

ROBERT B. ELLIS

Associate Professor of Applied Mathematics
Illinois Institute of Technology
10 W. 32nd St.
E1 Bldg. Rm. 105C
Chicago, IL 60616

Citizenship: USA
rellis@math.iit.edu
<http://math.iit.edu/~rellis/>
312.567.5336(off.)
312.567.3135(fax)

EDUCATION

- June 2002 **Ph.D. in Mathematics**, University of California at San Diego.
Thesis: *Chip-firing games with Dirichlet eigenvalues and discrete Green's functions*; thesis adviser: Fan Chung
- June 1996 **M.S. in Mathematics**, Virginia Tech, Blacksburg, VA.
Thesis: *A Kruskal-Katona Theorem for Cubical Complexes*; thesis adviser: Clara Chan.
- December 1994 **B.S. in Mathematics**, Virginia Tech, Blacksburg, VA.

PROFESSIONAL HISTORY

- Sep 2011 – present **Associate Professor**, Department of Applied Mathematics, Illinois Institute of Technology
- Sep 2005 – Aug 2011 **Assistant Professor**, Department of Applied Mathematics, Illinois Institute of Technology
- Sep 2002 – May 2005 **NSF VIGRE Visiting Assistant Professor**, Department of Mathematics, Texas A&M University
- Jun 2002 – Aug 2002 **Research Assistant**, University of California at San Diego, for Fan Chung.
- Sep 2001 – Jun 2002 **Research Assistant**, University of California at San Diego, for Andrew B. Kahng, VLSI CAD Laboratory.
- Sep 1996 – Jun 2001 **Teaching Assistant**, University of California at San Diego.
- Jan 1995 – Jul 1996 **Teaching Assistant**, Virginia Tech. Lecturer with full responsibility for two courses totaling three lecture sections. Teaching assistant, and tutor, each for one semester.

ACADEMIC CONCENTRATIONS AND RESEARCH INTERESTS

- Research Area** Discrete Applied Mathematics: combinatorics and graph theory
- Research Topics** Adaptive coding theory (liar games), covering codes, random graph models, deterministic random walks, extremal graph theory, spectral graph theory, chip-firing on graphs
- Types of Results** Bounds on and exact values for optimal sizes of adaptive error-correcting and covering codes, channel generalizations and asymptotic bounds, near-perfect adaptive codes, and bounds on sizes of fixed-radius covering codes. Connectivity thresholds and diameter bounds for random geometric graphs, distribution of small subgraphs in Erdős-Rényi and random intersection graphs. Discretizations of random walk on the integers. Number of cliques in graphs and extremal configurations. Bounds on graph eigenvalues. Structure of chip-firing on graphs and bounds on length of chip-firing games.
- Applications** Multi-hop routing in sensor networks, network substructure detection, data compression and VLSI design, pooling/batch-testing of samples for a desired property,

AWARDS AND RESEARCH SUPPORT

Fall 2008 Honorable Mention, IIT College of Science and Letters Dean's Excellence in Research Award
Fall 2009 IIT Interprofessional Projects Program (IPRO) Outstanding Faculty Award;
Nominated again in Spring 2010

Grant activity

2007-2008 "Optimal adaptive block coding for linear error rates," NSA Young Investigator grant, PI.
2007-2008 "A unified framework for the mathematics of intelligence analysis," AFRL TANGRAM, PI.
2008 "Prototyping a collaborative online undergraduate research forum," IIT Office of Undergraduate Research grant for student support.

PUBLICATIONS

Refereed Journal Articles

1. J. N. Cooper, R. B. Ellis, and A. B. Kahng, "Asymmetric binary covering codes," *J. Combin. Th. A*, 100 (2002), 232-249.
2. F. R. K. Chung and R. B. Ellis, "A chip-firing game and Dirichlet eigenvalues," *Discrete Math.* 257 (2002), 341-355.
3. R. B. Ellis and C. H. Yan, "Ulam's pathological liar game with one half-lie," *Int. J. Math. Math. Sci.* 29 (2004), 1523-1532.
4. R. B. Ellis, V. Ponomarenko, and C. H. Yan, "The Rényi-Ulam pathological liar game with a fixed number of lies," *J. Combin. Theory Ser. A*, 112 (2005), 328-336.
5. R. B. Ellis, X. Jia, and C. H. Yan, "On random points in the unit disk," *Random Structures Algorithms* 29 (2006), 14-25.
6. R. B. Ellis, J. L. Martin, and C. H. Yan, "Random geometric graph diameter in the unit ball," *Algorithmica* 47 (2007), 421-438.
7. R. B. Ellis, "Density of constant radius normal binary covering codes," *Discrete Math.*, 308 (2008), 4446-4459 (special Simonovits issue).
8. R. B. Ellis, V. Ponomarenko, and C. H. Yan, "How to play the one-lie Rényi-Ulam game," *Discrete Math.* 308 (2008), 5805-5808.
9. R. B. Ellis and K. L. Nyman, "Two-batch liar games on a general bounded channel," *J. Combin. Theory Ser. A* 116 (2009), 1253-1270.
10. R. B. Ellis and J. P. Ferry, "Variance of the subgraph count for sparse Erdős-Rényi graphs," *Discrete Appl. Math.* 158 (2010), 649-658.
11. J. N. Cooper and R. B. Ellis, "Linearly bounded liars, adaptive covering codes, and deterministic random walks," *J. Comb.* 1 (2010), 307-334 (Joel Spencer special issue).

Refereed Conference Proceedings

12. R. B. Ellis, A. B. Kahng, and Y. Zheng, "Compression algorithms for dummy fill layout data," *Proc. SPIE*, Vol. 5042, Design and Process Integration for Microelectronic Manufacturing, pp. 233-245, July 2003.

13. R. B. Ellis, J. L. Martin, and C. H. Yan, "Random geometric graph diameter in the unit disk with l_p -metric," extended abstract, *Lect. Notes Comput. Sc.* 3383 (2005), 167-172.
14. J. Bagga, R. Ellis, and D. Ferrero, "The structure of super line graphs," in *ISPAN '05: Proceedings of the 8th International Symposium on Parallel Architectures, Algorithms and Networks* (2005), 468-471.¹
15. G. Calinescu and R. B. Ellis, "Monitoring schedules for randomly deployed sensor networks," in *Proceedings of the DIALM-POMC Joint Workshop on Foundations of Mobile Computing* (2008), pp. 3-12.
16. J. Bagga, R. B. Ellis, and D. Ferrero, "The spectra of super line multigraphs." In: B.D. Acharya, G.O.H. Katona, and J. Nešetřil, eds., *Advances in Discrete Mathematics and Applications* (Proc. Int. Conf. Discrete Math., ICDM-2008, Mysore, India, 2008), to appear.

Manuscripts or Work in Progress

- R. B. Ellis, "Discrete Green's functions for products of regular graphs," manuscript.
- R. B. Ellis, J. P. Ferry, D. P. Lo, and D. Mubayi, "The block-cutpoint tree characterization of a covering polynomial of a graph," in preparation.
- R. B. Ellis, "Optimal packings within coverings for radius 1 adaptive block codes," in preparation.

Theses

- "Chip-firing games with Dirichlet eigenvalues and discrete Green's functions," Ph.D. Thesis, University of California at San Diego, June 2002.
- "A Kruskal-Katona Theorem for Cubical Complexes," Master's Thesis, Virginia Tech, June 1996.

Technical Reports

- Y. DeWoody, R. Ellis, R. Klima, M. Minic, M. Sellers, and J.-M. Yuan, "Examining Randomness of Certain Sequences," CRSC Industrial Mathematics Modeling Workshop for Graduate Students, Technical Report CRSC-TR97-8, 1997.
- A. Cintron-Arias, N. Curet, L. Denogean, R. Ellis, C. Gonzalez, S. Oruganti, and P. Quillen, "A Network Diversion Vulnerability Problem," IMA Mathematical Modeling in Industry Summer 2000 Program for Graduate Students, Technical Report 1752, February 2001.
- R. B. Ellis, A. B. Kahng, and Y. Zheng, "JBIG compression algorithms for 'dummy fill' VLSI layout data," Technical Report #CS2002-0709, UCSD CSE Department, 31pp., June 2002.

RESEARCH ADVISING

Master's Students

- Daniel Tietzer, graduated Fall 2011
- James Williamson, graduated Fall 2011

Miscellaneous Graduate Advising

- PhD committee, Oscar Ortega (2008, Applied Mathematics).
- PhD oral comprehensive exam committee, Lixin Wang (2008, Computer Science).
- Summer research adviser, PhD candidate Jingran Liu (Applied Mathematics), Summer 2009.
- PhD adviser (pre-dissertation), Gergely Bálint, Fall 2010-present.

¹ This corrected author list is posted by IEEE inside the pdf eprint at <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1575866>.



ResearchWeb and URJIIT– research advising aspects. ResearchWeb.iit.edu

originated from my conviction that the infrastructure and processes for undergraduate research at IIT should be strengthened, in collaboration with the Office of Undergraduate Research, IIT undergraduates, and other IIT stakeholders. ResearchWeb is now active as an online tool, and since going live on April 15th of 2010 has linked undergraduate researchers with faculty advisers for 18 projects in 9 different departments. The future of ResearchWeb is the ongoing development from Fall 2010 of the *Undergraduate Research Journal at IIT (URJIIT)* – an online journal with a companion print journal to showcase traditional and multi-media content from IIT's undergraduate thought-leaders. From the beginning, I have included undergraduates in the development of both, through a grant from the Office of Undergraduate Research, and through three IPRO's, from Fall 2009 to Fall 2010. The following table of ResearchWeb usage statistics represents the busy periods of preparation for Summer 2010 and Fall 2010 undergraduate research; we expect peaking activity during the beginning of each new term.



ResearchWeb statistics for April 15-September 16, 2010

Registered Students: 553	Research Positions Posted: 32	Research Positions Filled: 18
Registered Faculty: 96	Student Applications: 74	Departments Participating: 11

Undergraduate research advising

- Jeffrey Stanford, “Adaptive covering codes with linear error rates,” (supported by an Applied Mathematics summer research fellowship), Summer 2007.
- Jonathan Beagley, "Improved bounds for adaptive covering codes," Fall 2007.
- Anandha Abhay, “Prototyping a Collaborative Online Undergraduate Research Forum," supported by an internal peer-reviewed grant from the IIT Office of Undergraduate Research, Fall 2008.
- Ruoran Wang, “Computational study of a deterministic random walk,” supported by a grant from the IIT Office of Undergraduate Research, Summer 2010.

Undergraduate research advising at Texas A&M University

- Brian Worthen and David Mendoza, "Optimal strategies for the Rényi-Ulam pathological liar game with a fixed number of lies," Fall 2003-Spring 2004.
- Justin Wilson, "Rényi-Ulam liar games with 1 half-lie," Summer 2004-Summer 2005.

CONTRIBUTIONS TO TEACHING AT IIT

- IPRO 321 **Interprofessional Projects** (3 credit hours) Fall 2009, Spring 2010, Fall 2010 (in progress).
 Fall 2009 Outstanding Faculty Award
 Spring 2010 Nominated for Faculty Award
 IPRO 321 Spring 2010 brought ResearchWeb (<http://researchweb.iit.edu/>) to the IIT community. Our ambitious goal for Fall 2010 is to launch the *Undergraduate Research Journal at IIT (URJIIT)*; comparable journals exist at most of our peer universities.
- Math 100 **Introduction to the Profession** (2 credit hours) Fall, 2006-2010.
 Project adviser and supplemental lecturer.
- Math 152 **Calculus II** (5 credit hours) Fall, 2005-2007.
 Fall 2006 Dean’s letter of commendation
 Maple lab assignments integrated with lecture.

- Math 230 **Introduction to Discrete Mathematics** (3 credit hours) Spring 2008, 2009, 2011.
- Math 332 **Matrices** (3 credit hours) Fall 2010.
- Math 430 **Applied Algebra** (3 credit hours) Fall 2006, 2008; Spring 2011.
 Fall 2006 Dean's letter of commendation
 Converted to collaborative learning format in Fall 2008.
- Math 431 **Applied Algebra II** (3 credit hours) Spring 2009.
 Spring 2009 Dean's letter of commendation
 Instruction in collaborative learning format.
- Math 454 **Graph Theory and Applications** (3 credit hours) Fall 2005, 2009.
 Fall 2005 Dean's letter of commendation
 Assessment practices incorporated in Fall 2009.
- Math 475 **Probability** (3 credit hours) Fall 2007.
- Math 491 **Reading and Research** (variable credit) Fall 2006, 2007
 Fall 2006 Modeling winning strategies for the board game Clue (four students).
 Fall 2007 Improved bounds for adaptive covering codes (one student).
- Math 553 **Discrete Applied Mathematics I** (3 credit hours) Fall 2009.
- Math 554 **Discrete Applied Mathematics II** (3 credit hours) Spring 2006.
- Math 557 **Probabilistic Methods in Combinatorics** (3 credit hours) Spring 2010.
 Student-driven topic selection, individually advised research projects, and development of writing and presentation skills.

Teaching development

- IIT Teaching Institute, May 20-22, 2009. Workshop on assessment practices.
- IIT CSL Teaching Enrichment Workshop, November 22, 2005.

CONTRIBUTIONS TO TEACHING AT TEXAS A&M UNIVERSITY

- Math 152 **Engineering Mathematics II** (4 credit hours) Fall 2002, 2004.
- Math 152H **Honors Engineering Mathematics II** (4 credit hours) Fall 2003, Spring 2004.
 Customized lecture material and Maple labs.
- Math 220 **Foundations of Mathematics** (3 credit hours) Spring 2003.
- Math 491 **Research** (variable credit) Spring 2003, Summer 2004.
 I directed three students in two separate projects on adaptive coding theory.
- Math 662 **Algebraic Methods in Combinatorics and Graph Theory** (3 credit hours) Summer 2003.
 Co-developed research methods lectures from enumerative combinatorics, and from algebraic and spectral graph theory.

PROFESSIONAL ACTIVITIES

Journal articles refereed

Algorithmica, Ars Combinatoria, Discrete Applied Mathematics, Discrete Mathematics (2), Electronic Journal of Combinatorics (3), European Journal of Combinatorics, Journal of Combinatorial Theory Series A, Journal of Computer System Sciences, Journal of Symbolic Computation, Random Structures and Algorithms, SIAM Journal of Applied Mathematics, SIAM Journal on Discrete Mathematics, Mathematical Reviews (3).

Conference organization

- Co-organizer (with Catherine Yan, Daniela Ferrero, and Xingde Jia) of CombinaTexas 2004 and 2005, a regional NSF-supported combinatorics conference.
- Co-organizer (with Hemanshu Kaul and Michael Pelsmajer) of MIGHTY XLVII Midwest Graph Theory conference, November 7-8, 2008.

Project NExT Fellow 2005-2006

Project NExT (New Experiences in Teaching) is a competitive-application professional development program for recent PhD's run by the Mathematical Association of America. The program provides training in instruction, advising, research, and academic citizenship. Sponsors: American Mathematical Society and the IIT Department of Applied Mathematics.

Professional society membership

American Mathematical Society (AMS). Also the Society for Industrial and Applied Mathematics (SIAM), and the Mathematical Association of America (MAA) at various times.

Invited conference talks

Oct 2011 Extremal and Probabilistic Combinatorics Special Session, AMS Sectional Meeting, Lincoln, NE
Nov 2010 Graphs and Hypergraphs Special Session, AMS Sectional Meeting, Notre Dame, IN
Apr 2008 Graph Theory Special Session, AMS Sectional Meeting, Bloomington, IN
Jul 2007 Extremal and Probabilistic Combinatorics Special Session, AMS-PTL Joint International Meeting, Warsaw
Jun 2006 Liar Games and Error-Correcting Codes Minisymposium, SIAM Conference on Discrete Mathematics, Victoria, Canada
Oct 2004 Extremal Graph Theory and Combinatorics Special Session, AMS Sectional Meeting, Evanston, IL
Jan 2004 Probability and its Applications in Combinatorics Special Session, AMS National Conference, Phoenix
Jan 2002 Graph Theory Special Session, AMS National Conference, San Diego

Invited seminar or colloquium talks

Apr 2010 San Diego State University Mathematics and Statistics Colloquium
Oct 2007 Jackson State University Mathematics Colloquium
Jun 2007 University of California-San Diego Combinatorics Seminar
Apr 2007 University of Illinois Combinatorics Seminar
Mar 2005 IIT Applied Mathematics Colloquium
Jan 2005 Metron, Inc., Reston, VA
Oct 2004 IIT Applied Mathematics Colloquium
Oct 2004 University of Illinois Combinatorics Seminar
Oct 2003 Trinity University Mathematics Majors' Seminar, San Antonio

Plenary lectures

Apr 2008 IIT Menger Day faculty/student research plenary lecture

Contributed conference talks

Apr 2011 Illinois Section of the MAA, North Central College, Naperville, IL
Feb 2010 Workshop in Graph Theory and Combinatorics in Memory of Uri Peled, University of Illinois-Chicago
Dec 2009 Midwest Theory Day 59, DePaul University
Jul 2006 Sixth Czech-Slovak International Symposium on Combinatorics, Graph Theory, Algorithms and Applications, Prague
Apr 2006 DIMACS/DIMATIA/Renyi Combinatorial Challenges, Rutgers University
Feb 2006 Combinatexas '06, Houston
Jan 2006 AMS National Conference, San Antonio
Apr 2005 Erdős Magic Workshop, Bertinoro, Italy
Jan 2005 AMS National Conference, Atlanta
Sep 2004 12th International Symposium on Graph Drawing, New York City
Jan 2004 AMS National Conference, Phoenix
Jun 2003 Workshop on Extremal Graph Theory, Csopak, Hungary
Apr 2003 CombinaTexas 2003, San Marcos, TX

Home department colloquia and seminars

Sep 2010 IIT Math Club
Also Oct 2008
Feb 2010 IIT Discrete Applied Mathematics Seminar
Also Mar 2008, Mar 2007, Feb 2007, Sep 2006
Oct 2009 IIT Applied Mathematics Colloquium
Nov 2005 IIT Graduate Student Seminar
Nov 2004 Texas A&M Mathematical Physics and Harmonic Analysis Seminar
Nov 2004 Texas A&M Algebra/Combinatorics Seminar
Also Sep 2002
Oct 2003 Texas A&M Mathematics Postdoctoral Review
Also Oct 2002
Mar 2002 University of California-San Diego Combinatorics Seminar
Also Nov 2001, Oct 2000
Jun 2001 University of California-San Diego VLSI CAD Laboratory Seminar

Conferences and workshops attended²

Nov 2008 MIGHTY XLVII (Midwest Graph Theory), Chicago
Mar 2008 WiMax Day at IIT, Chicago
Nov 2007 Math Day 2007, Dayton, OH
Oct 2007 AMS Central Section Meeting, Chicago
Apr 2007 Random Combinatorial Structures, University of Nebraska
Nov 2006 EXCILL: Extremal Combinatorics at Illinois, Urbana-Champaign
Aug 2006 MathFest and Project NExT Workshop, Knoxville, TN
Jul 2006 Horizon of Combinatorics, Balaton, Hungary
Apr 2006 DIMACS/DIMATIA/Renyi Combinatorial Challenges, Rutgers University
Aug 2005 MathFest and Project NExT Workshop, Albuquerque

² In addition to those involving invited or contributed talks.

Feb 2005 CombinaTexas '05, San Marcos, TX
 Jan 2005 The Mathematics of Persi Diaconis, Univeristy of California at San Diego
 Jun 2004 SIAM Conference on Discrete Mathematics
 Jun 2004 NSF/CBMS: The Combinatorics of Large Sparse Graphs, speaker Fan Chung, San Marcos, CA
 May 2004 Joint AMS/MSS International Meeting, Houston
 Apr 2004 CombinaTexas '04, College Station, TX
 Oct 2003 Geometry Day '03, University of North Texas
 Mar 2003 AMS Southeastern Section Meeting, Baton Rouge
 Jan 2003 Spectral Analysis in Geometry and Physics, University of California at San Diego
 Jan 2003 AMS/MAA National Joint Meetings, Baltimore
 Oct 2001 42nd Annual Symposium on Foundations of Computer Science (FOCS), Las Vegas
 Aug 2000 AMS Mathematical Challenges of the 21st Century, Los Angeles
 Jul 2000 Institute for Mathematics and its Applications (IMA) Mathematical Modeling in Industry workshop for graduate students, University of Minnesota
 Jan 1997 AMS/MAA National Joint Meetings, San Diego
 Jul 1996 Center for Research in Scientific Computation (CRSC) Industrial Mathematics Modeling Workshop for graduate students, North Carolina State University

UNIVERSITY SERVICE

Committee service to IIT

Fall 2007-Spring 2010 IIT Research Council, Applied Mathematics representative

Other service to IIT

2008-2010 IIT Research Day poster judge
 Spring 2009, Fall 2009 IPRO Day judge
 2006, 2007, 2009 IIT Camras Scholarship interviewer
 2005-2008 Hosted IIT international students for Thanksgiving dinner
 Apr 2008 Chicago Area Undergraduate Research Forum poster judge

Service to the College of Science and Letters (CSL)

Fall 2008-Spring 2009 CSL Strategic Planning Committee
 Fall 2007-Summer 2008 CSL Dean Hiring Committee

Committee work and seminar organization for the Applied Mathematics (AM) Department

Spring 2009 – Fall 2009 IIT Networks and Optimization Seminar co-organizer
 Fall 2006 – Spring 2007, Discrete Applied Mathematics Seminar organizer
 Fall 2009
 Fall 2007, Fall 2006 – AM Faculty Hiring Committee
 Spring 2007
 Fall 2006 – Sep 2007 Applied Mathematics Colloquium organizer
 Fall 2005 – Spring 2006 Applied Mathematics Colloquium co-organizer

Other service to the Applied Mathematics Department

Fall 2010 Math Club Adviser (including competition organization and CPS event coordination)
 May 2008 Grading committee for Applied Mathematics undergraduate math contest.
 Fall 2005 – present Various undergraduate advising and recommendation letter writing.