MATHEMATICS NEWSLETTER

NEWS FOR THE UNDERGRADUATE

Director, Jeff Scroggs
Editor, Bisa Meek
www.math.ncsu.edu/undergrad

Fall 2003
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... Meet Rosalie Haughton

Before my junior year, I was actively involved in Hope for the Homeless, Habitat for Humanity, Campus Greens, and an intern for Rainforest Action Network. However, 18 hours of physics and math classes make volunteering quite difficult. I'm currently active in the NC Green Party and Campus Greens. I've been playing viola in an orchestra since 7th grade. In my free time I am learning bluegrass fiddle (coming slowly) and foreign languages. I speak French, a friend is teaching me Spanish, and I'm taking Arabic at NCSU. Last summer I studied abroad in France. Learning languages is an incredibly intellectual exercise and the language of a society can tell you a lot about its norms and self-image. Next summer I'm going to Senegal to volunteer at an AIDS awareness organization and I plan to volunteer in South America after I graduate.

Being a Math major is fun; it allows me to make really dorky jokes and know it's okay. The communal feeling of meeting another Math major is always fun. I met one a few days ago, and one of her first questions was, "What's your favorite kind of math?" What a superb question! It reminds me that I'm not in high school anymore: being smart is something to revel in.

I know I'll go to graduate school and receive my doctorate - I love learning. I'm looking at schools in France and the U.S. that offer complete, socially-relevant programs in languages. I don't want to make too many plans but I want to help people and I like learning different languages. It'll eventually figure itself out.

In terms of professors, I had Dmitry Zenkov for MA 401 and I thought he was great. Whenever I had questions about homework or test preparation, he would make time to be in his office for tutoring in the concepts we were studying. He's incredibly approachable and will talk manifold theory with you in the hallway between classes. What more could you ask for?

You can reach Rosalie at rahaught@unity.ncsu.edu

Mathematics Electives

These classes may be used as Advanced Math Elec. (GRP 002).

SPRING 2004

MA 325*	Intro. to Appl. Math
MA/LOG 335	Symbolic Logic
MA 341	Applied Differential Equations I
MA 401	Applied Differential Equations II
MA 408	Foundations of Euclidean Geometry
MA 410	Theory of Numbers
MA/CSC 416	Intro. to Combinatorics
MA 421	Intro. to Probability
MA 423*	Short-term Actuarial Models
MA 426	Mathematical Analysis II
MA/CSC 428*	Intro. to Numerical Analysis II
MA 432*	Mathematical Models in Life and Social Sciences
MA 437	Applications of Algebra
MA 491H	Reading in Honors Mathematics
MA 493E	Intro to Mathematical Finance
MA 501	Adv. Mathematics for Engineers and Scientists I
MA 502	Adv. Mathematics for Engineers and Scientists II
MA 512	Adv. Calculus II
MA 513	Intro. to Complex Variables
MA 520	Linear Algebra
MA 521	Abstract Algebra I
MA 535*	Stab. and Time Opt. Control of Hered. Systems
MA 537	Nonlinear Dynamics and Chaos
MA 544*	Computer Experiments in Mathematical Probability
MA 547	Financial Mathematics
MA/BMA 574*	Mathematical and Experimental Mod. of Phys. Proc. II
MA/CSC 580	Numerical Analysis I
MA/CSC 583	Intro. to Parallel Computing
MA 591S	Mathematics of Superspaces

**These classes may be used for the math modeling requirement for AMA majors (OPT 001).*

Class times are listed at
www.math.ncsu.edu/Courses/Sprg04.txt

Inside this issue

DID YOU KNOW ?

- that the Mathematics Department was in the School of Engineering until 1960 when the School of Physical Sciences and Applied Mathematics (now College of PAMS) was founded.

N.J. Rose

Spring 2003 Graduates

Mathematics

Robert Russell Barbeau, Jr.
Erin Slaughter Beaird
Chad Patrick Bell
Sara Carol Breece
Rita Lauren D'elia
Justin Christopher Flake*
Rachael Elizabeth Jacobs
David Richard Johnson*
Jeremy Wayne Maness*
Gregory John Nusz
Laura Jean Parunak
Joshua Joel Pearce
Elizabeth Ann Quigley
Gregory John Edgar Schmickle
Douglas William Vestal
Song Shuangfeng Zhong

Applied Mathematics

Eliza Jean Britt
Hunter Crenshaw Brown
Luke Elliot Cherveny*
Christine Elizabeth Finger
Robert Edward Futrell*
C. Franklin Goldsmith, III*
Zachary Michael Helms
Therese Marie Huels
Yang Kong Ly
Jonathan Ross Molinatto
Dmitri Morozov*
Cheri vonne Nelson
Kristen Iver Ricks
Joshua Glen Wander

* completed Math Honors program

Senior Awards

The College Senior Awards recognizes outstanding graduating seniors in three categories: Scholarly Achievement, Research, and Leadership. The following students were nominated by the Math department.

Scholarly Achievement
David Johnson

Research
Chris Flake

Leadership
David Johnson

Scholarship Awardees

Departmental Scholarships are awarded several times throughout the year and are based on academic accomplishment as measured by grade point average, adequate progress towards a degree in mathematics, and difficulty of the courses taken, and sometimes financial need. Forms are available at www.math.ncsu.edu/undergrad/scholarships. *We would like to recognize math majors who have received scholarships this academic year:*

Anderson Scholarship:
Christopher Goulette
Aspnes Scholarship:
Victoria Moultrie
Dr. Bullock Scholarship:
DeShane Spears
Mrs. Bullock Scholarship:
Christopher Rogus
Cell Scholarship:
Nathaniel Lewallen
Chaney Scholarship:
DeShane Spears
Goudes Merit Scholarhsip:
David Roberson
Mumford Scholarship:
Rubin Chen
Park Scholarship:
Heather Cherry, Andrea Hernandez
Petrea Scholarship:
Steven Farrar
Whitten Dean's Scholarship:
Ashley Arnold
Duke Energy:
KeTrena Langhurst, Mark Sutton
Fund For Excellence
Robert Darwin, Anthony Dixon, Lynn Harris, Nicole Lyerly, Shawanna Norman, Tony Parise, Nicole Pearson, Elizabeth Ransom
Park Scholars
Lucas Bilbro, Justin Brockman, Matthew Campbell, Robert Campbell, Mark Darby, Joshua Hines, Jerome Hodges IV, Erik Johnson, Tania Jones, Margaret Linak, Christopher Lunsford, Meghan McIntyre, Timothy Mowrer, Danielle Speller, Maya Thompson, Nicholas Vance, Donald Warren III

Student News

Nathan George (c/o 2001) was awarded a Gates Cambridge Scholarship for Graduate work at Cambridge and an NSF Fellowship. **Luke Cherveny** and **Franklin Goldsmith** were on the Honorable Mention list for an NSF Fellowship.

Chris Flake (c/o 2003) was awarded the 'best undergraduate poster presentation' for his presentation "A Predator-Prey Model with Disease Dynamics," at the MAA-SIAM meeting in Clemson. **Luke Cherveny** was a finalist with "Infinite Dimensional Lagrangian Reduction." **Jeremy Maness** (c/o 2003) was member of a CSC team that placed 3rd in the IEEE Computer Society International Design Competition (the only US team to make the finals).

Justin Brockman was one of 300 students selected to receive the Goldwater Scholarship (a prestigious scholarship for students). **Franklin Goldsmith** received a Fulbright Grant to study for one year at the Institue for applied Mathematics at the University of Freiburg (Albert-Ludwigs University of Freiburg).

Honors News

Pat Barrow and Chris Lipa graduated in Summer 2003. Current graduate students are Pat Barrow at Berkeley, Luke Cherveny at UCLA, Chris Flake at Maryland and Chris Lipa at Cornell, Dmitri Morozov at Duke, Robert Futrell at NC State and both Jeremy and David are currently working.

Jay Hodges attended the Budapest Semesters in Mathematics in spring 2003 and Nick Vance is attending this semester, bringing to 13 the number of NC State students who have participated in the Budapest Semesters. Jay Hodges completed a math REU (Research Experiences for Undergraduates, sponsored by NSF) last summer at Temple University and Masha Bessenov completed a materials science REU at Cornell. Presentations will take place later this semester.

In the last 10 years, 24 math majors

(Continued on page 4)

Pi Mu Epsilon

Spring 2003 Initiates

Osama Alia .....*Appl. Math/Comp. Sci.*
Jason Blevins.....*Appl. Math/Comp. Sci.*
Christopher Cottrell.....*Physics, Appl. Math*
Chian-Fen Ding..... *Operations Research*
Charles Ellison, III..... *Comp. Sci., Mathematics*
Daniel Finkel ..... *Operations Research*
Yan Gong.....*Mathematics*
Mark Harris .....*Physics, Appl. Math*
Lauren Huntley.....*Math Ed., Mathematics*
David Hysom.....*Mathematics*
Zviad Kharebava.....*Mathematics*
Nigel Kirby..... *Mathematics, Comp. Sci.*
KeTrena Langhurst .....*Statistics, Appl. Math*
Rachel Levy .....*Appl. Math*
Jessica McCoy..... *Industrial Engr.*
Corie Mellinger.....*Mathematics/Math Ed.*
Stephanie Morgan.....*Biological Sci., Appl. Math*
Vishal Patel .....*Electrical Engr., Appl. Math*
John Stanley .....*Physics*
Mark Sutton..... *Appl. Mathematics, Statistics*
Dewey Taylor .....*Mathematics*
Ming Tian .....*Aerospace Engr.*
Robert Todd .....*Marine Sci., Physics, Appl. Math*
Joshua Wander.....*Appl. Math*
Donald Warren.....*Mathematics/Physics*
Ellison Williams .....*Mathematics*
Kevin Windham.....*Appl. Math*
Xingzhou Yang.....*Mathematics*

DID YOU KNOW?
- that in 1961 the undergraduate program became a B.S. in Applied Mathematics
N.J. Rose

William Lowell Putnam Mathematical Competition

2002 Results:

NCSU students ranked:

Chris Lipa,	167
Dmitri Morozov,	469
David Johnson,	512
Brian Pike,	676

Patrick Barrow, a NCSU student playing for another school ranked 189. There were 3349 contestants from 476 institutions took part in the competition. NCSU team's rank is 139, out of 150 ranked teams.

For more information on the 2003 Annual William Lowell Putnam Mathematical Competition, please email Dr. Xiao-Biao Lin at xblin@math.ncsu.edu or visit:

www.math.vt.edu/events/

Phi Beta Kappa

Math Majors initiated Spring 2003:

Kristen Amsinck	Justin Brockman
Karen Donaghy	Charles Ellison, III
Therese Huels	Jessica King
KeTrena Langhurst	Christopher Lipa
Joshua Markwordt	Jessica McCoy
Dmitriy Morozov	Nick Vance

Mathematical Contest in Modeling & Interdisciplinary Contest in Modeling

(MCM/ICM), challenges teams of students to clarify, analyze, and propose solutions to open-ended problems. The contest attracts diverse students and faculty advisors from over 500 institutions around the world. For more information contact Dr. Scroggs at scroggs@math.ncsu.edu.

www.comap.com/undergraduate/contests/

Virginia Tech Regional Mathematics Contest

The 25th Annual Virginia Tech Regional Mathematics Contest will be held from 8:30 - 11:00 am on Saturday November 1, 2003. Last year 248 students from 41 colleges and universities in Virginia and the adjoining states participated. Cash awards up to $650 will be provided by Virginia Tech. The contest is open to all NCSU undergraduate students. Interested persons must contact Professor Xiao-Biao Lin by sending email to xblin@math.ncsu.edu. Walk-in registration starts 15 minutes prior to the contest at the NCSU contest site, usually at HA201 (to be confirmed).

Wolfpack M6 Contest The Mathematics Department sponsors the Wolfpack Magnificent, Monthly, Mesmerizing, Money-Making, Minatory, Mathematical Problem Contest for undergraduate students of North Carolina State University. Each month of the Academic Year a problem is posted. Sometimes the problem is somewhat tame, and sometimes it is not. The student submitting the first and/or the best solution for the month's problem is recognized and receives a cash prize of one one-hundred-thousandth of one million dollars!

Rules:

1. Contestants must be currently enrolled undergraduates at NCSU.
2. Submitted solutions must be complete and readable. Include your name, e-mail address, class, and curriculum.
3. Submit your solution electronically to tsynkov@math.ncsu.edu or on paper to the Mathematics Department Secretary in Harrelson 255. Electronic submissions must be in plain text, PDF, PostScript, TEX or LATEX. Microsoft-based submissions, such as Word, are accepted, but discouraged.
4. Submission deadline will be posted with each problem.

www.math.ncsu.edu/undergrad/contest/

DID YOU KNOW ?

- that the programs were called "Engineering Mathematics" in order to overcome objections by the University at Chapel Hill who didn't want competition with their own programs in mathematics.

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Honors

(Continued from page 2)

have completed summer REU's at schools including Rutgers, U Ill., Lafeyette Col., Hope Col., Rose-Hulman, Oregon St., Florida St., Col. School of Mines, Penn St., U Wash., U Puerto Rico, and Indiana. Ten students have received NSF Graduate fellowships. We're ranked 12th nationally for NSF Fellowships in math since 1994.

Tim Bushnell, Greta Grizzard and Mark Lavin anticipate graduating in December 2003. New members of the Honors Program: Masha Bessenov, Justin Brockman, Robert Campbell, Josh Clemons, Robert Darwin, Chris Goulette, Ketrena Langhurst, Jessica McCoy, Jonathan McDaniel, Vishal Patel, Kenneth Running, Robert Todd, Eamonn Tweedy and Donald Warren.

Students interested in more information should contact Dr. Paur, HA 202, 515-2598, sopaur@math.ncsu.edu or check out the honors program web site; www.math.ncsu.edu/honors.edu/honors.

Solutions to *Spring 2003 Can You Solve This?*

Given four distinct parallel planes, prove that there exists a regular tetrahedron with a vertex on each plane.

Denote the planes, in order, by $\Pi_0, \Pi_1, \Pi_2, \Pi_3$, and let d_i be the distance from Π_i to $\Pi_0 (i = 1,2,3)$. We shall solve the problem by taking a regular tetrahedron $P_0P_1P_2P_3$ of edge length 1 and passing parallel planes $\Pi'_0, \Pi'_1, \Pi'_2, \Pi'_3$, through its vertices in such a way that P_1, P_2, P_3 all lie on the same side of Π'_0, and the distances d'_i between Π'_i and Π'_0, satisfy

(1) $$\frac{d'_1}{d_1} = \frac{d'_2}{d_2} = \frac{d'_3}{d_3} \quad .$$

Once this is achieved, the configuration can be rotated so that $\Pi'_0 \| \Pi_0$ and then enlarged (or shrunk) uniformly by the factor d_1 / d'_1. The resulting regular tetrahedron of edge length d_1 / d'_1 is the one whose existence we were asked to establish.

It is convenient to place P_0 on plane Π_0 and to take P_0 as origin of a coordinate system in 3-space. We denote the unit vectors to P_1, P_2, P_3 again by P_1, P_2, P_3. We shall determine the planes Π'_i by finding the direction of their unit normal N. Since N is a unit vector perpendicular to Π'_i, and P_i lies on Π'_i, the distance from Π'_i to Π'_0 is $d'_i = P_i \cdot N$.

Consequently equations (1) may be written in the form

(2) $$\frac{P_1 \cdot N}{d_1} = \frac{P_2 \cdot N}{d_2} = \frac{P_3 \cdot N}{d_3},$$

where the coordinates (a_i, b_i, c_i) of the unit vectors P_i are known, and where the coordinates (x, y, z) of the normal vector N to Π'_i are to be determined. Equations (2) are equivalent to a system of two homogeneous equations

(3) $$\alpha_1 x + \beta_1 y + \gamma_1 z = 0$$
$$\alpha_2 x + \beta_2 y + \gamma_2 z = 0$$

Here

$$\alpha_1 = \frac{a_1}{d_1} - \frac{a_2}{d_2}, \beta_1 = \frac{b_1}{d_1} - \frac{b_2}{d_2}, \gamma_1 = \frac{c_1}{d_1} - \frac{c_2}{d_2},$$

$$\alpha_2 = \frac{a_1}{d_1} - \frac{a_3}{d_3}, \beta_2 = \frac{b_1}{d_1} - \frac{b_3}{d_3}, \gamma_{21} = \frac{c_1}{d_1} - \frac{c_3}{d_3}.$$

Such a system (3) always has at least one non-trivial solution (x, y, z). This is an instance of the general theorem that a system of $n-1$ linear homogeneous equations in n unknowns always has a nontrivial solution. It can be proved for example inductively on n, by elimination.

COURSE ADVERTISEMENTS

Introduction to Mathematical Finance
MA 493E, Instructor: Dr. Tao Pang
TH 1:05-2:20pm

This course will introduce several topics of modern mathematical finance, including the theory of option pricing, and portfolio optimization. We will study the famous Black-Scholes theory of options, concepts of arbitrage and hedge, and a simple derivation of Black-Scholes call option formula. We will cover some general topics in finance, such as time value of money, rate of return on an investment cash flow sequence, utility function and expected utility maximization, mean-variance analysis, optimal portfolio selection, and the capital assets pricing model. Finally, we will introduce a classical portfolio optimization problem, Merton's problem. Students who want to work in finance industry or conduct research in mathematical finance or financial economics will benefit from this course.
Prerequisite(s): MA421 or equivalent, JR or SR level, knowledge of elementary probability theory.

Mathematics of Superspaces
MA 591s
Instructor: Dr. Fulp

In this course we develop the basic properties of supernumbers. These are elements of a special kind of algebra whose generators anti-commute. We then develop properties of super vector spaces, linear transformations of such spaces and their matrix representations. Smooth and analytic mappings between two superspaces; differentiation and integration of such functions will also be discussed. Time permitting, supermanifolds, super Lie groups and super Lie algebras will be covered.
Prereq. MA 405, ability to manipulate Taylor series, and to absorb abstract ideas. Since we are dealing with a completely new algebraic system we will develop all essential ideas from scratch. These area was developed extensively by physicists but applications will be postponed to a future course or seminar.

Mathematical Biology

How is a disease transmitted through a population? How do Malaysian fireflies synchronize their lights with each other? How often should a patient get chemotherapy? How does a cell pinch itself in two? If you've ever wanted to answer a biological question with a mathematical answer, perhaps you should try a course in mathematical biology. Mathematical biology encompasses all of biology and most of mathematics. There are several courses in mathematical biology at NCSU which can count as applied math electives. If you are an upper-level math major who has had some biology courses, you are prepared for these courses:

MA 432: Mathematical Models in Life and Social Sciences (pre. MA 301 or 341, 305 or 405, programming language)
BMA 567: Modeling of Biological Systems (pre. MA 131)
MA/BMA 573 or **574:** Mathematical & Experimental Modeling of Physical Processes I, II (pre. MA 341, MA 405, programming language)

Nonlinear Dynamics and Chaos
MA 537, Instructor: Dr. John Franke
MWF 10:15 - 11:05

See the beauty of fractals and the connection with chaotic dynamical systems.

Stability and Time Optimal Control of Hereditary Systems
MA 535, Instructor: Dr. E. Chukwu
www.math.ncsu.edu/Courses/MA535.html
Prerequisites: MA 341 and MA 425 or 511

We study the stability and Time Optimal Control theory of ordinary and hereditary system models. Examples include national economies, cooperative and competitive systems, electric circuits, spread of AIDS and other diseases, and vibrations of flexible structures. We will use MATLAB or Maple programs.

Computer Experiments in Mathematical Probability
MA 544, www.math.ncsu.edu/~jack/ma544.html
Pre-requisite MA421
Instructor: Jack Silverstein

This class will explore the benefits of using computers to gain insight into mathematical behavior. Examples will be chosen from topics in probability theory which are not typically covered in other courses or which do not have a complete mathematical treatment at this time.

Introduction to Parallel Computing
MA/CSC 583
www4.ncsu.edu/eos/users/w/white/www/white/bob.html
Prereq. CSC 302 or MA 402 or MA/CSC 428 or MA/CSC 580

Introduction to basic parallel architectures, algorithms and programming paradigms; message passing collectives and communicators; parallel matrix products, domain decomposition with direct and iterative methods for linear systems; analysis of efficiency, complexity and errors; applications such as 2D heat and mass transfer. The first half of the course will introduce the basic message passing interface (MPI) subroutines. The second half will use MPI to solve linear systems via direct and minimized iterative methods.

NEW MEMBERS OF THE MATH DEPARTMENT

Bojko Bakalov

I was born in Karlovo, Bulgaria and studied at Sofia University. I came to the U.S. in 1996 and received my Ph.D. from MIT in 2000. After that I was a Miller Research Fellow at the University of California, Berkeley. My research interests include vertex algebras, integrable systems and conformal field theory.

Janice Gaddy

I am the accounting technician with Mary Byrd. I retired from the Department of Statistics on December 31, 2002 with 30 years of service to NC State Government. I began working at NCSU in 1975 in the Department of Statistics. In my spare time I enjoy crafts, reading, walking, listening to music, and spending time with family. My husband, Al, is also retired from NC State Government, and our son and daughter-in-law, Jason & Kelly, graduated from NCSU.

Kristian Jenssen

I am from Oslo, Norway, and I did my Ph.D. in Trondheim, Norway. During the Ph.D. I spent one year at SISSA, Trieste, Italy, and I returned there for a postdoctoral position. After Italy I went to Indiana Univ., Bloomington, for another postdoc before coming to NCSU. My field of research is partial differential equations, in particular systems of conservation laws.

Irina Kogan

I was born in Moscow, Russia. High school gave me a solid mathematical background, lifelong friends and a passion for hiking and camping. I received an equivalent of a M.S. in Applied Mathematics at the Moscow Inst. for Petrochemical and Natural Gas Industry in 1993 and a Ph.D in Mathematics at the University of Minnesota in 2000. I was a Gibbs Instructor at Yale University before I joined NCSU. In my current research I am interested in symmetries and the way symmetries can help in solving differential and algebraic equations.

Demetrio Labate

I was born in Torino, Italy. I graduated from the Politecnico di Torino, where I received my Ph.D. in Electrical Engineering in 1995. Then I was at the Georgia Institute of Technology, where I received my Ph.D in Mathematics in 2000. I was a postdoc fellow at Washington University in St.Louis until 2003. My area of research is harmonic analysis, with emphasis in time-frequency analysis and wavelets. I am also interested in signal and image processing applications.

Alun Lloyd

I am from the UK, where I studied math at Cambridge before receiving my Ph.D. in biology from Oxford. After that, I spent four years at the Inst. for Advanced Study in Princeton. My area of research is mathematical biology, and I am particularly interested in modeling the spread of diseases. When I am not working, I can often be found cycling around Raleigh.

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