Michael Andrew La Croix

CONTACT INFORMATION

72 Golden Avenue
Medford, MA, 02155
(781) 874-0728

malacroi@math.mit.edu
www.math.uwaterloo.ca/~malacroi

INTERESTS

- ❑ Enumerative Combinatorics
- ❑ Random Matrices
- ❑ Symmetric Functions
- ❑ Low Dimensional Topology
- ❑ Mathematical Illustration

EDUCATION AND TRAINING

Massachusetts Institute of Technology, **January 2013 – Present**
Cambridge, Massachusetts, USA

Postdoctoral Associate (Mathematics Department)

Advisor:	Professor Alan Edelman
Research Topic:	The Combinatorial Foundations of Random Matrix Theory
Summary:	Many questions about β-Gaußian random matrices can be resolved via a combinatorial interpretation of their moments. These interpretations can involve such varied objects as matchings, polygonal glueings, and maps, depending on context. By refining the combinatorial statistics on these objects, we can answer progressively more refined questions about the associated matrices. Remarkably, for some problems, the most refined statistics on maps are more refined than the corresponding models for β-random matrices. The present research attempts to generalize random matrix theory to provide the missing questions for these answers.

University of Waterloo, **September 2003 – August 2009**
Waterloo, Ontario, Canada

Ph.D. in Combinatorics and Optimization, conferred October 2009

Thesis Title:	*The combinatorics of the Jack parameter and the genus series for topological maps*
Advisors:	Professor David M. R. Jackson and Professor Ian P. Goulden
Research Area:	Establishing structural links between the enumerative properties of graph embeddings in non-orientable surfaces and the algebraic properties of the Jack parameter from symmetric function theory.

University of Waterloo, **January 2002 – August 2003**
Waterloo, Ontario, Canada

M.Math. in Combinatorics and Optimization, conferred October 2003

Essay Title:	*Approaches to the enumerative theory of meanders*
Advisor:	Professor David M. R. Jackson
Topic:	A survey of enumerative results pertaining to meanders

University of Waterloo, **September 1996 – April 2001**
Waterloo, Ontario, Canada

B.Math. with Distinction, conferred June 2001

Majors:	Pure Mathematics, Combinatorics and Optimization
Details:	Dean's Honour List and co-operative education program

TEACHING EXPERIENCE

Lecturer **September 2009 – December 2010**
Department of Statistics and Actuarial Science
University of Waterloo, Waterloo, Ontario, Canada
I taught a variety of introductory linear algebra and probability courses to mathematics and engineering students. Administrative duties included co-ordinating a multi-section probability course for mathematics majors. A unique challenge was to present the content of this course in a manner that was suitable for both live and remote consumption, in a traditional lecture setting and via video conferencing. In addition, I investigated newly acquired print-on-demand technology prior to recommending its adoption for the publishing of departmental course notes.

- MATH 115 - Linear Algebra (Engineering)
- MATH 136 - Linear Algebra I (Honors Mathematics)
- STAT 220 - Probability (Nonspecialists Mathematics)
- STAT 230 - Probability (Honors Mathematics)

Sessional Lecturer **Winter 2009**
Department of Combinatorics and Optimization
University of Waterloo, Waterloo, Ontario, Canada
While enrolled as a doctoral student, I taught a single section of each of two multi-section courses aimed at first year honours mathematics students.

- MATH 136 - Linear Algebra I (Honors Mathematics)
- MATH 138 - Calculus 2 for Honours Mathematics

Sessional Lecturer **Winters 2005, 2007, 2008**
Department of Combinatorics and Optimization
University of Waterloo, Waterloo, Ontario, Canada
On three separate occasions, I taught a section of the multi-section introductory combinatorics course. In addition to lecturing, duties included collaboratively preparing assignments and exams.

- MATH 239 - Introduction to Combinatorics (Honors Mathematics)

Teaching Assistant **January 2002 – August 2009**
Department of Applied Mathematics
University of Waterloo, Waterloo, Ontario, Canada
Duties have included preparing and running tutorials, marking assignments, critiquing essays, proctoring and marking tests and exams, organizing undergraduate and graduate markers, and working in the Math Faculty Tutorial Centre. Courses included:

- ECE 103 - Discrete Mathematics (Electrical Engineering)
- MATH 239 - Introduction to Combinatorics (Honors Mathematics)
- CO 220 - Introduction to Combinatorics (Nonspecialist Mathematics)
- CO 227 - Introduction to Optimization (Nonspecialist Mathemtics)
- CO 330 - Combinatorial Enumeration (Honors Mathematics)
- CO 342 - Introduction to Graph Theory (Honors Mathematics)
- CO 350 - Linear Optimization (Honors Mathematics)
- CO 380 - Mathematical Discovery and Invention (Honors Mathematics)
- CO 430/630 - Algebraic Enumeration (Honors / Graduate Mathematics)
- CO 450/650 - Combinatorial Optimization (Honors / Graduate Mathematics)
- CO 480 - History of Mathematics (Honors Mathematics)

Publishing & Visualization Experience

LaTeX Consultant

Faculty of Mathematics, **December 2010 – February 2011**
University of Waterloo, Waterloo, Ontario, Canada

I implemented a LaTeX class to update the page layout of a newly designed set of linear algebra notes to integrate colour and make them visually appealing for primarily electronic distribution, while simultaneously suitable for concurrent small-run printing.

Pearson Canada Inc. **December 2010**

I designed a LaTeX class to implement the visual style required for the second edition of *Introduction to Linear Algebra for Science and Engineering*, by Daniel Norman and Dan Wolczuk, after I identified issues that made the publisher's prototype class unsuitable for its required use.

Rimini Centre for Economic Analysis **October 2009 – present**

I implemented, and supervised the adoption of a LaTeX class to mimic the output of a style designed for Microsoft Word documents, and allow the seamless integration of articles submitted in Word and LaTeX formats into finished issues of the journal *Review of Economic Analysis*.

Technical Illustrator

Pearson Canada Inc. **October 2010 – December 2011**

I recreated existing illustrations and designed new illustrations, suitable for printing on a two-colour offset press, for the second edition of *Introduction to Linear Algebra for Science and Engineering* by Daniel Norman and Dan Wolczuk.

Faculty of Mathematics, **August 2009**
University of Waterloo, Waterloo, Ontario, Canada

I adapted hand-drawn illustrations from existing notes for a course on multivariate calculus aimed at honours mathematics students, to make new colour versions suitable for use in high resolution digital distribution and monochrome printed course notes.

Selected Co-operative Education Work Placements

SoftImage **September 1999 – December 1999**
Montreal, Quebec, Canada **May 2000 – August 2000**

Worked as a Software Design Engineer to develop a user interface for manipulating the placement of textures on objects for use in 3D animation.

Corel Corporation **January 1997 – April 1997**
Ottawa, Ontario, Canada **September 1997 – December 1997**

Worked as a Quality Assurance Specialist and Application Developer on a 3D CAD project. Duties included designing and testing an automation interface, and the construction of utilities for visualizing gears and pipe networks.

Awards

Ontario Graduate Scholarship in Science and Technology **September 2007 – April 2008**
Provincial Award
$10,000 award, granted on research merit and demonstrations of leadership to support graduate studies

Tutte Scholarship **May 2007 – August 2007**
Departmental Award
$3000 award, granted on research merit to support graduate studies in Combinatorics

Sinclair Scholarship **September 2006 – December 2006**
Departmental Award
$1000 award, granted on research merit to support graduate studies in Combinatorics and Optimization

Natural Sciences and Engineering **May 2004 – April 2006**
Research Council of Canada
Postgraduate Scholarship - Doctoral
National Award
$42,000 over two years, granted on research and academic merit to support doctoral studies in the natural sciences

President's Graduate Scholarship **May 2005 – April 2006**
Institutional Award
$10,000 granted on research and academic merit

Outstanding Teaching Assistant Award **Fall 2004**
Departmental Award

Natural Sciences and Engineering **January 2002 – December 2003**
Research Council of Canada
Postgraduate Scholarship - A
National Award
$34,600 over two years, granted on research and academic merit to support graduate studies in the natural sciences

René Descartes National Scholarship **September 1996 – April 2001**
Institutional Award
$12,000 over course of degree, granted on academic merit and leadership skills to support undergraduate studies in mathematics

Math Faculty Work Report Award **September 1998 – December 1998**
Institutional Award
$150 awarded to recognize communications excellence in the preparations of a technical report based on experiences from a co-operative education job experience

University of Guelph **June 1995 – August 1995**
College of Biological Sciences
Summer Research Fellowship
Provincial Award
$2000 plus accommodations, granted to recognize academic excellence and leadership among high school students with an interest in pursuing research in the field of biology

JOURNAL ARTICLES

Alan Edelman and **Michael La Croix**, "The Singular Values of the GUE (Less is More)", *Random Matrices: Theory and Applications*, to appear.

Folkmar Bornemann and **Michael La Croix**, "The Singular Values of the GOE", *Random Matrices: Theory and Applications* 4 (2015), no. 2, 32 pages.

J. Cibulka, J. Hladky, **M.A. LaCroix**, and D.G. Wagner. "A combinatorial proof of Rayleigh monotonicity for graphs", *Ars Combinatoria*. 117 (2014), 333–348.

Michael A. La Croix, "A combinatorial proof of a result of Gessel and Greene", *Discrete Mathematics*. 306 (2006): 2251-2256.

CONFERENCE AND SEMINAR PRESENTATIONS

A Surprising Decomposition for the Singular Values of the Gaussian Unitary Ensemble, Everytopic Seminar, Brandeis University, Waltham, MA, October 22, 2015.

Combinatorial Models for Random Matrices with Gaussian Entries, SFB Colloquium, TU Munich, Garching, Germany, January 27, 2015.

Exploring Some Non-constructive Map Bijections, SIAM Conference on Discrete Mathematics, Minisymposium on the Combinatorics of Maps, Minneapolis, MI, June 18, 2014.

β-Gaußian Ensembles and the Non-orientability of Polygonal Glueings, AMS Spring Eastern Section Meeting, Special session on Combinatorics and Integrability, Chestnut Hill, MA, April 6, 2013.

Moments of Gaußian β-Ensembles via Map Enumeration, presented as a supplement to the graduate course 18.338 (Eigenvalues of Random Matrices), M.I.T. Cambridge, MA, April 10, 2012.

Jack Symmetric Functions and the Non-Orientability of Rooted Maps, Joint Mathematics Meetings of the American Mathematical Society (AMS) and Mathematical Association of America (MAA), Boston, MA, January 4–7, 2012.

All work and no play makes Jack enumerate maps, Center of Cancer Systems Biology, Saint Elizabeth's Medical Center, Boston, MA, February 15, 2011.

PHD THESIS

Michael Andrew La Croix, *The combinatorics of the Jack parameter and the genus series for topological maps*, University of Waterloo, Ontario, Canada, 2009.

MASTERS ESSAY

Michael Andrew La Croix, *Approaches to the enumerative theory of meanders*, University of Waterloo, Waterloo, Ontario, Canada, 2003.

ILLUSTRATION

Daniel Norman and Dan Wolczuk, *Introduction to Linear Algebra for Science and Engineering*, Illustrated by **Michael A. La Croix**, Pearson Canada Inc., 2012.

Jonathan Novak, "Three lectures on free probability", Illustrated by **Michael LaCroix**. To appear in the proceedings of the MSRI semester "Random matrix theory, interacting particle systems and integrable systems."