Curriculum Vitae - Renato Feres - November 2013

Professional Preparation

- Universidade Estadual de Campinas, Brazil, B.S. in Physics, 1984;

- Universidade Estadual de Campinas, Brazil, M.S. in Mathematics, 1985;

- California Institute of Technology, Ph.D. in Mathematics, 1989;

- Mathematical Sciences Research Institute, post-doctoral fellowship, 1989-1990;

- University of Chicago; L. E. Dickson Instructor, post-doctoral fellowship, 1990-1993.

Appointments and visiting positions

- Visiting Professor, University of Massachusetts, Amherst, Sabbatical semester, September 1, 2009-December 1, 2009 (no official affiliation with university).

- Visiting Professor, Université Paris-Sud 11, at Orsay, June 2008.

- Professor, Washington University, St. Louis, 2005 - present.

- Associate Professor, Washington University, St.Louis, 1997- 2005

- Visiting Researcher at the ETH Zürich, April 2001-July 2001;

- Visiting Professor, École Normale Supérieure de Lyon, September 2000-April 2001.

- Assistant Professor, Washington University, St.Louis, 1993-1997.

Publications

The pdf files of the not too ancient articles can be obtained at
`http://www.math.wustl.edu/~feres/publications.html`

Articles in print or accepted for publication:

- *Diffusivity in multiple scattering systems*, with Timothy Chumley and Hong-Kun Zhang. (2013) To appear in Transactions of the A.M.S.

- *Multiple scattering in random mechanical systems and diffusion approximation*, with Jasmine Ng and Hongkun Zhang. Commun. Math. Phys. V. 323, N. 2 (2013).

- *From billiards to thermodynamics*, with Tim Chumley and Scott Cook. Computers and Mathematics with Applications, Vol. 65, n. 10 (2013), p. 1596-1613.

- *Random billiards with wall temperature and associated Markov chains*, with Scott Cook, Nonlinearity 25 (2012) 2503-2541.

- *Spectral gap for a class of random billiards*, with Hong-Kun Zhang, Commun. Math. Phys. 313, 479-515 (2012).

- *Harmonic functions over group actions*, with E. Ronshausen. in Geometry, Rigidity and Group Actions, Ed. B. Farb and D. Fisher, University of Chicago Press, 2011, 59-71.

- *The spectrum of the billiard Laplacian of a family of random billiards*, with Hong-Kun Zhang, Journal of Statistical Physics, V. 141, N.6 (2010) 1030-1054.

- *Higher order approximations of isochrons*, with D. Takeshita, Nonlinearity **23** (2010) 1303-1323.

- *A general formula for reactant conversion over a single catalyst particle in TAP pulse experiments*, with A. Cloninger, G.S. Yablonsky, and J.T. Gleaves. Chemical Engineering Science, 64 (2009) 21, 4358-4364.

- *Harmonic functions on $\mathbb{R}$-covered foliations and group actions on the circle*, with S. Fenley and K. Parwani. Erg. Th. Dyn. Syst. 29 (2009) 4, 1141-1161.

- *Probabilistic analysis of transport-reaction processes over catalytic particles: theory and experimental testing*, with G.S. Yablonsky, A. Mueller, A. Baernstein, X. Zheng, J.T. Gleaves. Chemical Engineering Science, 64 (2008) 3, 568-581.

- *Random walks derived from billiards* in Dynamics, Ergodic Theory, and Geometry. Ed. B. Hasselblatt. Mathematical Sciences Research Institute Publications 54, 2007, pages 179-222.

- *Probing Surface Structure via time-of-escape analysis of gas in Knudsen regime.* Joint with G. Yablonsky. Chemical Engineering Science, Vol. 61, Issue 24, December 2006, pages 7864-7883.

- *Dynamics on the space of harmonic functions and the foliated Liouville problem*, with A. Zeghib. Ergod. Th. & Dynam. Sys. 25 (2005), 1-14.

- *A differential-geometric view of normal forms of contractions*, in Modern Dynamical Systems and Applications, Eds.: M. Brin, B. Hasselblatt, Y. Pesin, Cambridge University Press, (2004) 103-121.

- *Knudsen's cosine law and random billiards.* Joint with Gregory Yablonsky, Chemical Engineering Science 59 (2004) 1541-1556.

- *Leafwise holomorphic functions*, with A. Zeghib. Proceedings of the American Mathematical Society, V. 131, n. 6, 1717-1725, 2003.

- *Groups that do not act by automorphisms of codimension-one foliations*, with D. Witte. Pacific Journal of Math, Vol. 204, No. 1, 2002, 31-42.

- *Cartan geometries and Dynamics*, joint with P. Lampe, Geometriae Dedicata 80 (2000), 29-41.

- *Topological Superrigidity and Anosov Actions of Lattices.* Joint with Francois Labourie, Annales Scientifiques de l'ENS, 4e. serie, t. 31, 1998, p. 599-629.

- *Actions of discrete linear groups and Zimmer's conjecture,* Journal of Differential Geometry, vol.42, no. 3, 1995, 554-576.

- *The invariant connection of a $\frac{1}{2}$-pinched Anosov diffeomorphism and rigidity*, Pacific Journal of Mathematics, vol. 171 No. 1, 1995, 139-155.

- *Hyperbolic dynamical systems, invariant geometric structures, and rigidity.* Mathematical Research Letters 1, 11-26, 1994.

- *The center foliation of an affine diffeomorphism*, Geometriae Dedicata 46, 233-238, 1993.

- *Affine actions of higher rank lattices*, Geometric and Functional Analysis Vol. 3. No. 4 1993 p.370-394.

- *Connection-preserving actions of lattices in SL(n,R)* Israel Journal of Math. 79, 1992, 1-21.

- *Geodesic flows on manifolds of negative curvature with smooth horospheric foliations*, Ergod. Th. & Dynam. Sys. (1991), 11, 653-686.

- *Anosov flows with smooth foliations and rigidity of geodesic flows in threee-dimensional manifolds of negative curvature*, with A. Katok. Ergod. Th. and Dynam. sys. 10 (1990) 657-670.

- *Invariant tensor fields of dynamical systems with pinched Lyapunov exponents and rigidity of geodesic flows*, with A. Katok. Ergod. Th. and Dynam. sys. 9 (1989) 627-632.

Articles not submitted for publication:

- *The Minimal Entropy Theorem and Mostow Rigidity* (after Besson, Courtois, Gallot), 1996.

  `http://www.math.wustl.edu/~feres/mostow.pdf`

- *Bounded Representations of Amenable Groupoids and Transference* (with S. Durand), 1994.

  `http://www.math.wustl.edu/~feres/durand.pdf`

Books and expository articles

- *Rigidité, groupe fondamental et dynamique*, with Martine Babillot and Abdelghani Zeghib; Edited by Patrick Foulon. Panoramas et Synthèses (Société Mathématique de France) n. 13, 2002.

- *An introduction to cocycle super-rigidity.* In: Rigidity in dynamics and number theory, Eds.: M. Burger and A. Iozzi. Springer, 2002.

- *Ergodic Theory and Dynamics of G-spaces*, with A. Katok. Chapter 9 of Handbook of Dynamical Systems, Vol. Ia, Elsevier, 2002.

- *Dynamical Systems and Semisimple Groups - an introduction.* Tracts in Mathematics, 126, Cambridge University Press, 1998.

Articles in preparation (working titles only)

- *Differential Geometry of Collision Systems*, with William Ward.

- *k-Harmonic measures and a problem in catalysis*, with Matthew Wallace and Ari Stern.

- *Stochastic thermodynamics of small mechanical systems*, with Timothy Chumley and Scott Cook.

Long term book projects

- *Lectures in probabilistic modeling* (book project) Early draft distributed in separate files can be downloaded from web address:

  `http://www.math.wustl.edu/ feres/Math450syll.html`

  Much more material in manuscript form was added concerning the statistical analysis of simulated data, after course on the topic taught during the Spring 2009 semester, and similar course taught in the Spring of 2012.

- *Geometry, Probability, and Dynamics* (book project). A very early draft can be downloaded from the web address:

  `http://www.math.wustl.edu/~feres/Math545Fall2001.html`.

  Much more material in manuscript form is being added, which is part of a course on the Geometry of Physics, taught during the Fall of 2010. Some material from a course on Brownian motion on Riemannian manifolds was also added.

- *A course in applied mathematics, with emphasis on reaction diffusion systems* (tentative title). Approx. 50 pages. Early draft can be downloaded from

  `http://www.math.wustl.edu/~feres/mathchem.html`.

  I expect that much of this material will be part of the text on probabilistic modeling, in which concepts connected to "reactions" (stochastic Petri nets) are used as the unifying language.

Current research projects, collaborations.

- Long term project concerning the statistical physics of billiard-Markov models of gas-surface scattering and interaction. Various aspects of this work are ongoing collaboration with Hong-Kun Zhang (U. Mass,

Amherst), Timothy Chumley, Jasmine Ng, Scott Cook (the three are thesis advisees), Gregory Yablonsky (Washington University, Chemical Engineering).

- Ongoing collaboration with the research group on heterogeneous catalysis (laboratory of John Gleaves at chemical engineering department at Washington University), particularly Gregory Yablonsky and Eugene Redekop (both from Washington University Chemical Engineering). The topic is reaction-diffusion systems associated to certain types of gas-metal catalysis in so called TAP (temporal analysis of products) experiments.

Thesis advising, current Ph.D. students

- Christopher Cox (Geometry of Hamilton-Jacobi equation)

- William Ward (Hamiltonian dynamics for systems with collisions)

- Matthew Wallace (co-advising with Al Baerstein, Harmonic measures and generalizations.)

Past PhD student advisees

- Timothy Chumley (Central limit theorems and diffusions associated to billiard-Markov models, 2013).

- Jasmine Ng (Random billiards and spectrum, 2011)

- Josh Brady (Navier-Stokes equations, joint with Eliot Fried, 2011)

- Scott Cook (Statistical mechanics, joint with John Shareshian, 2010)

- Emily Ronshausen (Harmonic functions over group actions, 2009)

- Michele Penner (Foliations and property T, 1997)

- Peter Lamp (Rigidity of actions of Lie groups, 1996)

Undergraduate research advisees, current

- Madison Cannon

- Zhe Jiang

- Stephen Rong

- Alan Talmage

- Tyler Ellison

Undergraduate research advisees, past

- Edward Bryden (2013)

- Qing Liu (2013)

- Alec Koppel (2011)

- Matt Gokel (2011)

- Alex Cloninger (2009)

- Jeremy Diepenbrock(2008)

- Alex Mueller (2007)

- Lawrence Hellman

Course development. These are mostly courses which I have developed and taught during the past few years. Currently, I am focused on two on these courses in particular for which I am working on textbooks. One is on stochastic simulation and the other is on physics for mathematics graduate students.

- **Monte Carlo methods.** Taught in the Spring of 2009 and Spring of 2012. Mostly about stochastic simulation, MCMC methods with emphasis on scientific applications and modeling.

- **Geometry of Physics**. A course on geometric topics in mathematical-physics. Aims to provide mathematics graduate students with acquaintance of classical and semiclassical field theories, mainly general relativity and gauge theories. (Course first offered in the Fall of 2008. It was offered again in the Fall of 2010 (under Math 543), with emphasis on classical mechanics and electromagnetism.) I am currently writing a textbook for it and hope that the course will become a more or less regular offering as a post-manifold theory choice for a graduate topics course in geometry/topology.

- **Stochastic modeling**. This is a course on stochastic calculus with an emphasis on numerical computations and modeling problems, taught as Math 450 (topics in applied mathematics). Some preliminary notes (approximately 250 pages) are available in dispersed form as lecture notes at the address:

  `http://www.math.wustl.edu/~feres/Math450syll.html`

  The course was first taught in the spring of 2007. It was taught again in the spring of 2010, when the focus was on statistical analysis of simulated data (under Math 350). It was a especially successful course that demonstrated the interest and demand for this type of topic at a relatively early stage in the math program.

Other new courses taught in the past.

- *p*-**Adic Analysis** (Summer 2009). A two-week math/summer orientation course for the incoming graduate students.

- **The Laplacian on Graphs**. A course on graph theory with emphasis on spectral properties of graph-Laplacians and analytically inspired topics, such as discrete versions of partial differential equations from mathematical physics and random walks. The audience is a mixture of mathematics graduate students and science students from other areas. (In 2005, two were biophysics graduate students from the University of Missouri, St. Louis.) Offered for the first time in the Fall of 2005. (Math 535).

- **Groups and Physics**. Course on group representations and applications, for advanced undergraduates and graduate students in mathematics and physics. Offered for the first time in the Spring 2004. (Math 481)

  Topics: the symmetric group and representations of finite groups; compact groups and Peter-Weyl theorem; irreducible representations of $GL(n,\mathbb{C})$, $SL(n,\mathbb{C})$, $SU(n)$, with emphasis on $n = 2, 3$; Wigner's classification of irreducible representations of the Poincaré group and Mackey's theorems on induced representations. Possible physical topics: molecular vibrations and spectrum; the hydrogen atom; elementary particles and gauge theories. It will be based on *Group theory and physics*, by S. Sternberg.

- **Reaction-diffusion systems**. A course on applied mathematics, being taught currently (Fall 2003, Math 350) to undergraduates in mathematics and chemical engineering. It is centered on topics related to chemical kinetics, diffusion processes, and applications to chemical engineering, environmental science, and biology. Topics include: box models and environmental problem solving; stoichiometry and linear algebra; non-linear differential equations and dynamical systems (vector fields and flows, linearization and local stability, limit sets, bifurcation theory); the linear diffusion equation; diffusion and probability; general properties of reaction-diffusion equations and special systems; pattern formation.

  A very preliminary set of notes that contains the material covered during the first four weeks of the course (about 50 pages) can be downloaded from:

  `http://www.math.wustl.edu/~feres/mathchem.html`

- **Geometry and Probability**. This is a course for science, engineering and mathematics students (graduate and advanced undergraduate) on the subject of stochastic calculus on manifolds and applications. It has been taught once so far, in the Fall 2001. Taught again in the Spring of 2010.

  A rough set of notes (about 160 pages) can be downloaded from

  `http://www.math.wustl.edu/~feres/Math545Fall2001.html`

- **Mathematical methods for physics** - Math 308. This is a variant of the analysis course Math 318, focused on the needs of science, particularly physics, students. The program was developed in consultation with members of the physics department, particularly M. Conradi. First offered in the Spring 2002. It is now offered on a regular basis by the math department. I will teach it for the third time in the Spring 2004 semester.

Funding and Grants

- Research support from the ETH Zürich during by stay at the ETH department of mathematics, April 2001 - July 2001;

- Centre National de la Recherche Scientifique research funding during my stay at the Ecole Normale Supérieure de Lyon, September 2000 - April 2001;

- National Science Foundation research grant DMS-9623109, 1996-1998.

Committees and service

- Organizer (jointly with Hong-Kun Zhang and Tim Chumley) of special session on *Statistical Properties of Dynamical Systems*, at the October 18-20, 2013 St. Louis 1094th Meeting of the AMS.

- Chancellor's Fellowship Committee, 2014.

- Served on Chancellor's Fellowship Committee, 2013.

- Member of the mathematics department executive committee.

- Currently heading the department minorities recruiting initiative. Also a member (mentor) in the National Alliance for Doctoral Studies in Mathematics, which is aimed to increase the participation of students from underrepresented background in mathematics in doctoral programs.

- Served on the department undergraduate committee (Fall 2008-Spring 2009).

- Scientific Committee, International Workshop on Mathematics in Chemical Kinetics and Engineering, MACKIE-2009, Ghent, Belgium (February 2009).

- On the editorial board of journal *Discrete and Continuous Dynamical Systems* since 12/2005.

- SErved on the special lectures committee of the mathematics department (2006).

- Organizer of the undergraduate math club during the Fall 2006 - Spring 2007.

- Member of the University Judicial Board, 2004-2005.

- Mathematics department hiring committee, 2005

- Chairman of the Missouri Section of the Mathematical Association of America, during 2003. I organized the association's last annual meeting, which took place April 3-6 2003, at Washington University.

- I have served on the W. H. Roever Lectures Series in Geometry committee for the past four years. These are lectures given annually by distinguished mathematicians to memorialize W. H. Roever, who was a professor of the math department during the first half of the twentieth century. Recent speakers have included Gregory Margulis, Alice Chang, Micha Kapovich.

- I have twice in the past (2001 and 2003) traveled to China to interview prospective students applying for admission in our graduate program. This is an initiative of both the chemistry and the mathematics department whose main purpose is to evaluate the student's proficiency in English.

- Served on the mathematics department undergraduate committee. Some of the committee's attributions are to regularly review the math curriculum, orient the instructors of problem sessions regarding general procedures and duties (proctoring exams, teaching evaluations), among others.

- Served on the mathematics department graduate committee during 2002-2003. This involves reviewing and selecting applications of prospective graduate students, advising first year students in choosing courses and academic activities, reviewing the students performance in the qualifying courses, making decisions about the curriculum, among other attributions.

- Served for several years on the mathematics department Library committee, which involved the selection of new books and decision whether to place them at Olin or math library.

Invited Talks

- *Geometry in (very) high dimensions*, undergraduate talk given at the Sixth Annual Field of Dreams Conference (aimed at mathematics students from underrepresented groups interested in pursuing graduate school), Phoenix, AZ, November 2012.

- *Random dynamical systems with microstructure*, Workshop on Cartan Connections, geometry of homogeneous spaces, and dynamics, orgabized by A. Cap, C. Frances, and K. Melnick, at the Erwin Schrödinger

International Institute for Mathematical Physics, Vienna, July 10-23, 2011.

- *Mechanics and probability*, AMS sectional meeting, special section on Symplectic and Poisson Geometry, organized by Lin, Pelayo, Ziegler, Statesboro, GA, March 12-13, 2011.

- *Billiards, Markov chains, and classical scattering*, AMS Southeastern Section Meeting, Richmond, Virginia. (In "Statistical properties of Dynamical Systems.") November 06, 2010.

- *Billiards with micro-structure: spectrum and diffusion*, Institut Henri Poincaré, Progress in Dynamics, Paris, November 2009.

- *Random Billiards*, Colloquium at Tufts University, October 2009.

- *Discrete harmonic functions and dynamics*, Dynamical systems seminar, Tufts University, October 2009.

- *Reactant conversion in a simple reaction-diffusion system*, Applied Math seminar, U. Mass., Amherst, November 2009.

- *Discrete harmonic functions over group actions,* Applied Math seminar, U. Mass., Amherst, October 2009.

- *Harmonic functions and dynamics*, Geometry/Dynamics day, EIU, April 2009.

- *Random billiards*, Applied math seminar, U. Mass., Amherst, March 2009.

- *Actions on the circle and the Liouville property*, U. of Chicago, dynamics seminar, October 2008.

- *Harmonic functions and group actions*, Université Paris-Sud 11, Orsay, seminar at the Topology/Dynamics group, June 2008.

- *Harmonic functions and Brownian motion on foliated manifolds.* DePaul University meeting of the American Mathematics Society, October, 2007. (Organized by I.D. Ugarcovici and M. Gidea.)

- *Probing surface structure via time-of-escape analysis of gas in Knudsen regime.* Mathematics in Chemical and Biochemical Kinetics and Engineering (MACKiE-2), Houston, February 8, 2007.

- *Harmonic functions on foliated spaces.* Conference in honor of professor Francesco Mercuri. December 19, 2006, University of Campinas, Brazil.

- *The foliated Liouville problem.* Talk given at the geometry seminar, Indiana University, Bloomington, April 6, 2006.

- *Random Walks and Diffusion.* Talk given at the IGERT seminar (Dynamics of Complex Systems in Science and Engineering.) Northwestern University, February 3, 2006.

- *Dynamics on Networks.* Talk given at the Laboratory for Neurodynamics, University of St. Louis, MO, August 26, 2005. (Organized by Sonya Bahar.)

- *Random walks derived from billiards.* Conference on billiard dynamics and geometry, Eastern Illinois University, November 5, 2005. (Organized by P. Coulton, G. Galperin, and G. Ronsse.)

- *The dynamical Liouville problem.* BIRS workshop on Rigidity, Group Actions, and Dynamics. Banff, Canada, July 9-14, 2005. (Organized by D. Fisher, E. Lindenstrauss, D. Witte Morris, R. Spatzier.)

- *Random Billiards and Diffusion*, Workshop on Probabilistic Limit Laws for Dynamical Systems. International Center for Mathematical Sciences, Edinburgh, Scotland, June 13-17, 2005. (Organized by H. Bruin, I. Melbourne, M. Pollicott, M. Nicol, R. Sharp.)

- *Leafwise harmonic functions on foliated spaces* (series of three lectures). Instituto de Matemáticas, Unidad Morelia, Morelia, Mexico, November 2004.

- *The foliated Liouville problem*, Differential Geometry Day, at Eastern Illinois University, November 2004.

- *Random walks derived from billiards*, workshop in dynamical systems at Penn State U., October 2004.

- *Non-stationary local normal forms and differential geometry* (series of three lectures). Troisième Cycle Romand de Mathématiques (universities of the Rhône-Alpes region). Diablerets, Switzerland, March 2002. Meeting organized by E. Ghys and P. de la Harpe.

- *The foliated Liouville problem.* ETH (Swiss Federal Institute of Technology, Zürich), two talks, May and June 2001. (Invited by M. Burger.)

- *A survey of rigidity theory of semisimple group actions.* Ecole Normale Supérieure de Lyon, two talks, February and March, 2001. (Seminar organized by A. Zeghib and T. Barbot.)

- *Topological superrigidity*, series of three lectures given at a meeting at the Isaac Newton Institute for Mathematical Sciences, Cambridge U.K., January, 2000. (Organized by G. Margulis et al.)

- *Rigid geometric structures and actions of semisimple Lie groups*, series of three lectures for the meeting Etat de la Recherche organized by the Société Mathématique de France, Institut de Recherche Mathématique Avancée, Strasbourg, June 1999. (Organizer: P. Foulon.)

- *Knudsen Diffusivity in a channel with rough wall surface.* Annual meeting of the American Institute of Chemical Engineers in Dallas, Texas, November 1999. (Session organized by L. Nitsche and J. Nitsche.)

- *Topological superrigidity*, series of three lectures, Conference in Ergodic Theory, Geometry and Arithmetic, at the Erwin Schroedinger Institute, Vienna, February 1997. (Organized by A. Katok et al.)

- *Fluxos geodésicos com foliações de Anosov diferenciáveis.* Colóquio Brasileiro de Matématica, IMPA Rio de Janeiro, Summer 1997. (Session organized by A. Rigas.)

- *Cocycle superrigidity and geometry.* Series of four lectures given at Penn State University, April 1996. (Invited by A. Katok.)

- *Actions of $SL(n, \mathbb{Z})$ on tori.* Hebrew University (Givat Ram) – First joint meeting of the American Math. Society and the Israel Math. Union. (Presentation given at the Group Theory session, organized by S. Mozes.) May, 1995.

- *Half-pinching and invariant connections.* The University of Warwick – Math. Research Centre. Workshop on Ergodic Theory on Riemannian Manifolds, July 1995. (Organized by M. Pollicott.)

- *Actions of semisimple groups and Zimmer's conjecture.* Stefan Banach International Math. Center, Warsaw – Conference on Dynamical Systems, June 1995.

- *Anosov flows with smooth foliations.* LMS Durham Symposium on Dynamical Systems, England, July 1988. (Organized by P. Manning.)

- Regular participant of the annual *Workshop on Rigidity of geometric structures*, since 1988.

- Seminar talks given at various places, among which: University of Seattle, Mathematical Sciences Research Institute, University of California at Berkeley, University of Maryland, Northwestern University, University of Chicago, University of Illinois at Chicago, PennState University, University of Minnesota, University of Michigan (Ann Arbor), University of Illinois at Urbana-Champaign, University of Florida at Gainesville, IMPA (Rio de Janeiro), University of Campinas (São Paulo).

Courses taught (only since 2001)

- 523 - Quantum Mechanics for Students of Mathematics, Spring 2014.

- 493 - Probability, Fall 2013.

- Grad. Orient. - Introduction to p-adic analyss, Summer 2013.

- 3200 - Statistics and Data Analysis, Spring 2013.

- 547 - Symplectic Geometry and Mechanics, Spring 2013.

- 350 - Introduction to Monte Carlo methods, Fall 2012.

- 449 - Numerical Applied mathematics - Fall 2012.

- Grad. Orient. - Introduction to p-adic analysis, Summer 2012.

- 233 - Calculus III (sections 1 and 2), Fall 2011.

- Grad. Orient. - Invitation to modern dynamics, Summer 2011.

- 5043 - Algebraic topology, Spring 2011.

- 5041 - Geometry I, Fall 2010.

- 543 - Geometry of Physics, Fall 2010.

- 350 - Simulation analysis of random processes, Spring 2010.

- 553 - Brownian motion on Riemannian manifolds, Spring 2010.

- Graduate Orientation Course - p-Adic Analysis, Summer 2009.

- 5052 - Measure Theory and Functional Analysis II, Spring 2009.

- 5051 - Measure Theory and Functional Analysis I, Fall 2008.

- 545 - Geometry of Physics, Fall 2008.

- 132 - Calculus II - Sections 1, 2, Spring 2008.

- 450 - Computational random processes, Spring 2007.

- 523 - Introduction to Ergodic Theory Fall 2006.

- 449 - Numerical Applied Mathematics Fall 2006.

- 5032 - Algebra II, Spring 2006.

- 5031 - Algebra I, Fall 2005.

- 535 - Spectral Graph Theory, Fall 2005.

- 309 - Matrix Algebra Spring 2005.

- 495 - Stochastic Processes Spring 2005.

- 545 - Discrete Subgroups of Lie Groups, Fall 2004.

- 308 - Mathematics for the Physical Sciences Spring 2004.

- 485 - Groups, Representations, and Physics Spring 2004.

- 350 - Mathematics of Reaction-Diffusion Systems, Fall 2003.

- 308 - Mathematics for the Physical Sciences Spring 2003.

- 418 - Introduction to Topology and Modern Analysis Spring 2003.

- 417 - Introduction to Topology and Modern Analysis Fall 2002.

- 441 - Geometry I Fall 2002.

- 100 - Foundations for Calculus Spring 2002.

- 545 - Stochastic calculus on Riemannian manifolds, Fall 2001.