Tangents
News from the Department of Mathematical Sciences
University of Massachusetts Lowell
Fall 2003

Fresh Ph.D.s Among Alumni: Math Not a Stale Subject for Our Majors

In the past year we've heard from four of our alumni from the 1990s who earned master's degrees at UML, went on to earn doctorates in mathematics or mathematics education, and have launched their professional careers. Here are updates on all of them, in their own words.

Tom Boucher (M. S. in 1998, Ph. D. from Texas A & M in 2003) I'll be officially graduating in December 2003, but I've defended and the dissertation is with the Thesis Office now. My research involved deriving conditions under which threshold autoregressive nonlinear times series possess a particular form of ergodicity known as V-uniform ergodicity. I accepted a position as a postdoctoral fellow in the Department of Statistics here at Virginia Tech and plan on being here for a couple years beefing up my vita before seeking a tenured position. All is well here. I can be reached at the Virginia Tech Department of Statistics.


Donna Dietz


John Burke

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New Hire: Alexander Kheifets

We are very pleased to welcome Alexander Kheifets to the faculty of the Department of Mathematical Sciences.

Prof. Kheifets received his degrees in mathematics from the Kharkov State University, Kharkov, Ukraine, where he earned his Ph. D. under the supervision of Prof. Victor Katsnelson. Prof. Kheifets


Alexander Kheifets

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Books by Emeritus Faculty

Gerry Kaiser

A Friendly Guide to Wavelets was first published in 1994 before Gerry's retirement. The book was very well received and went into its 6th printing with Birkhauser as early as 1999. It was selected as a 1995 Library of Science book of the month. The URL (http://www.wavelets.com/) links to Gerry Kaiser's Center for Signals and Waves in Virginia and has links and reviews of his book (as well Gerry's many current activities).

This volume is designed as a textbook for an introductory course on wavelet analysis and time-frequency analysis aimed at graduate students or advanced undergraduates in science and engineering. It can also be used as a self-study or reference book by practicing researchers in signal analysis and related areas. Since the expected audience is not presumed to have a high level of mathematical background, much of the needed analytical machinery is developed from the beginning. The only prerequisites for the first eight chapters are matrix theory, Fourier series, and Fourier integral transforms. Each of these chapters ends with a set of straightforward exercises designed to drive home the concepts just covered, and the many graphics should further facilitate absorption. Chapters 10 and 11 are about electromagnetic wavelets and radar. They consist of original research and are written in a more advanced style.

Allen Glisson in reviewing this book for *IEEE Antennas and Propagation Magazine* wrote "In summary, Kaiser has written an excellent introduction to the fundamental concepts of wavelets. For a book of this length and purpose, I think it should be essentially unbeatable for a long time."

Gerry Kaiser's previous book *Quantum Physics, Relativity, and Complex Spacetime: Towards a New Synthesis* was published by North-Holland, Amsterdam, 1990. The complete book is available at the URL http://wavelets.com/90NH.pdf. A long review (published in the *Bulletin of the AMS*, 1992) of this book by Robert Hermann of Boston University can be viewed at the site http://www.ams.org/bull/ pre-1996-data/199328-1/hermann.pdf.

Mary Beth Ruskai

Prof. Ruskai was an editor along with R. Coiffman and G. Belkin of the 487 page volume *Wavelets and their Applications*, published by Jones and Bartlett, 1992.

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Kiwi's Korner

Let me begin by welcoming Sasha Kheifets who arrived this semester from the College of William and Mary in Williamsburg, Va. Sasha is a complex and harmonic analyst who has spent time in Israel and the Ukraine. Please look for the article about her elsewhere in this newsletter for more details.

The fall semester is well underway and we seem to have had fewer startup problems than usual. Last year at this time the beginning of the semester coincided with the relocation of the department. We are now beginning our second year in the new building and most faculty finally have electricity and e-mail and the floods have subsided.


James Graham-Eagle

The department finally has a PC lab of its own. Well, not exactly, but close. Professor O'Brien of the Department of Environmental Earth and Atmospheric Studies has kindly allowed as to use his GIS lab for teaching our PC-based courses. Thanks to funds from the dean's office and the division of Continuing Studies and Corporate Education, and especially donations from alumni, the lab will be upgraded sometime this semester. It will be used for the SAS programming courses and (I hope) Maple labs.

Last April we had our annual Mathematics Alumni Reception/Awards Ceremony. About 30 people attended in all—approximately equal numbers of faculty and students but not many alumni. Awards were made to:

Randy Froc and John Tucker—Outstanding Undergraduate Student in Mathematics

Tim Piwowar—Outstanding Graduate Student in Mathematics

Brian Petrowicz, Vijaya Vanga and John Tucker—Mathematical Modeling Competition

Vijaya Vanga—Richardson-Bedell Scholarship.

If you have access to the internet, you might want to visit the Math Sciences Web site at www.uml.edu/dept/math. There is a page devoted to alumni with a link to photos from the event. We will host a similar event on Friday, April 23, 2004 and I hope you can find the time to attend. If you were not notified of the event this year it means you are missing from our alumni database. If you would like to be informed of such occasions, please let me know.

Congratulations to Kostya Rybnikov who has been granted leave for the fall semester to take part in the Discrete and Computational Geometry Program at the Mathematical Sciences Research Institute in Berkeley, Calif. These MSRI Programs attract the leading researchers in their fields and provide an excellent environment for mathematicians with common interests to meet and collaborate.

Kiwi

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New Hire: Alexander Kheifets

later became an associate professor at Kharkov State University and a postdoctoral fellow at the Weizmann Institute of Science, Israel. More recently, Prof. Kheifets also held positions at the College of Judea and Samaria, Israel, and the College of William and Mary in Virginia. His research interests are in harmonic, real and complex analysis, as well as in operator theory, with particular emphasis on scattering theory and interpolation problems.

In his spare time Prof. Kheifets, who is also known as Sasha, enjoys music, reading, theater, and movies.

The Problem

In this month's problem, a "closed hemisphere" is a hemisphere together with its boundary, which is an equator. This problem came from one of the recent William Lowell Putnam Mathematics Competitions.

Given five points on a sphere, prove that four of them lie on some closed hemisphere.

Three correct solutions from among all that are submitted by February 15, 2004, will earn the solvers a "Math Challenge" t-shirt.

Solution to previous problem

No complete solutions were turned in for the previous problem, which was

You have 55 cards arranged in a circle. On the underside of each card is an arbitrary number, all different from each other and unknown to you. You wish to find a card whose number is larger than the numbers on the two neighboring (adjacent) cards. In other words, you are looking for a local maximum on the circle. What is the fewest number of cards that need to be turned over in order to guarantee that you find such a card? The choice of which card to turn can depend upon the results of the preceding turns.

Partial Solution: There is a way to be guaranteed of finding a relative maximum by flipping 19 of the 55 cards. You can't do it by flipping the cards in the order given since you could be unlucky—if they are in order and you flip from smallest to largest you need all 55 to reach the one relative max. This leads to the follow-up questions: (a) how do you get a relative maximum in 19 (or fewer) flips? (b) Is 19 the best you can do? and (c) Can you prove that 19 or some smaller number is best?

James Graham-Eagle, Chair

Writers: Ken Levasseur, Raj Prasad, Ann Marie Hurley, Dan Klain, Guntram Mueller, and Alex Olsen

Tangents is produced biannually by the Publications Office for the Department of Mathematical Sciences. Your comments are welcome.

Summer Opportunities in Science Program at UML

Summer Opportunities in Science (SOS) at UMass Lowell is a program designed for incoming freshmen who intend to major in either mathematics or science. The students receive a paid internship to work with teams of faculty and graduate students on research or academic projects. The tasks assigned to the students could include data acquisition, mastering and operating research grade equipment, and setting up equipment and experiments. The research areas focus on bioinformatics, atmospheric research, meteorology, submillimeter wave technology, photonics, nanotechnology, radiation and advanced materials. The students also assist with creating and updating course Web sites for the various departments. It is a great opportunity for the students to build connections with faculty and other students before they assume their own classes and studies.

This past summer, the program had three students in mathematics, two in chemistry and six in physics. All the 11 enjoyed their summer, learned a lot and appreciated the connections they were able to make.

What Are You Up To?

Want to keep your classmates up to date on what you're doing and where you are? Take a few moments to tell us where you are, and whatever else you might like to share. We'll add it to the UML Math Alumni page on the Web: www.uml.edu/dept/math/alumni.htm.

We can be contacted by mail at Department of Mathematical Sciences, UML North, UMass Lowell, Lowell MA 01854. Telephone: (978) 934-2410. E-mail: Mathematics@uml.edu

You might also wish to contact our Office of Alumni Relations, Wannalancit Mills Complex, 600 Suffolk St., Lowell, MA 01854-3629. Toll free telephone: (877) UML-ALUM. E-mail: Alumni_Office@uml.edu

The Mathematical Sciences Web Page

Have you visited the Mathematical Sciences Web page lately? The address is http://www.uml.edu/dept/math — but don't worry if you forget it. If you "Google" the phrase "UML Math," the first result will be our Web page

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Fresh Ph.D.s Among Alumni: Math Not a Stale Subject for Our Majors

Donna Dietz (M. S. in 1995 from UML, Ph. D. from RPI in 2002) My area of research is currently Computer Aided Geometric Design, a combination of Analytic Geometry and Numerical Analysis. My thesis question was how to design 2D convex cubic spiral spline segments without the long computational overhead of calculating the roots of the derivative of the curvature of the cubic. The solution involved some geometric analysis of what was actually making the problem difficult, and the numerical creation of tables of solution ranges for various regions of the problem.

I have accepted a position at Mansfield University as a tenure track professor at the assistant level. My homepage is at http://www.mansfield.edu/~ddietz

Maureen (Doyle) Neumann (M. S. in 1995 from UML) I graduated from the University of Washington in 2001. The title of my dissertation was: "The Subjects and Agents of Change: Teachers Navigating the Role of Leader and Learner"

I am working at the University of Vermont Education Department in Mathematics Education. I believe it is important to develop teachers who have a depth of understanding in their mathematical content knowledge and in their pedagogical content knowledge in order to enhance student learning in grades K-5. I am also interested in understanding how mathematics teacher leaders navigate a role of leader and learner, how they work to inform their fellow teachers' thinking about teaching mathematics, and how successful professional development and teacher leadership exist in the complicated context and culture of schools.

John Burke (M. S. in 1995 from UML) I was a mechanical engineering major at University of Lowell when I started. I found that lab work was not my thing and differential equations (taught by Professor Stephen Pennell) stole me away into mathematics. I could not believe how interesting this subject was (and still is) to me. I transferred into math, and I have not looked back since.

I had a very bad academic (but fantastic social!) junior year. I knew that I wanted to go on to graduate school so I decided to take some graduate level courses to show 'em I could. And I did, mostly with Professor James Graham-Eagle (Kiwi). Thank goodness I did take those classes. I'm sure with strong letters of recommendation and good grades in those grad level courses, UMass Lowell gave me the break I needed.

While in grad school at Lowell, I couldn't learn enough, and I wanted to go on. Without Lowell I would not have been accepted to Arizona State University. I would not be doing research in dynamical systems, singular and randomly perturbed theory, and cellular biochemical modeling. I have just accepted a postdoc position at MIT working with Doug Lauffenburger (see http://web.mit.edu/cbe/dallab/index.html). I will be modeling and analyzing the apoptosis signal transduction pathway, and investigating how these pathways act as perturbations to the cell cycle and metabolic pathway. Best of all I will be working with doctoral students who will be verifying these models experimentally.

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Books by Emeritus Faculty

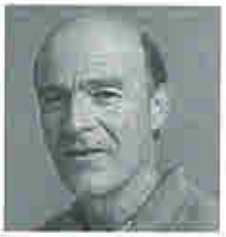
This book consists of research papers on wavelets and are the proceedings of a conference held here at UMass Lowell. The wavelets conference included 10 main lectures by Ingrid Daubechies. Her lectures from that conference were published by the AMS as Ten lectures on Wavelets in 1992.

Yuly Makovoz

Yuly Makovoz is the coauthor with G.G. Lorentz and M. Golitschek of the book in approximation theory entitled *Constructive Approximations.*

In *Math Reviews*, L. Schumaker writes, "Approximation theory has a history of well over 100 years, and many books on the subject have appeared (these authors refer to 90 of them)…. The book under review is the culmination of a 15-year writing project initiated by George Lorentz with the idea of presenting a unified treatment of some of the many developments that have occurred in the subject since his 1966 textbook. It is a companion to an earlier book [R. A. DeVore and G. G. Lorentz, Constructive approximation, Springer, Berlin, 1993]. As the authors point out, the goal of these two volumes was not completeness (it would obviously take quite a few more volumes to treat all of approximation theory), and not all included topics are treated in the same depth.

"The emphasis of this book is on univariate approximation of real functions, with very little about multivariate approximation or complex approximation. Moreover, several important univariate topics such as splines and wavelets are given minimal coverage.… Here are some of the topics discussed: polynomial approximation, constrained approximation, incomplete polynomials, weighted polynomials, orthogonal expansions, splines, rational approximation, Stahl's theorem, Padé approximation, Hardy space methods, Muntz polynomials, nonlinear approximation, widths, entropy, sequences of operators, and superposition.



Michael Grossman

"The chapters of this book can be read more or less independently from each other, although there are frequent references to material in the first volume. While not specifically designed as a text, it does include some problems and an extensive bibliography. The index is adequate, but for this type of encyclopedic work a much more detailed index would have been appreciated. As was the first volume, this book is a carefully crafted presentation of important and useful mathematics, and should be on the shelf of everyone working in approximation theory or in one of its myriad of applications."

Michael Grossman

Mike Grossman, along with Robert Katz, authored the book *Non-Newtonian Calculus.* The noted historian of mathematics, Prof. Ivor Grattan-Guinness of Middlesex University in England, wrote, "There is enough here to indicate that non-Newtonian calculi… have considerable potential as alternative approaches to traditional problems. This very original piece of mathematics will surely expose a number of missed opportunities in the history of the subject." In their introduction, Grossman and Katz write, "Since this book is intended for a wide audience, including students, engineers, scientists, as well as mathematicians, we have presented many details that would not appear in a research report and we have excluded all proofs. (All results stated can be proved in a straightforward way). It is assumed, of course, that the reader has a working knowledge of the rudiments of classical calculus." An electronic link to their book can be found at the URL www.angelfire.com /ma4/nnc

Thanks For the Contributions!

Our thanks to all who have contributed to the Department of Mathematical Sciences over the past few years. Your generosity has enabled us to make purchases, award scholarships, and engage in activities that would otherwise have been impossible.

Many of you have responded generously to the UML phonathon and other fundraising contacts. These contributions can benefit the Department of Mathematical Sciences directly if you specify that you wish to have your gift applied to Mathematics. Otherwise, it will provide valuable assistance to the University at the college level.

Tangents
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