
- Mathematisches Forschungsinstitut Oberwolfach, Four-manifolds workshop, Oberwolfach Germany (1996)

Contributed presentations at conferences outside the United States of America

- AMS and Romanian Mathematical Society Joint International Meeting, Special Session, Mathematical finance, stochastic analysis, and partial differential equations, Alba Iulia, Romania (2013)
- Frontiers in Financial Mathematics, Dublin, Ireland (2013)
- International workshop on PDEs and stochastic analysis, Yerevan, Armenia (2012)
- 12th international conference on free boundary problems, Chiemsee, Germany (2012)
- International conference on math finance and economics, Istanbul, Turkey (2011)
- 35th conference on stochastic processes and their applications, Oaxaca, Mexico (2011)
- Econometrics, numerical methods, and foundations, Guanajuato, Mexico (2011)
- Analysis, stochastics, and applications, Vienna, Austria (2010)
- First joint American Mathematical Society & Unione Matematica Italiana, Pisa, Italy (2002)
- First joint American Mathematical Society & Société Mathématique de France International Meeting, Lyon, France (2001)

Invited presentations at colloquia and seminars outside the United States of America

- Chinese University of Hong Kong, Topology Seminar Lecture Series (2018)
- Institut de Mathématiques de Jussieu, Geometric Analysis Seminar, Paris, France (2017)
- University of Glasgow, Geometry and Topology Seminar, Glasgow, Scotland (2015)
- Aarhus University, Centre for Quantum Geometry of Moduli Spaces, Geometry Seminar, Denmark (2014)
- Hausdorff Institute, Harmonic Analysis and Partial Differential Equations Seminar, Bonn, Germany (2014)
- Newton Institute, Free Boundary Problems and Related Topics Seminar, Cambridge, England (2014)
- University of Cambridge, Geometry and Partial Differential Equations Seminar, Cambridge, England (2014)
- Imperial College London, Geometry and Analysis Seminar, London, England (2014)
- Mathematical Institute, University of Oxford, Geometry and Analysis Seminar, Oxford, England (2014)
- University of Glasgow, Geometry and Topology Seminar, Glasgow, Scotland (2014)
- Edinburgh Mathematical Physics Group Seminar, Edinburgh, Scotland (2014)
- Eidgenössische Technische Hochschule Zürich, Analysis Seminar, Zürich, Switzerland (2014)
- Mathematisches Institut, Universität Köln, Geometry Seminar, Cologne, Germany (2013)
- Max-Planck-Institut für Mathematik, Oberseminar Analysis, Leipzig, Germany (2012)
- Eidgenössische Technische Hochschule Zürich, Financial and insurance mathematics seminar, Zürich, Switzerland (2012)
- Technische Universität Berlin, Stochastic analysis and stochastic finance seminar, Berlin, Germany (2012)

- University of Göttingen, Mathematics colloquium, Göttingen, Germany (2004)
- McMaster University, Mathematics colloquium, Hamilton, Ontario, Canada (2003)
- Max Planck Institut für Mathematik, Gauge theory seminar, Bonn, Germany (2003)
- Max Planck Institut für Mathematik, Gauge theory seminar, Bonn, Germany (2002)
- Max Planck Institut für Mathematik, Gauge theory seminar, Bonn, Germany (2001)
- Imperial College, Differential geometry seminar, London, England (2001)
- University College, Differential geometry seminar, National University of Ireland, Maynooth, Ireland (2000)
- Max Planck Institut für Mathematik, Gauge theory seminar, Bonn, Germany (2000)
- Mathematisches Institut, Universität Bielefeld, Bielefeld, Germany (2000)
- University of Frankfurt, Mathematics colloquium, Frankfurt, Germany, (2000)
- McMaster University, Mathematics colloquium, Hamilton, Ontario, Canada, (1999)
- University of Dublin, Trinity College, Seminar, Dublin, Ireland (1999)
- Ecole Polytechnique, Differential geometry seminar, Paris, France (1998)
- Mathematisches Institut, Differential geometry seminar, Universität München, Munich, Germany (1998)
- Mathematisches Institut, Differential geometry seminar, Universität Osnabrück, Osnabrück Germany (1998)
- Max Planck Institut für Mathematik, Oberseminar, Bonn, Germany (1998)
- University College, Differential geometry seminar, National University of Ireland, Dublin, Ireland (1994)

Invited participant at conferences within the United States of America

- Geometry of manifolds, Simons Center for Geometry and Physics, (2017)

Invited presentations at conferences within the United States of America

- AMS Special Session on topics in qualitative properties of PDEs, Boston (2018)
- SIAM conference on analysis of partial differential equations, Baltimore, Maryland (2017)
- Gauge Theory and Topology Workshop, Simons Center for Geometry and Physics (2017)
- Florida International University Winter conference on geometry, topology and applications (2017)
- AMS Special Session on PDE methods in geometric flows, Stony Brook University (2016)
- International workshop on advances in nonlinear analysis, Pittsburgh, Pennsylvania (2014)
- Workshop on the mathematics of financial risk management, Penn State University, State College, Pennsylvania, (2012)
- Stochastic analysis in finance and insurance conference, University of Michigan, Ann Arbor, Michigan (2011)
- Georgia international topology conference, Athens, Georgia (2001)
- Marston Morse conference on gauge theory and symplectic geometry, Institute for Advanced Study, Princeton, New Jersey (1999)
- Mathematical Sciences Research Institute, Four-manifolds workshop, Berkeley, California (1997)
- Georgia Topology Conference, Symplectic topology, Athens, Georgia (1996)

Contributed presentations at conferences within the United States of America

- SIAM conference on analysis of partial differential equations, Scottsdale, Arizona (2015)
- SIAM conference on analysis of partial differential equations, Buena Vista, Florida (2013)
- AMS Special Session, Partial differential equations, stochastic analysis, and applications to mathematical finance, Philadelphia, Pennsylvania (2013)
- 36th conference on stochastic processes and their applications, Boulder, Colorado (2013)
- SIAM conference on financial mathematics and engineering, Minneapolis, Minnesota (2012)
- SIAM financial mathematics and engineering conference, San Francisco, California (2010)

- AMS Special Session, Gauge theory and low-dimensional topology, Raleigh, North Carolina (1999)
- AMS Special Session, Holomorphic vector bundles and complex geometry, Urbana-Campaign, Illinois (1999)
- AMS Special Session, Gauge theory and its interaction with holomorphic and symplectic geometry, Columbia, Missouri (1996)
- AMS Special Session, Invariants of smooth four-manifolds, Princeton, New Jersey (1996)
- AMS Special Session, Gauge field theory, New York, New York (1996)
- AMS Special Session, Partial differential equations and math physics, Boston, Massachusetts, (1995)
- AMS Special Session, Gauge theory and applications, Brooklyn, New York, (1994)
- AMS Special Session, Gauge theory and four-manifolds, Los Angeles, California (1992)

Invited presentations at colloquia and seminars within the United States of America

2019

- Boston College, Topology seminar

2018

- Harvard University, Topology seminar
- Massachusetts Institute of Technology, Geometry and Analysis seminar
- Rice University, Colloquium

2017

- Columbia University, Geometry and Analysis seminar
- Purdue University, Partial Differential Equations seminar
- Stony Brook University and Simons Center for Geometry and Physics, Colloquium
- University of Maryland, Informal Geometric Analysis seminar
- University of Wisconsin, Geometric and Topology seminar

2016

- Bryn Mawr College, Colloquium
- Dublin Institute for Advanced Studies, Theoretical physics seminar
- Harvard University, Gauge theory, symplectic geometry, and topology seminar
- Institute for Advanced Study, Analysis seminar
- Massachusetts Institute of Technology, Geometry and topology seminar
- Princeton University, Topology seminar
- Princeton University, Differential geometry and geometric analysis seminar
- University of Massachusetts, Amherst, Geometry and topology seminar

2015

- University of Minnesota, Minneapolis, Differential geometry and topology seminar
- Michigan State University, East Lansing, Mathematical physics and gauge theory seminar
- University of California, Irvine, Geometry and analysis seminar
- Stanford University, Analysis seminar

2014

- Lehigh University, Geometry and analysis seminar
- Princeton University and IAS, Symplectic geometry seminar
- University of Nebraska, Lincoln, Mathematics colloquium
- Columbia University, Geometry and analysis seminar

2013

- Columbia University, Geometry and analysis seminar

- Columbia University, Mathematical finance seminar

2012

- Massachusetts Institute of Technology, Cambridge, Analysis seminar
- New York University – Courant Institute, New York, Analysis seminar
- University of Pennsylvania, Philadelphia, Applied mathematics and computer science colloquium

2011

- Brown University, Providence, Analysis and geometry seminar
- University of California, Santa Barbara, Differential geometry seminar
- University of Texas, Austin, Mathematical finance seminar

2010

- Penn State University, State College, Applied mathematics colloquium

2004

- Johns Hopkins University, Baltimore, Analysis seminar

2002

- Lafayette College, Mathematics colloquium
- Haverford College, Mathematics colloquium
- State University of New York, Stony Brook, Analysis seminar

2001

- Michigan State University, East Lansing, Gauge theory seminar
- Rutgers University, New Brunswick, Nonlinear analysis seminar
- Rutgers University, New Brunswick, Geometry and topology seminar

2000

- Brown University, Seminar
- University of Wisconsin, Madison, Mathematics colloquium
- Rutgers University, Seminar

1999

- Johns Hopkins University, Mathematical physics seminar
- University of Michigan, Ann Arbor, Mathematics colloquium
- University of Michigan, Ann Arbor, Seminar
- Harvard University, Gauge theory and topology seminar
- Yale University, Topology seminar

1998

- Boston University, Differential geometry seminar
- Brown University, Differential geometry seminar
- Princeton University, Topology seminar
- Rutgers University, Topology seminar

1997

- Columbia University, Geometry and analysis seminar
- Massachusetts Institute of Technology, Analysis seminar
- University of Wisconsin, Madison, Differential geometry seminar
- University of Wisconsin, Madison, Topology seminar
- Yale University, Topology seminar
- Ohio State University, Columbus, Seminar
- State University of New York, Stony Brook, Seminar

- Texas A & M University, Seminar
- Stanford University, Mathematics colloquium
- University of California, Los Angeles, Differential geometry seminar
- University of Washington, Seattle, Mathematics colloquium
- University of California, Santa Barbara, Differential geometry seminar

1996

- Courant Institute, Differential geometry and topology seminar
- University of Illinois, Urbana-Champaign, Differential geometry seminar
- Ohio State University, Columbus, Mathematics colloquium
- Ohio State University, Columbus, PDEs and several complex variables seminar
- Harvard University, Gauge theory and topology seminar
- Princeton University, Differential geometry and topology seminar
- Brown University, Differential geometry seminar
- Massachusetts Institute of Technology, Symplectic geometry seminar

1995

- Columbia University, Geometry and analysis seminar
- Boston University, Differential geometry seminar

1994

- Institute for Advanced Study/Park City, Mathematics colloquium

1993

- State University of New York, Buffalo, Mathematics colloquium
- Harvard University, Gauge theory and topology seminar
- Stanford University, Gauge theory seminar
- University of California, Berkeley, Differential geometry seminar
- Mathematical Sciences Research Institute, Area II seminar
- Columbia University, Geometry and analysis seminar

1992

- Columbia University, Geometry and analysis seminar