Frederick John Hickernell Highlights

- 43 years as a faculty member: University of Southern California (4 years), Hong Kong Baptist University (19+ years), and Illinois Institute of Technology (19+ years)
- 25 years as department chair/head: Hong Kong Baptist University (13 years) and Illinois Institute of Technology (12 years)
- Vice Provost for Research, Illinois Institute of Technology (2018–2024)
- Director of the Center for Interdisciplinary Scientific Computation, Illinois Institute of Technology (2017–18)
- Fellow of the Institute of Mathematical Statistics (since 2007)
- 2016 Joseph F. Traub Prize for Achievement in Information-Based Complexity
- Served as editorial board member for *Journal of Complexity*, *Mathematics of Computation*, *SIAM Journal on Numerical Analysis*, and other journals
- Actively promoted research at the intersection of applied and computational mathematics, statistics, and theoretical computer science by organizing conferences and leading a 2017-18 year-long NSF-SAMSI research program
- Research themes and pointers to the more important of my 135 publications (h-index 39) with citation counts from my Google Scholar profile (click here):

  Fluid Flow Instability. Nonlinear waves in fluids are often described by the Korteweg-de Vries (KdV) equation, which admits solitary wave (soliton) solutions. I discovered that the nonlinear dynamics of some marginally linearly stable shear flows are described by a Boussinesq equation [78, 79] (41 cit. combined). In this situation, colliding solitons of moderate amplitude pass through each other unscathed as in the KdV case, but colliding solitons of large enough amplitude result in finite-time blow-up.

  In a different setting, I analyzed the stability of a shear flow with a critical layer where time-dependence, nonlinearity and viscosity have similar importance. This resulted in a new type of nonlinear evolution equation with a non-local (in time) term [77] (97 cit.). Similar behavior was later found by others.

  In collaboration with a petroleum engineer I studied the instability of flow through porous media [72, 74] (96, 101 cit.).

  Discrepancy and Cubature Error. Integrals of multidimensional functions are approximated by the average of function values at well-chosen points. I pioneered the use of reproducing kernel Hilbert spaces to systematically characterize the error of such approximations (cubatures) as the discrepancy of the sampling scheme times variation of the integrand [61, 68, 115, 116] (920, 100, 78, 376 cit.). Much of the cubature error analysis of quasi-Monte Carlo methods since the mid-1990s has been based on reproducing kernel Hilbert spaces of integrands. Some of these ideas can be extended to reproducing kernel Banach spaces [12] (76 cit.).

  Low Discrepancy Sequences. Efficient cubatures require sequences of low discrepancy points. My collaborators and I proposed randomized Halton sequences [56] (270 cit.), implemented randomly scrambled digital nets in software [41] (187 cit.), and discovered lattice rules that can be extended in sample size [40, 52] (103, 154 cit.). A review of lattice rules co-authored with one of the early discoverers is given in [113] (62 cit.). I have computed the asymptotic convergence rates for discrepancies of digital nets and sequences [55, 59, 67] (67, 44, 90 cit.) and demonstrated how the tent transformation improves the order of convergence of lattice rules [111] (106 cit.). My collaborators and I showed how control variates can be applied to cubatures using low discrepancy sequences [34] (95 cit.). A connection between discrepancy and linear codes has been established [29] (86 cit.).

Experimental Designs and Other Statistical Applications. Discrepancy measures have also been used as criteria for statistical design of experiments. In [57] (110 cit.) I demonstrated the relationship between discrepancies based on reproducing kernels and goodness-of-fit statistics, which can be used to obtain designs that are robust to model misspecification [60] (56 cit.). This idea was pursued further in [30, 43, 45] (56, 159, 56 cit.), which showed how discrepancy generalized common quality measures for fractional factorial designs. Discrepancy can provide a statistical test that multivariate data fit an hypothesized distribution [50] (65 cit.)

Tractability and Multi-Level Methods. High, or even infinite, dimensional integrals arise often, e.g., in financial risk calculations. Unfortunately, traditional cubature error bounds can increase exponentially with dimension—suffering a curse of dimensionality. My co-authors and I have established conditions on the class of problems considered under which convergence rates may or may not depend exponentially on the dimension [39, 44, 49, 54] (62, 81, 51, 150 cit.). We have also analyzed the error of multi-level cubature methods, which avoid the computational cost penalties arising when evaluating functions of many variables [18, 20] (99, 95 cit.).

Function Approximation. Although not as extensive as my work in cubature, I have also worked on the topic of multidimensional function approximation or recovery. This includes function approximation using trigonometric polynomials with lattice sampling [110] (56 cit.), radial basis functions as smoothing splines for approximation of the surface wind field [58, 62] (50, 48 cit.), the flat limit of radial basis function approximation [15] (44 cit.), tractability of function approximation [13] (50 cit.), and support vector machines in reproducing kernel Banach spaces [7] (49 cit.).

Adaptive Algorithms. During the past decade, I have been searching for algorithms that adaptively determine the computational effort required to obtain the desired accuracy based on knowledge obtained by sampling the input function. Adaptive algorithms are quite popular in widely-used software because they relieve the user from having to determine how much computational effort is needed. However, nearly all adaptive algorithms lack solid guarantees of success. We derived algorithms for univariate quadrature and univariate function approximation [9] (23 cit.), and for cubature via Monte Carlo [96] (35 cit.) and quasi-Monte Carlo [4, 85, 92–94] (37, 4, 14, 28, 25, cit.). These algorithms adaptively determine the sample size, while keeping the sampling density the same. An improved algorithm for univariate function approximation and optimization [5] (8 cit.) adapts the sampling density as well. Although our present algorithms have low orders of convergence, we expect that our new paradigm will lead us to higher order adaptive algorithms with guarantees. These algorithms have been implemented in a MATLAB software package [3, 127] and a Python library [126].

Curriculum Vitae for
Frederick John Hickernell

Frederick John Hickernell

Contact Information

Office: Michael Paul Galvin Tower, Room 10F9-1
Office of the Vice Provost for Research, Illinois Institute of Technology
10 W 35th St, Chicago, IL 60616
Phone: 312-567-3470 Mobile: 630-696-8124 Fax: 312-567-3135
Email: hickernell@iit.edu Web: www.iit.edu/~hickernell
Profiles: ORCID Google Scholar LinkedIn ResearchGate

Current Research Areas

Numerical analysis, computational complexity

Adaptive algorithms

Machine learning

Multi-dimensional integration and function approximation

Monte Carlo and Quasi-Monte Carlo methods

Experimental design

Education

PhD in mathematics, Massachusetts Institute of Technology, 1981

BA (summa cum laude) in mathematics and physics, Pomona College, 1977

Employment History

2005–present	Professor of Applied Mathematics, Illinois Institute of Technology
2018–2024	Vice Provost for Research, Illinois Institute of Technology
2017–2018	Director of the Center for Interdisciplinary Scientific Computation, Illinois Institute of Technology
2005–2017	Chair of Applied Mathematics, Illinois Institute of Technology
1999–2005	Professor of Mathematics, Hong Kong Baptist University
1989–2002	Head of Mathematics, Hong Kong Baptist University
1995–1999	Associate Professor of Mathematics, Hong Kong Baptist University
1987–1995	Senior Lecturer in Mathematics, Hong Kong Baptist College
1985–1987	Lecturer in Mathematics, Hong Kong Baptist College
1981–1985	Assistant Professor of Mathematics, University of Southern California

Professional and Honorary Society Memberships

American Mathematical Society

American Scientific Affiliation, Fellow by election

American Statistical Association

Hong Kong Statistical Society

Institute of Electrical and Electronics Engineers, Senior Member

Institute of Mathematical Statistics, Fellow by election

International Statistical Institute, by election

Mathematical Association of America

Phi Beta Kappa, by election

Sigma Xi, by election

Society for Industrial and Applied Mathematics

Awards

IIT College of Science and Letters, Dean's Excellence Award for Research, 2007, 2017

IIT Outstanding Student Organization Advisor, 2015

Joseph F. Traub Prize for Achievement in Information-Based Complexity, 2016

Subjects Taught

summarized by subject content rather than by code and title

Mathematics Subjects — various sections of calculus for mathematics, science, engineering, and business majors

Applied Mathematics Subjects — differential equations for mathematics, science and engineering majors, mathematical modeling for final year mathematics majors

Computational Subjects — numerical methods (introductory and advanced) for mathematics majors, applied numerical methods for science majors, numerical partial differential equations, data analysis and visualization for graduate students

Statistics Subjects — introductory computer-based statistics for non-majors, first-year statistics for mathematics majors, regression, Monte Carlo methods, statistical learning

Laboratory Subjects — computer laboratories in mathematical and statistical software such as MATLAB, JMP, and SPSS for undergraduate mathematics majors and graduate students, computer laboratories for calculus instruction

Project Subjects — half-year and full-year mathematics undergraduate honours projects, graduate applied mathematics and scientific computing theses, independent reading

Research Students and Postdoctoral Fellows Supervised

Year indicates when they completed their studies. Links to their professional web pages. Cited publications were co-authored with them based on work during or after their studies.

AI Mingyao, Postdoc, 2003–2005 [21, 25]

CHOW Chi Kin, MPhil, 1991

Nicholas CLANCY, BS, 2013 [9]

Josef DICK, Postdoc, 2004–2005 [23, 26]

DING Yuhan, PhD, 2015 [3, 5, 9, 83, 86, 87, 127]

Onyekachi Osisiogu EMENIKE, Postdoc, 2022–2023 [1]

Regina HONG Hee Sun, PhD, 2002 [41, 42, 52, 59, 112, 117]

Claude HALL, Jr., PhD student, 2022–present

Caleb HAMILTON, BS/MS, 2015 [9]

HUANG Fanglun, PhD, 2004, presently Professor at Anhui University

R. JAGADEESWARAN, PhD, 2019 [3, 4, 83, 85, 131]

JIANG Lan, PhD, 2016 [3, 91, 96, 127]

Lluís Antoni JIMÉNEZ RUGAMA, PhD, 2016 [3, 6, 86, 91–94, 127]

KANG Jiangrui, PhD student, 2024–present

Nathan KIRK, Postdoc, 2024–present [137]

Peter KRITZER, Postdoc, 2007 [1, 14, 24, 87, 88, 122]

LEUNG King Tai, BSc, 2004 [104]

LI Da, MS, 2016 [92]

LI Dong, BSc, 2002 [110]

LI Yiou, PhD, 2014 [10, 16, 89]

LIU Kwong Ip, PhD, 2007 [23, 103, 108]

LIU Minqian, Postdoc, 2000–2002 [30, 31, 43, 45]

LIU Yuewei, Visting PhD student, 2010–2011, from Lanzhou University [96]

MA Jingtang, Postdoc, 2004–2005, presently at Chinese Academy of Sciences

NIU Ben, PhD, 2011 [18, 20, 98]

Aleksei SOROKIN, BS/MS 2021, PhD student, 2021–present [2, 83, 84, 126, 129, 130, 137]

John RIDDLE, BA, 2010 [15]

TONG Xin, MS, 2014, presently a postdoc at Florida State University [3, 5, 127]

WONG Mei Ning, MPhil, 2002

YAM Chiu Yu, MPhil, 2000 [53]

YANG Shijun, Postdoc, 2006–2007 [22, 27]

YUE Rong Xian, PhD, 1997 [17, 32, 36, 37, 46, 47, 51, 55, 60, 65, 114]

ZENG Xiaoyan, PhD, 2008, presently a faculty member at Shanghai University [11, 19, 24, 104]

ZHANG, Kan, PhD student, 2016–present [3]

ZHANG Yizhi, PhD, 2018, [3, 9, 127]

ZHANG Yonglin, PhD, 2004, deceased, former Dean of Statistics at Beijing Information Science and Technology University

ZHOU Xuan, PhD, 2015 [3, 95, 127]

Publications

Database entries for *Mathematical Reviews (MR)* and *Zentralblatt für Mathematik (ZM)* are given where available.

Refereed Journal Articles

[1] O. Emenike, F. J. Hickernell, and P. Kritzer, *A unified treatment of tractability for approximation problems defined on Hilbert spaces*, J. Complexity **84** (2024), 101856, DOI 10.1016/j.jco.2024.101856.

[2] A. G. Sorokin, A. Pachalieva, D. O'Malley, J. M. Hyman, F. J. Hickernell, and N. W. Hengartner, *Computationally efficient and error aware surrogate construction for numerical solutions of subsurface flow through porous media*, Adv. Water Resources **193** (2024), 104836, DOI 10.1016/j.advwatres.2024.104836.

[3] X. Tong, S.-C. T. Choi, Y. Ding, F. J. Hickernell, L. Jiang, Ll. A. Jiménez Rugama, R. Jagadeeswaran, K. Zhang, Y. Zhang, and X. Zhou, *Guaranteed automatic integration library (GAIL): An open-source MATLAB library for function approximation, minimization, and integration*, J. Open Res. Software **10** (2022), 7, DOI 10.5334/jors.381.

[4] R. Jagadeeswaran and F. J. Hickernell, *Fast automatic Bayesian cubature using lattice sampling*, Stat. Comput. **29** (2019), 1215–1229, DOI 10.1007/s11222-019-09895-9.

[5] S.-C. T. Choi, Y. Ding, F. J. Hickernell, and X. Tong, *Local adaption for approximation and minimization of univariate functions*, J. Complexity **40** (2017), 17–33, DOI 10.1016/j.jco.2016.11.005.

[6] L. Gilquin, Ll. A. Jiménez Rugama, E. Arnaud, F. J. Hickernell, H. Monod, and C. Prieur, *Iterative construction of replicated designs based on Sobol' sequences*, C. R. Math. Acad. Sci. Paris **355** (2017), 10–14, DOI 10.1016/j.crma.2016.11.013.

[7] G. E. Fasshauer, F. J. Hickernell, and Q. Ye, *Solving support vector machines in reproducing kernel Banach spaces with positive definite functions*, Appl. Comput. Harmon. Anal. **38** (2015), 115–139, DOI 10.1016/j.acha.2014.03.007.

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[10] Y. Li and F. J. Hickernell, *Design of experiments for linear regression models when gradient information is available*, J. Statist. Plann. Inference **144** (2014), 141–151, DOI 10.1016/j.jspi.2013.01.010.

[11] X. Y. Zeng and F. J. Hickernell, *On Hamming distance matrix*, Comm. Appl. Math. Comput. **28** (2014), 502–509, DOI 10.3969/j.issn.1006-6330.2014.04.015.

[12] G. Song, H. Zhang, and F. J. Hickernell, *Reproducing kernel Banach spaces with the ℓ^1 norm*, Appl. Comput. Harmon. Anal. **34** (2013), 96–116, DOI 10.1016/j.acha.2012.03.009.

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Computer Software

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[137] F. J. Hickernell, N. Kirk, and A. G. Sorokin, *Quasi-Monte Carlo methods: What, why, and how?*, in preparation for submission to MCQMC 2024 proceedings, 2025+.

Ongoing Research

This indicates my research plan for the coming couple of years.

[R1] Applications of quasi-Monte Carlo methods to finance and other kinds of problems

[R2] Approximation of functions, in particular application to computer experiments

[R3] Methods for solving high dimensional linear problems using lattices and net designs; tractability

[R4] Reliable error estimation for numerical algorithms; adaptive algorithms

[R5] Uniform and other space-filling designs

Selected Invited Talks

including where the results reported were published

[T1] *Challenges in developing great MCQMC software*, Special Session on Developments in and Applications of MCQMC Software, Fifteenth International Conference on Monte Carlo and Quasi-Monte Carlo Methods, Linz, Austria, July 18, 2022 [83, 126, 129, 130].

[T2] *Advances and Challenges in Quasi-Monte Carlo Software*, Special Session on Quasi-Monte Carlo Software, Thirteenth International Conference on Monte Carlo Methods and Applications, Mannheim, Germany, August 17, 2021 (virtually) [126, 129, 130].

[T3] *Quasi-Monte Carlo Software*, Tutorial given at the Fourteenth International Conference on Monte Carlo and Quasi-Monte Carlo Methods, Oxford, England, August 10, 2020 (virtually) [84, 126, 129, 130].

[T4] *An Optimal Adaptive Algorithm Based on a Pilot Sample*, Special Session on Current Challenges in High-Dimensional Algorithms, Twelfth International Conference on Monte Carlo Methods and Applications, Sydney, Australia, July 8, 2019 [86, 87].

[T5] *Adaptive Approximation for Multivariate Linear Problems with Inputs Lying in a Cone*, RICAM Workshop on Multivariate Algorithms and Information-Based Complexity, Linz, Austria, November 9, 2018 [86, 87, 93, 94].

[T6] *Fast Adaptive Bayesian Cubature Using Low Discrepancy Sampling*, Special Session on When to Stop a Simulation, Thirteenth International Conference on Monte Carlo and Quasi-Monte Carlo Methods, Rennes, France, July 4, 2018 [4].

[T7] *The Advantages of Sampling with Integration Lattices*, Conference in Honour of Ian Sloan on the Occasion of His 80$^{\text{th}}$ Birthday, 17-19 June 2018, UNSW, Sydney, Australia [4, 68, 92, 127].

[T8] *Adaptive Bayesian Cubature Using Quasi-Monte Carlo Sequences*, Minisymposium on Probabilistic Numerical Methods for Quantification of Discretisation Error, SIAM Conference on Uncertainty Quantification, Garden Grove, CA, April 17, 2018 [4].

[T9] *Adaptive Probabilistic Numerical Methods Using Fast Transforms*, SAMSI-Lloyds-Turing Workshop on Probabilistic Numerical Methods, Alan Turing Institute, London, April 11, 2018 [4].

[T10] *When to Stop Sampling: Answers and Further Questions*, Invited talk, Trends and Advances in Monte Carlo Sampling Algorithms, Statistical and Applied Mathematical Sciences Institute (SAMSI) Program on Quasi-Monte Carlo and High-Dimensional Sampling Methods for Applied Mathematics (QMC), Duke University, December, 2017 [4, 93, 94, 127].

[T11] *Error Analysis for Quasi-Monte Carlo Methods*, Invited tutorial at the Opening Workshop of the Statistical and Applied Mathematical Sciences Institute (SAMSI) Program on Quasi-Monte Carlo and High-Dimensional Sampling Methods for Applied Mathematics (QMC), Duke University, August 28, 2017 [90].

[T12] *Deterministic, Randomized, and Bayesian Ways to Stop a Simulation*, Special Session on Stochastic Simulation, Eleventh International Conference on Monte Carlo Methods and Applications, Montréal, Canada, July 6, 2017 [4, 93, 94, 127].

[T13] *Local Adaption for Univariate Function Approximation and Minimization with Guarantees*, IBC on the 70$^{\text{th}}$ Anniversary of Henryk Woźniakowski, Będlewo, Poland, September 2, 2016 [5].

[T14] *Error Analysis of Quasi-Monte Carlo Methods*, Invited tutorial at the Twelfth International Conference on Monte Carlo and Quasi-Monte Carlo Methods, Stanford University, August 14, 2016 [90].

[T15] *Adaptive Quasi-Monte Carlo Methods*, Special Session on Recent Developments in Monte Carlo Methods, 23$^{\text{rd}}$ Spring Research Conference, Illinois Institute of Technology, May 26, 2016 [93, 94].

[T16] *Bridging the Gap Between Numerical Analysis and Computational Practice: A Case Study*, 45$^{\text{th}}$ Anniversary Distinguished Lecture, Hong Kong Baptist University, Hong Kong, December 2, 2015 [9, 93, 94, 96].

[T17] *Guaranteed Fixed-Width Confidence Intervals for Monte Carlo and Quasi-Monte Carlo Simulation*, Invited Talk, 47èmes Journées de Statistique de la Société Française de Statistique, Lille, France, June 1, 2015 [93, 94, 96].

[T18] *Adaptive Monte Carlo and Quasi-Monte Carlo Integration*, Mini-symposium on High-Dimensional Approximation and Integration: Analysis and Computation, SIAM Conference on Computational Sciences and Engineering, Salt Lake City, UT, March 13–18, 2015 [93, 94, 96].

[T19] *Adaptive Algorithms for Stochastic Computation*, ICERM Workshop on Information Based Complexity and Stochastic Computation, Providence, RI, September 15–19, 2014 [93, 94].

[T20] *A Survey of Issues in Reliable Computational Science*, Mini-Symposium on Reliable Computational Science, SIAM Annual Meeting, July 7–11, 2014 [127]

[T21] *Reliable Error Estimation for Cubature Using Sobol' Sequences*, Special Session Celebrating in Honor of Ilya M. Sobol', Eleventh International Conference on Monte Carlo and Quasi-Monte Carlo Methods, Leuven, Belgium, April 6–11, 2014 [93].

[T22] *Constructing Trustworthy Automatic Numerical Integration Algorithms*, Plenary talk at the Midwest Numerical Analysis Day, University of Chicago, IL, May 25, 2013 [9].

[T23] *Designs for Computer Experiments with Gradient Information*, Invited Session on Computer Experiments, Spring Research Conference, Harvard University, Cambridge, MA, June 13–15, 2012 [10, 16].

[T24] *Monte Carlo Algorithms Where the Integrand Size is Unknown*, plenary talk at the Tenth International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing, University of New South Wales, Sydney, February 13–17, 2012, [96].

[T25] *The Reliability of Error Estimates for Multivariate Numerical Integration*, AMS Special Session on Mathematics of Computation, Joint Mathematics Meetings, Boston, January 4–8, 2012 [96].

[T26] *Designs and Model Families for Computer Experiments with Derivative Information*, Invited Ses-

sion on Design and Modeling for Computer Experiments, International Conference on Design of Experiments, Memphis, May 10–13, 2011 [10, 16].

[T27] *Strong Tractability of Function Approximation Using Radial Basis Function Methods*, Special Session Celebrating Stefan Heinrich's 60$^{\text{th}}$ Birthday, Ninth International Conference on Monte Carlo and Quasi-Monte Carlo Methods, Warsaw, August 15–20, 2010 [97].

[T28] *Computational Issues for Kernel-Based Function Approximation* Stream on Complexity and Approximation in Numerical Analysis, International Conference on Engineering and Computattional Mathematics, Hong Kong, May 27–29, 2009 [24].

[T29] *Evaluating Options Whose Payoffs Depend on Continuously Monitored Asset Prices*, AMS Special Session on Mathematics of Computation, Joint Mathematics Meetings, Washington, DC, January 5–8, 2009 [18, 98].

[T30] *Approximating Functions of Many Variables: New Territory for Low Discrepancy Designs*, Special Session Celebrating Ian Sloan's 70$^{\text{th}}$ Birthday, Eighth International Conference on Monte Carlo and Quasi-Monte Carlo Methods, Montreal, July 6–11, 2008 [24].

[T31] *Breaking the Curse of Dimensionality with Lattice Designs*, Special Session on Mathematical Modeling and Numerical Methods, AMS Fall Central Section Meeting, Chicago, October 5, 2007 [24].

[T32] *Energy and Discrepancy as Criteria for Designs for Numerical Computation, Part 1*, Special Session on Approximation in High Dimensions, Seventh International Conference on Computational and Mathematical Methods in Science and Engineering, Chicago, June 20–23, 2007 [19, 132].

[T33] *Tractability of Linear Multivariate Problems in the Average Case Setting*, Special Session on Tractability of Multivariate Problems, Seventh International Conference on Monte Carlo and Quasi-Monte Carlo Methods, August 14–18, 2006 [100].

[T34] *Optimal Points for High Dimensional Problems*, Mini-Symposium on Optimal Points and Shapes for Numerical Computation, SIAM Annual Meeting, July 10–14, 2006.

[T35] *Kai-Tai Fang's Contributions to Quasi-Monte Carlo Methods*, International Conference on Statistics in Honour of Professor Kai-Tai Fang's 65$^{\text{th}}$ Birthday, Hong Kong, June 20–24 2005.

[T36] *Solving High Dimensional Numerical Problems*, Midwest Numerical Analysis Conference, University of Iowa, Iowa City, May 20–22, 2005, [104].

[T37] *Fast Spline Algorithms Using Low Discrepancy Point Sets*, Fifth IMACS Seminar on Monte Carlo Methods, Tallahassee, May 16-20, 2005, [104].

[T38] *Experimental Design, Coding Theory and Reproducing Kernel Hilbert Spaces*, International Congress of Chinese Mathematicians, Hong Kong, December 17–22, 2004.

[T39] *Error Analysis of Numerical Integration — Hilbert is Helpful but Banach is Better*, Modern Computational Methods in Applied Mathematics, Będlewo, Poland, June 14–19, 2004.

[T40] *Experimental Designs Using Digital Nets with Small Numbers of Points*, Special Session on Highly-Uniform Point Sets, Sixth International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing, Juan-les-Pins, Cote d'Azur, France, June 7–10, 2004.

[T41] *Spline Methods for Solving High Dimensional Problems*, Special Session on the Tractability of Multivariate Integration, Sixth International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing, Juan-les-Pins, Cote d'Azur, France, June 7–10, 2004, [104].

[T42] *Accurate Methods for Evaluating Multidimensional Integrals*, International Conference on Mathematics and its Applications in Honour of Roderick Wong's 60th Birthday, City University, May 28–31, 2004.

[T43] *Optimality and Robustness of Net Designs*, Workshop on Experimental Design, Institute of Statistical Science, Academia Sinica, Taipei, December 22–24, 2003.

[T44] *Enhancing the Accuracy of Quasi-Monte Carlo Methods*, Mini-Symposium on Quasi-Monte Carlo Methods, Fifth International Congress on Industrial and Applied Mathematics, Sydney, Australia, July 7–11, 2003, [34].

[T45] *Tractability of Integration Using Lattices and Digital Nets*, Mini-Symposium on Tractability of Multivariate Problems, Fifth International Congress on Industrial and Applied Mathematics, Sydney, Australia, July 7–11, 2003 [107].

[T46] *Low to High Accuracy Integration of Non-Periodic Functions Based on Lattice Sampling*, Special Session on the Tractability of Multivariate Integration, Fifth International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing, Singapore, November 25–28, 2002, [107].

[T47] *An Algorithm-Driven Approach to Error Analysis for Multidimensional Integration*, Foundations of Computational Mathematics, Institute of Mathematics and Its Applications, University of Minnesota, August 5–14, 2002, [26].

[T48] *Existence of Good Extensible Rank-1 Lattices*, Numerical Integration and Its Complexity, Oberwolfach, Germany, November 18–24, 2001, [40].

[T49] *Quasi-Monte Carlo Sampling for Integration and Simulation in Statistics Problems*, Special Session on Quasi-Monte Carlo Methods, Fifth International Chinese Statistical Association (ICSA) International Conference, Hong Kong, August 17–19, 2001.

[T50] *Optimal Quadrature of Multivariate Haar Wavelet Series*, International Conference of Computational Harmonic Analysis, Hong Kong, June 4–8, 2001, [37].

[T51] *When Is $O(N^{-2+\epsilon})$ Convergence Obtainable for Lattice Quadrature Rules?*, Special Session on the Tractability of Multivariate Integration, Fourth International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing, Hong Kong, November 27 – December 1, 2000, [111].

[T52] *The Price of Pessimism in Multidimensional Integration*, Workshop on the Computational Complexity of Multivariate Problems, Hong Kong, October 4–8, 1999, [48].

[T53] *Error Decay Rates for Quasi-Monte Carlo Quadrature*, Mini-Symposium on Quasi-Monte Carlo Methods, Fourth International Congress on Industrial and Applied Mathematics, Edinburgh, Scotland, July 5–9, 1999, [55].

[T54] *Randomized Quasi-Monte Carlo*, Workshop on Applied Probability (Financial Mathematics and Stochastics), Hong Kong, May 31 – June 4, 1999, [112].

[T55] *What Affects the Accuracy of Quasi-Monte Carlo Quadrature?*, Third International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing, Claremont, CA, USA, June 22–26, 1998, [115].

[T56] *Measures of Quality for Uniform Designs*, Workshop on Experimental Design, Hong Kong, May 24, 1997, [57].

[T57] *Quadrature Error Bounds and Figures of Merit for Quasi-random Points*, Workshop on Quasi-Monte Carlo Methods and Their Applications, Hong Kong, December 13–15, 1995, [68].

Selected Grants and Gifts

The publication list for each grant is not complete. It only includes those publications that I (co-)authored.

[G1] M. Saleh (PI), F. J. Hickernell, K. T. Christensen, M. Krishnamurthy, and W. A. Payne *ART: Illinois Tech Forward Initiative*, NSF-TIP-2331458, US$6,000,000, 2024–2028

[G2] F. J. Hickernell (PI) and Y. Ding, *Collaborative Research: Cost-Efficient and Confident Sampling for Modern Scientific Discovery*, NSF-DMS-2316011, US$350,000, 2023–2026, partially supported [1, 2]

[G3] Y. Ding (PI) and F. J. Hickernell, *REU Site: Summer Undergraduate Research Experience (SURE) at Illinois Tech*, NSF-DMS-2244553, US$404,893, 2023–2026

[G4] F. J. Hickernell, *Quasi-Monte Carlo Software*, gifts from alumni, US$37,000, 2021–2023, partially supported [83, 126, 129]

[G5] F. J. Hickernell (PI), *Community Quasi-Monte Carlo Software Library*, SigOpt, US$20,000, 2019–2020, partially supported [84, 126, 129, 130]

[G6] G. E. Fasshauer and F. J. Hickernell (PI), *Stable, Efficient, Adaptive Algorithms for Approximation and Integration*, NSF-DMS-1522687, US$270,000, 2015–2018, partially supported [4–6, 86, 88, 91–95, 127, 131].

[G7] F. J. Hickernell (PI), *Modern Monte Carlo Methods for High Energy Event Simulation, Parts I, II*, Fermilab, US$7,440, US$9,495, 2015.

[G8] G. E. Fasshauer and F. J. Hickernell (PI), *Kernel Methods for Numerical Computation*, NSF-DMS-1115392, US$320,000, 2011–2014, partially supported [7, 9, 12, 13, 93–97, 127].

[G9] I. Cialenco, J. Duan (PI), and F. J. Hickernell, *NSF/CBMS Regional Conference in the Mathematical Sciences — Recent Advances in the Numerical Approximation of Stochastic Partial Differential Equations*, NSF-DMS-0938235, US$34,975, 2010.

[G10] F. J. Hickernell (PI), *Stochastic Optimization of Complex Systems*, Department of Energy, DE-SC0002100, US$188,229, 2009–2013, a collaboration with Mihai Anitescu (Argonne National Laboratories), John R. Birge (University of Chicago), and Paul D. Hovland (Argonne National Laboratories), partially supported [10, 13, 16, 97].

[G11] J. Duan, G. E. Fasshauer, F. J. Hickernell, S. Li, and X. Li (PI) *Scientific Computing Research Environments for the Mathematical Sciences at IIT*, NSF-DMS-0923111, US$97,900, 2009–2011, partially supported [96].

[G12] G. E. Fasshauer and F. J. Hickernell (PI), *Fast and Accurate High Dimensional Function Approximation*, NSF-DMS-0713848, US$244,000, 2007–2011, partially supported [12–15, 18–20, 23, 24, 97, 98].

[G13] F. J. Hickernell, *Algorithms and Tractability for Multivariate Approximation*, FRG/03-04/II-49, HK$110,000, RGC/HKBU/2009/04P, HK$318,000, completed August 2005, partially supported [23, 104].

[G14] F. J. Hickernell, *Construction of Low Discrepancy Sequences*, RGC/HKBU/2007/03P, HK$486,000, ongoing, completed February 2005, [25, 29, 30, 103–105, 108].

[G15] F. J. Hickernell, *Minimum Generalized Aberration Experimental Designs*, FRG/02-03/II-37, HK$154,224, completed August 2005, partially supported [25, 30, 102, 103].

[G16] F. J. Hickernell, W. Y. Cheng, Y. K. Cheng, B. Hu, L. Liao, J. Liu, K. P. Ng, L. H. Tang, T. Tang, and X. Wu, *Learning Computational Science on a Parallel Architecture*, TDSG/02-03/04, HK$3,000,000, completed December 2005.

[G17] F. J. Hickernell, *Higher Accuracy Methods for Multidimensional Quadrature*, FRG/00-01/II-62, HK$196,400, and RGC/HKBU/2020/02P, HK$564,000, completed February 2005, partially supported [23, 26, 32–36, 38, 39, 102, 106, 107, 110].

[G18] F. J. Hickernell and T. Tang, *Spectral Methods Using Arbitrary Lattices: A Preliminary Study*, FRG/99-00/I-45, HK$38,000, completed September 2002, partially supported [110].

[G19] F. J. Hickernell, *Low Discrepancy Sampling on a Finite Grid*, FRG/99-00/II-65 & FRG/01-02/I-20, HK$171,500, completed September 2002.

[G20] K. T. Fang, F. J. Hickernell and L. Y. Chan, *Connections Among Orthogonal, Optimal and Uniform Designs*, RGC/HKBU/2029/99E, HK$331,000, completed December 2004, partially supported [43, 45, 53].

[G21] F. J. Hickernell, *An Integrated Approach to Experimental Designs*, FRG/99-00/II-01, HK$141,500, completed March 2001, partially supported [43, 45, 53].

[G22] F. J. Hickernell, *The Computational Complexity of Multidimensional Quadrature*, FRG/97-98/II-99, HK$179,000, completed March 31, 2001, and RGC/HKBU/2030/99P, HK$405,000, completed August 2002, partially supported [26, 34, 37–42, 46, 48, 49, 51, 55, 106, 111, 112, 114].

[G23] K. T. Fang and F. J. Hickernell, *The Robustness and Efficiency of Experimental Designs for Complex Systems — A Study of the Uniform Design*, RGC/97-98/47, HK$435,600, completed September 2000, partially supported [44, 47, 50, 55, 56, 115].

[G24] F. J. Hickernell, *The Generation and Application of Good Lattice Point Sequences*, FRG/96-97/II-67,

HK$162,992, completed February 2000, partially supported [52, 54, 55, 115, 116].

[G25] F. J. Hickernell, K. T. Fang and L. Z. Liao, *Quasi-Monte Carlo Methods for Scientific Computing*, FRG/95-96/II-01, HK$190,000, completed July 1998, partially supported [57, 59, 61, 65, 67, 117].

[G26] K. T. Fang and F. J. Hickernell, *Some Problems in Non-Normal and Non-Linear Multivariate Statistics*, RGC/94-95/38, HK$303,000, completed September 1997, partially supported [57, 60, 61, 63, 65–67, 118–120, 133].

[G27] K. T. Fang, F. J. Hickernell, P. C. B. Lam and K. W. Ng, *Number-Theoretic Methods in Statistics and Their Applications*, RGC/91-92/04, HK$345,000, completed December 1993, partially supported [68–71].

Research Centers and Institutes

2009–present	Faculty Affiliate, Wanger Institute for Sustainable Energy Research (WISER)
2017–2018	Director, Center for Interdisciplinary Scientific Computation (CISC)
2003–2004	Director, High Performance Cluster Computing Centre Supported by Dell and Intel, Hong Kong Baptist University
2001–2004	Director, Peking University – Hong Kong Baptist University Joint Research Institute for Applied Mathematics
1992–2004	Member, Statistics Research and Consultancy Centre Hong Kong Baptist University

Professional and Community Service

Examining, Refereeing, and Editorial Work

Associate Editor, *International Journal of Numerical Analysis and Modeling*, 2003–2017

Associate Editor, *Journal of Mathematical Research with Applications*, 2010–present

Associate Editor, *Journal of Complexity*, 1999–present; one of two judges chosen to select the Best Paper Award for 2002, 2018

Associate Editor, *SIAM Journal on Numerical Analysis*, 2005–2018

Associate Editor, *Mathematics of Computation*, 2008–2016

Corresponding Editor, *Institute of Mathematical Statistics Bulletin*, 1992–2001

External examiner for MPhil and PhD theses at other universities

NSF panel member; referee for research grant proposals to national funding agencies in various countries

Referee for various journals, including, *ACM Trans. Model. Comput. Simul.*, *Ann. Inst. Statist. Math.*, *Ann. Statist.*, *Math. Comp.*, *Math. Comput. Modelling*, *SIAM J. Numer. Anal.*, *SIAM J. Sci. Comput.*, *SIAM Rev.*

Reviewer for Mathematical Reviews, 2001–2008

Leadership in Professional and Service Organizations

Member, the Numerical Algorithms Group (NAG), 2010–2022

International Christian School (ICS) Parent Association Chairman, 2002–2004, Executive Committee Member, 2001–2004; Member of the ICS School Management Committee, 2002–2004; Member of the ICS Headmaster Search Committee, 2002

Hong Kong Professional and Educational Services Board Member, 1991–2005, Chairman of the Board, 2001–2003

Hong Kong Meteorological Society Executive Committee Member, 1989–1992

Hong Kong Mathematical Society Membership Secretary, 1988–1990

Advisor, United Christian College (Kowloon East), 2003–2004

Conference and Program Organization

Program Committee Member, biennial *International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing*, 1998–present, Organizing Committee Co-Chair, 2000, Steering Committee Member, 2006–present

Program Committee Member, biennial *International Conference on Monte Carlo Methods and Applications*, 2017–2021

Co-Organizer, Workshop on Multivariate Algorithms and Information-Based Complexity, part of the Johann Radon Institute for Computational and Applied Mathematics (RICAM) special fall 2018 semester on Multivariate Algorithms and their Foundations in Number Theory, Linz, Austria, 2018

Program Leader (one of four) for The Statistical and Mathematical Sciences Institute (SAMSI) yearlong Program on Quasi-Monte Carlo and High Dimensional Sampling Methods for Applied Mathematics, Research Triangle, North Carolina, 2017–18

Program Committee Member and Local Arrangements Chair of the Sixteenth Statistical Research Conference, Chicago 2016

Scientific Committee Member, *Seventh International Conference on Computational and Mathematical Methods in Science and Engineering*, Chicago, 2007

Co-Chair, Scientific Committee, *International Conference on Statistics in Honour of Professor Kai-Tai Fang's 65^{th} Birthday*, Hong Kong, 2005

Program Committee Member, *Fifth IMACS Seminar on Monte Carlo Methods*, Florida, 2005

Organizing Committee Member, *International Congress of Chinese Mathematicians*, Hong Kong, 2004

Conference Committee Member and Organizing Committee Chair, *International Conference on Scientific Computing and Partial Differential Equations*, Hong Kong, 2002

Special session organizer, *Fifth International Chinese Statistical Association (ICSA) International Conference*, Hong Kong, 2001

Organizing Committee Member, *Foundations of Computational Mathematics Fall 1999 Semester* in Hong Kong; Co-organizer, *Workshop on the Computational Complexity of Multivariate Problems*, Hong Kong, 1999

Local Organizing Committee Chairman, *International Symposium on Contemporary Multivariate Analysis and Its Applications*, Hong Kong, 1997

Co-organizer, *Workshop on Quasi-Monte Carlo Methods and Their Applications*, Hong Kong, 1995

International Organizing Committee Member and Local Organizing Committee Member, *Second International Conference on East Asia and Western Pacific Meteorology and Climate*, Hong Kong, 1992

Local Organizing Committee Vice-Chairman, *International Symposium on Multivariate Analysis and Its Applications*, Hong Kong, 1992

Local Organizing Committee Member, *Asian Mathematical Conference*, Hong Kong, 1990

Illinois Institute of Technology Service

Convener, Research Council, 2018–present

Member, Steering Committee for the Center for the Study of Ethics in the Professions, 2014–present

Co-Facilitator, Department Chairs Forum, 2013–2017

Advisor, Intervarsity Christian Fellowship, 2005–2017

Chair, Biology Chair Search Committee, 2015

Chair, Provost Search Committee, 2014–2015

Member, Selection Committee for the ERIF grants and Starr-Fieldhouse Fellowships, 2014

Chair, Physics Chair Search Committee, 2013

Chair, Review Committee for the Dean of the College of Science and Letters, 2012–13

Member, Review Committee for the Department of Mathematics and Science Education, 2012

Member, Sigma Xi Research Awards selection committee, 2008, 2009, 2011

Chair, Computer Science Chair Search Committee, 2005–2007, 2009

Member, Provost Search Committee, 2007–08

Member, Research Center Review Committee, 2007

Hong Kong Baptist University Service

Council standing committees: Campus Development, Personnel

Senate (formerly Academic Board) and its standing committees: Academic Development, Academic & Professional Standards, Academic Rules & Regulations (chair, member), Christian Activities, Research, Student Affairs

University standing committees: Staff Affairs, Information Technology, Promotion Panel

Various university ad hoc committees and working groups, including: Academic Staff Performance Management Task Group, Centre for Educational Development Review Panel, Committee on Termination of Appointment, Internationalization Committee, Internationalization Advisory Committee, Panel to Review a Dispute Involving the Religion & Philosophy Department and a Staff Member, Search Committee for the Vice-President for Development, Student Activities Fund Disbursement Panel, Student Disciplinary Panel, Working Group on Self-Funded Courses (chair), Working Group on Senate Standing Committee Memberships, Zero-Based Budgeting Committee

Course boards: BSc Combined Sciences, MSc Scientific Computing

Science Faculty standing committees: Academic Administrative, Computing (chair), Projects, Research Specialist Panel (deputy chair, member), Staff Development Resources