

Igor Rivin

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RESEARCH INTERESTS Geometry of polyhedra, differential geometry, low dimensional topology, graph theory, combinatorics, probability theory, matrix analysis, asymptotics, symbolic computation, computational physical chemistry, computational biology, computational methods in mathematics, finance.

EDUCATION ♦ **Princeton University**, Princeton, NJ
Ph.D. in Mathematics, September 1986.
Doctoral Dissertation: *Geometry of Polyhedra in Hyperbolic 3-space*,
William P. Thurston, advisor.
M.Sc. in Mathematics, September 1982.

♦ **University of Toronto**, Canada.
B.Sc (Hon), with distinction in Mathematics, September 1981.

WORK EXPERIENCE ♦ **Founder and President of Rivin Financial, Inc.** (2004 – present)
♦ **Visiting Fellow**, Princeton University, July 2005-June 2006.
♦ **Professor of Mathematics**, Temple University (July 1999 – present)
Courses taught: Advanced Algorithms (Computer Science Core Course), Quantum Computation, Advanced Problem Solving, Mathematics and Computation, various Calculus courses.
♦ **EPSRC Advanced Research Fellow with Rank of Reader**, Department of Mathematics, University of Manchester, UK January 1999-July 2000
♦ **Warwick Research Fellow**, Warwick University, Coventry, UK (July 1995-December 1998)
♦ **Olga Tausski-John Todd Instructor**, California Institute of Technology, Pasadena, CA (September 1995-September 1998)
♦ **Research fellow**, University of Melbourne, Victoria, Australia (September 1994 – September 1995).
♦ **Member**. Institute for Advanced Study, Princeton, NJ (September 1993-August 1994)
♦ **Consultant**, NEC Research Institute, Princeton, NJ (February 1991-August 1993)
♦ **Director of Advanced Development**, Wolfram Research Inc (January 1990-January 1991).
♦ **Manager of Algorithm Development**, Wolfram Research Inc (June 1989-December 1990).
♦ **Member of Technical Staff**, Wolfram Research Inc (January 1989-February 1989)

- ◇ **Research Associate; Application director of the QLISP project**, Computer Science Department, Stanford University (January 1987-December 1988)
- ◇ **Member of Technical Staff**, Symbolics Inc (MACSYMA Group), (June 1986-December 1986)
- ◇ **Consultant**, Los Alamos National Laboratory (January 1986-June 1986)
- ◇ **Member**, Institut des Hautes Études Scientifiques, Paris (September 1985-June 1986)
- ◇ **Consultant**, Symbolics Inc (MACSYMA Group) (June 1983-September 1985).

VISITING
POSITIONS

- ◇ **Distinguished Visitor**, Université Paul Sabatier, Toulouse, January 2004.
- ◇ **Visiting Researcher**, Microsoft Research, September 2001
- ◇ **Maître des Recherches**, École Polytechnique, Palaiseau, France (October-December 1999)
- ◇ **Distinguished Visitor** Federal University of Cear , Fortaleza, Brazil (January 1999)
- ◇ **Visiting Professor**, Universit  Paris-Sud, Orsay (June 1999)
- ◇ **Visiting Professor**, CWI, Amsterdam (February 1999)
- ◇ **Visiting Research Professor**,  cole Polytechnique, Palaiseau (November 1998)
- ◇ **Visiting Professor**, IHES, Paris (March 1998, August-September 1997)
- ◇ **Distinguished Visitor**, Universit  de Rennes, I (June 1997)
- ◇ **Chercheur Associ  CNRS**, ENS de Lyon (Spring 1996)
- ◇ **Visiting Professor**, Centre  mil Borel, Institut Henri Poincar , Special Semester in Low Dimensional Topology and Hyperbolic Geometry, Spring 1996.
- ◇ **Chercheur Associ  CNRS**, Universit  Louis Pasteur, Strasbourg, France.

HONORS AND
AWARDS

- ◇ **Lady Davis Fellow**, Hebrew University, Jerusalem 2005-2006.
- ◇ **Distinguished Scholar**, Mathematics Department, Temple University, 2005-2006.
- ◇ **EPSRC College Member** Jan 2003-Dec 2006.
- ◇ **Plenary Speaker**, Janos Bolyai 200th anniversary celebration, 2002.
- ◇ **Advanced Research Fellowship**, Engineering and Physical Sciences Research Council, The United Kingdom, 1998
- ◇ **Junior Whitehead Prize**, London Mathematical Society, 1998
- ◇ **Plenary Address**, Nordic Mathematics Congress, Lule , Sweden, 1992.
- ◇ **Doctoral Fellowship**, Natural Sciences and Engineering Research Council of Canada, 1983.
- ◇ **University Fellowship**, Princeton University, 1981
- ◇ **First Prize**, Canadian Mathematics Olympiad, 1977

EXTERNAL
FUNDING

- ◇ NSF Department of Mathematical Sciences Research Grant DMS-0072622
- ◇ NSF DMS exploratory research grant (jointly with Henry Cejtin, under the auspices of the Geometry Center) – \$50000 grant to develop ideas on mathematical computation.

INVITED
LECTURES

- Plenary/Principal Addresses:
- ◇ **Banff International Research Station, Kneser-Poulsen Conjecture**, November 2005
 - ◇ **Georgia Topology Conference** Athens, Georgia, June 2005
 - ◇ **Banff International Research Station, Geometric and Asymptotic Methods in Group Theory**, June 2005
 - ◇ **Bolyai 200th anniversary conference** Budapest, July 2002.

- ◇ **Conference in geometry and computation** Warwick, July 1999.
- ◇ **Conference on Foundations of Computation** Oxford, July 1999
- ◇ **British Mathematics Conference** Southampton, March 1999.
- ◇ **International Conference on Geometry and Topology**, The Technion, Haifa, Israel, January 1999.
- ◇ **Orbifold Theorem Conference** Tokyo, Japan, July 1998
- ◇ **West Coast Topology Conference** Stanford, Spring 1996
- ◇ **Special Semester on Low-dimensional topology** Institut Henri Poincaré, Paris, Spring 1996 (Lecture series on geometry of polyhedra)
- ◇ **Wasatch Topology Conference**, Park City, Utah, Fall 1995 (two lectures)
- ◇ **Southern California Topology Day**, Caltech, Fall 1995
- ◇ **Spring Topology Fest**, Cornell University, Spring 1994
- ◇ **Nordic Mathematics Congress** Luleå, Sweden, June 1992
- Department Colloquia:
 - ◇ **University of New Hampshire**, Fall 2005
 - ◇ **City College of New York**, Spring 2005
 - ◇ **City College of New York**, Fall 2004.
 - ◇ **University of Chicago**, Fall 2003
 - ◇ **University of New Hampshire**, Fall 2003
 - ◇ **University of Illinois, Urbana/Champaign**, Summer 2003
 - ◇ **Queens University**, 2002
 - ◇ **University of Exeter**, 2001
 - ◇ **École Polytechnique**, 2001, 1997
 - ◇ **Aberdeen University**, 1998
 - ◇ **LORIA, Nancy, France**, 1998
 - ◇ **Universite Paul Sabatier, Toulouse**, 1998
 - ◇ **University of Southern California**, 1995
 - ◇ **University of Toronto**, 1994, 1993
 - ◇ **Institute for Advanced Study**, 1993
 - ◇ **University of Chicago (Computer Science)**, 1993
 - ◇ **ENS de Lyon**, 1992
- Seminars:
 - ◇ **Topology Seminar**, Rutgers University (Newark), Fall 2005
 - ◇ **Combinatorics Seminar**, MIT, Fall 2005
 - ◇ **Topology Seminar**, Brandeis University, Fall 2005
 - ◇ **Geometry Seminar**, University of Chicago, Spring 2005
 - ◇ **Algebra Seminar**, Temple University, Spring 2005
 - ◇ **Analysis Seminar**, Rutgers University, Fall 2004
 - ◇ **Group Theory Seminar**, CUNY Graduate Center, Fall 2004
 - ◇ **Topology Seminar**, Université Paul Sabatier, Toulouse, Spring 2004
 - ◇ **Geometry Seminar** Indiana University, Fall 2003

- ◇ **Geometry Seminar** University of Michigan, Fall 2003
- ◇ **Dynamics Seminar** Northwestern University, Fall 2003
- ◇ **Geometry Seminar** Rutgers University, Fall 2003
- ◇ **Geometry Seminar** University of Chicago, Fall 2002
- ◇ **Analysis Seminar** Rutgers University, Spring 2001
- ◇ **Analysis Seminar** Johns Hopkins University, Fall 2000
- ◇ **Geometry Seminar** University of Manchester, Fall 2000
- ◇ **Topology Seminar** Rutgers University, Spring 2000
- ◇ **Geometry Seminar** Kings College, London, Fall 1999
- ◇ **Differential Geometry Seminar**, ETH, Zurich, Fall 1999
- ◇ **Geometry Seminar**, Princeton University, Fall 1999
- ◇ **Lecture Series on Geometry of Graphs**, École Polytechnique, Fall 1999
- ◇ **Geometry Seminar**, École Polytechnique, Fall 1999
- ◇ **Geometry Seminar**, École Polytechnique, Fall 1998
- ◇ **Geometry Seminar**, University of Edinburgh, Fall 1998
- ◇ **Geometry Seminar**, King's College, London, Fall 1997
- ◇ **Topology University**, Oxford University, Fall 1997
- ◇ **Geometry and Dynamics Seminar**, Université de Paris Sud, Orsay, Summer 1997 (two talks).
- ◇ **Workshop on geometry and Dynamics**, Université Rennes I, Summer 1997 (lecture series on geometry of simple geodesics).
- ◇ **Seminar on Lie Groups and Differential Geometry**, University of Chicago, Fall 1995
- ◇ **Topology Seminar**, UC Santa Barbara, Fall 1995
- ◇ **Spectral Geometry Seminar**, Université Joseph Fourier, Grenoble, Summer 1992.

- TEACHING
- ◇ At Stanford University Computer Science Department designed and taught two courses (one a sequel to the other) on Symbolic and Algebraic Computation.
 - ◇ At Caltech designed and taught courses on Riemann Surfaces (undergraduate/graduate) and Graph Theory (graduate) also a course on Geometry.
 - ◇ At Warwick University designed and taught an undergraduate course on Combinatorics and a graduate (Master's level) course in topology of surfaces.
 - ◇ At University of Manchester designed and taught a graduate course in Graph Theory
 - ◇ At Temple University, designed and taught two graduate courses on "Advanced Algorithms" (in the Computer Science Department), two (Mathematics Advanced Undergraduate) courses entitled "Senior Problem Solving" (one focussing on number theory, the other on Fourier and Laplace transform methods), one course entitled "sophomore problem solving" (actually discrete mathematics for computer science students), a graduate course (in Mathematics) on Quantum Computing, a graduate course on Riemannian Geometry, and a graduate course on Graph Theory and Related Topics, and a graduate course on Mathematical Computation. Have also taught service calculus courses. For 2005-2006 I am in process of designing courses in Computational Mathematics (with SCHEME) and Topology.
 - ◇ Designed and taught lecture series on Geometry of Polyhedra (at the Institut Henri Poincaré), on geometry of geodesics (at Université Rennes I) and on dynamics of graphs and groups (at the École Polytechnique).

- SERVICE
- ◇ Editor, Online Journal of Analytic Combinatorics.

Igor Rivin

- ◇ Editor, *Advances in Applied Mathematics*.
- ◇ Editor, *Geometriae Dedicata*
- ◇ MSRI Committee of Academic Sponsors.
- ◇ Organizer of the David Epstein 60th anniversary conference, 1997; Editor of the Conference Proceedings Volume (both together with Caroline Series and Colin Rourke).
- ◇ Organizer of the First Spring Convexity Day (Princeton University, March 2003).
- ◇ Reviewer for *Math. Reviews* (137 Reviews)
- ◇ Referee for *Acta Mathematica*, *Annals of Mathematics*, *Inventiones Math.*, *GAGA*, *Journal of Differential Geometry*, *Geometry and Topology*, *Advances in Applied Mathematics*, *Differential Geometry and its Applications*, *Discrete and Computational Geometry*, *Pacific Journal of Mathematics*, *Experimental Mathematics*, *Topology*.
- ◇ Proposal Reviewer for the National Science Foundation (DMS).

DEPARTMENT SERVICE ◇ Currently serving on the Mathematics Department Faculty Search Committee, Technology Committee, Colloquium Committee, and Library Committee. In the past have also served on the Personnel Committee and The Department of Computer Science and Information Technology Search Committee.

- ◇ While at NEC Research and IAS organized the Princeton University Topology Seminar.

SUNDRY SKILLS ◇ C, HTML/XML, Lisp/Scheme, ML, Java, *Mathematica*, MACSYMA, MATLAB, Maple, R/S-Plus, SAS.

- ◇ python, Unix tools ((ba)sh, awk, sed, Perl).
- ◇ Unix/Linux, MS-Windows, MacOS X
- ◇ Fluent spoken/written English, French, and Russian; fair Italian.

CREATIVE WORKS **◇ Preprints**

1. Igor Rivin. Triangulations into Groups. arxiv.org preprint math.GT/0510613
2. Igor Rivin. Extra-Large metrics. arxiv.org preprint math.GT/0509320
3. Ilya Kapovich, Igor Rivin, Paul Schupp, Vladimir Shpilrain. Asymptotic density in free groups and Z^k . arxiv.org preprint math.GR/0507573.
4. Igor Rivin. Continuity of Volumes – On a generalization of a conjecture of J.W. Milnor, arxiv.org preprint math.GT/0502543.
5. Igor Rivin. Estimates and identities for the average distortion of a linear transformation, arxiv.org preprint math.CA/0412260
6. Igor Rivin. Surface Area and other measures of Ellipsoids, arxiv.org preprint math.MG/0403375, submitted
7. Yury Grabovsky, Omar Hijab, Igor Rivin. Differentiability of functions of matrices. arxiv.org preprint math.FA/0310086, submitted.
8. Igor Rivin. Surface Area of Ellipsoids, arxiv.org preprint math.MG/0306387
9. Igor Rivin. Simple Estimates for Ellipsoid Measures, arxiv.org preprint math.MG/0306085
10. Igor Rivin. Spheres and Minima, arxiv.org preprint math.PR/0305252
11. Henry Cejtin and Igor Rivin. A property of Alternating Groups, arxiv.org preprint math.GR/0303036
12. Igor Rivin. The *Amplitude Modulation* transform, arxiv.org preprint math.CA/0212199.
13. Igor Rivin. A multidimensional Law of Sines, arxiv.org preprint math.GM/0211261.
14. Igor Rivin. Another simple proof of a theorem of Chandler Davis, arxiv.org preprint math.FA/02082333.
15. Igor Rivin. Moment zeta function and applications, arxiv.org preprint math.NT/0201109, (submitted).
16. Igor Rivin. Yet another zeta function and learning, arxiv.org preprint cs.LG/0107033.
17. N. L. Komarova and Igor Rivin. Mathematics of Learning, arxiv.org preprint math.PR/0105235.
18. Igor Rivin and Jean-Marc Schlenker. On the Schläfli differential formula, arxiv.org preprint math.DG/0001176
19. Igor Rivin, Growth in free groups (and other stories), arxiv.org preprint math.CO/9911076
20. Igor Rivin. Simple Cycles, arxiv.org preprint math.CO/9910093

◇ Research Articles accepted and in press

1. M. D. Foster and I. Rivin and M. M. J. Treacy and O. Delgado Friedrichs. A geometric solution to the Largest Free Sphere problem in zeolite frameworks, Journal of Microporous and Mesoporous Materials, in press.
2. M. D. Foster, M. M. J. Treacy, J. B. Higgins, I. Rivin, E. Balkovsky, and K. H. Randall. Crystal Structure Solution by a Systematic Topological Search: The Framework Topology of Zeolite ZSM-10. J. Appl. Cryst (in press).
3. Igor Rivin. Some observations on the simplex, to appear in: Non-Euclidean Geometries, János Bolyai Memorial Volume (A. Prékopa, ed. in chief), Kluwer Scientific Publishers, Dordrecht-Boston. (arxiv.org preprint math.MG/0308239).

◇ Research articles

1. Igor Rivin. A simple proof of Mirzakhani's simple curve asymptotics. (December 2004), *Geometriae Dedicata*, vol 114 (2005).
2. Igor Rivin. On some mean matrix inequalities of dynamical interest. arxiv.org preprint math.DS/0312048, electronically published in Communications in Mathematical Physics on January 22, 2005
3. Igor Rivin. Symmetrized Chebyshev Polynomials, arxiv.org preprint math.CA/0301241, Proceedings of the American Mathematical Society, electronically published on November 19, 2004.
4. Igor Rivin. Some properties of the Conjugacy Class Growth Function, in "Group Theory, Statistics, and Cryptography", Contemp. Math. vol. 360, Nov 2004 (American Math. Soc.)
5. Igor Rivin. A Remark on "Counting primitive elements in free groups" (by Burillo and Ventura), arxiv.org preprint math.GR/0302083, *Geometriae Dedicata* **107**(1), 99-100, August 2004.
6. Mike Treacy, Igor Rivin, Evgueni Balkovsky, Keith Randall. Enumeration of periodic tetrahedral network II. Polynodal graphs. Microporous and Mesoporous Materials, **74**, 121 (2004).
7. N. L. Komarova and Igor Rivin. Harmonic mean, random polynomials, and stochastic matrices, arxiv.org preprint math.PR/0105236, *Advances in Applied Mathematics*, **31**(2003), no. 2, pp. 501-526.
8. Igor Rivin, Combinatorial optimization in geometry, arxiv.org preprint math.GT/9907032, *Advances in Applied Mathematics*, **31**(2003), no. 1, pp. 242-271.
9. Igor Rivin, Counting cycles and finite dimensional L^p norms, arxiv.org preprint math.CO/0111106, *Advances in Applied Mathematics*, **29**(2002), no. 4, pp. 647-662.
10. Dmitry Jakobson and Igor Rivin. Extremal Metrics on Graphs, I. *Forum Math.*, **14**, 2001.
11. Igor Rivin. Simple curves on surfaces, *Geometriae Dedicata*, **87**, (1/3):345-360, August 2001 (see also arxiv.org preprint math.GT/9907041)
12. Igor Rivin and J-M Schlenker. The Schläfli formula in Einstein manifolds with boundary, *ERA Amer. Math. Soc.* 5 (1999), pp. 18-23.
13. Frederic Almgren, Jr and Igor Rivin. The mean curvature integral is invariant under bending, In : The David Epstein 60th birthday Festschrift (I. Rivin, C. Rourke, C. Series, eds); International Press 1999.
14. D. Jakobson, S. Miller, I. Rivin, Z. Rudnick, Quantum chaos in graphs, in Proceedings of the IMA workshop on emerging applications of number theory, 1999. arxiv.org preprint hep-th/0310002
15. Daryl Cooper and Igor Rivin, Combinatorial scalar curvature flow and rigidity of ball packings, *Mathematical Research Letters*, **3**, no. 1, January 1996.
16. Igor Rivin, A characterization of ideal polyhedra in hyperbolic 3-space, *Annals of Mathematics* **143**, no. 1, January 1996.
17. Greg McShane and Igor Rivin, Simple curves on hyperbolic tori, *C. R. Acad. Sci. Paris Sér. I. Math.*, **320**, no. 12, June 1995.

18. Greg McShane and Igor Rivin, Geometry of geodesics and a norm on homology, *International Mathematics Research Notices*, February 1995.
19. Igor Rivin, Ilan Vardi and Paul Zimmerman, The N -queens problem, *American Mathematical Monthly*, **101**, no. 7, August-September 1994.
20. Igor Rivin, Euclidean structures on simplicial surfaces and hyperbolic volume, *Annals of Mathematics* **139**, no. 3, May 1994.
21. Igor Rivin and Srimat Chakradhar. Discrete test generation by continuous methods, Proceedings of the IEEE VLSI Testing Symposium, Atlantic City, April 1994.
22. Igor Rivin, Intrinsic Geometry of convex ideal polyhedra in hyperbolic 3-space, In: Analysis, Algebra and Computers in Mathematics – Proceedings of the 21st Nordic Congress of Mathematicians, in the series Lecture Notes in Pure and Applied Mathematics, Marcel Dekker, New York-Basel-Hong Kong, 1994.
23. Igor Rivin, On the geometry of ideal polyhedra in hyperbolic 3-space, *Topology* **32**(1), January 1993.
24. Igor Rivin and C. D. Hodgson, A characterization of compact convex polyhedra in hyperbolic 3-space. *Inventiones Mathematicae* **111**(1), January 1993; (corrigendum, **117**, p. 359).
25. Yuh-Dauh Lyuu and Igor Rivin, A note on tight bounds for transition to perfect generalization in perceptrons, *Neural Computation* **4**(6), November 1992.
26. C. D. Hodgson, Igor Rivin and Warren D. Smith. A characterization of ideal polyhedra and polyhedra inscribed in the sphere, *Bulletin of the AMS* **27**(2), October 1992.
27. M. M. J. Treacy, Satish Rao and Igor Rivin. A topological method for determining new zeolite frameworks, In proceedings of *Ninth International Zeolite Conference*, Montreal, Canada, July 1992.
28. Igor Rivin and Ramin Zabih. A dynamic programming solution to the N -queens problem, *Information Processing Letters* **41**(5), 1992.
29. Eric Grinberg and Igor Rivin. Infinitesimal analysis of the Busemann-Petty problem, *Bulletin of the London Mathematical Society*, **22**, no. 5, September 1990.
30. Igor Rivin and Ramin Zabih. An algebraic approach to constraint satisfaction problems, In proceedings of *International Joint Conference on Artificial Intelligence*, 1989.

◇ **Doctoral Dissertation**

- On the geometry of convex polyhedra in hyperbolic 3-space, Mathematics Department, Princeton University, 1986.

◇ **Technical Reports**

- Igor Rivin and Arkady Rabinov, Programming in QLISP – A case study, Stanford Computer Science technical report, 1988.
- Igor Rivin, Customizing the Definite Integrator, Part I, *Macsyma Newsletter*, October 1986.
- Igor Rivin, Customizing the Definite Integrator, Part II, *Macsyma Newsletter*, January 1987.

◇ **Editorial**

- With Colin Rourke and Caroline Series: The David Epstein 60th birthday festschrift – volume 1 of *Geometry and Topology* monographs, International Press, 1999.

◇ **Translations**

- Viktor Kulikov and P. V. Kurchanov. *Complex algebraic varieties: Periods of integrals and Hodge Structures.*,
Encyclopaedia of Mathematical Sciences 36, Springer Verlag, 1997
- V. V. Shokurov. *Algebraic Curves and their Jacobians*,
Encyclopaedia of Mathematical Sciences 36, Springer Verlag, 1997

◇ **Problems**

- Igor Rivin. On the simplex,
American Mathematical Monthly problem, June-July 1995.

PATENTS ◇ **US Patent Number 5,506,852** Igor Rivin and Srimat Chakradhar.
Testing VLSI circuits for defects.

SOFTWARE ◇ <http://www.math.temple.edu/~rivin/software>