

# **ANNUAL REPORT**

**2008-2009**

**Annual Report**  
**Mathematics Department**  
**2008-09**

# Annual Report Executive Summary, 2008-09

## Department of Mathematics

### Learning: Undergraduate

The Mathematics Department awarded 73 B.S. degrees from June, 2008, through May, 2009.

Eleven students participated in 9 undergraduate research projects, including 2 honors theses.

Three Virginia Tech teams participated in COMAP's international Mathematical Contest in Modeling, with two of the teams earning Meritorious rankings.

An extensive review of Emporium operations resulted in several changes that increased effectiveness and reduced complaints.

A thorough analysis comparing high school mathematics preparation with first-semester calculus outcomes resulted in insight into the effectiveness and limitations of remediation and in changes in identification of calculus-ready students.

### Learning: Graduate

The Mathematics Department awarded 18 M.S. degrees and 6 Ph.D. degrees from June, 2008, through May, 2009.

The Mathematics Department has 74 graduate students, with 50 supported as department GTA's, 1 as a start-up GTA, 6 as GRA's, 1 as a Hatcher Fellow, 1 as a 2010 Fellow, 1 as an ICTAS Fellow, 4 by their employers, and 5 by other departments at Virginia Tech.

Students have more opportunities than ever before in geometry / topology and in math education. The department's GTA training and mentoring program remains exceptionally strong.

### Discovery

Total expenditures for Math and ICAM in 2008 were \$1,154,517, distributed among roughly 31 grants held by 26 faculty members.

In 2008 the faculty published over 100 refereed articles and gave over 100

invited lectures.

17 members of the faculty served on 50 editorial boards.

Mark Shimozone is one of three Principal Investigators on the National Science Foundation Focused Research Group: Affine Schubert Calculus: Combinatorial, Geometric, Physical, and Computational Aspects.

Reinhard Laubenbacher is a Principal Investigator, John Burns and Lizette Zietsman are Co-Principal Investigators, and Jeff Borggaard and Henning Mortveit are Senior Personnel on the National Science Foundation Research Experience for Undergraduates: Modeling and Simulation in Systems Biology.

The Mathematics Department was one of the hosts of the Eighteenth International Symposium on the Mathematical Theory of Networks and Systems (MTNS 2008) held in Blacksburg, VA, during July, 2008. More than 300 scientists from around the world attended. Math professors Joseph Ball, Christopher Beattie, and Serkan Gugercin were among the organizers.

John Burns was a Visiting Research Fellow at the United Technology Research Center.

Michael and Yuriko Renardy were chosen to be Very Important Visitors for the 2009 program on Complex Fluids at the Institute for Mathematics and its Applications.

### **Engagement**

In its thirtieth year, the Virginia Tech Regional Mathematics Contest included 398 students from 74 colleges, including colleges as far away as California, Oregon, and Prince Edward Island.

Various members of the faculty are in leadership roles in all three major national mathematics organizations. Reinhard Laubenbacher is the SIAM Vice-President for Science Policy, Ezra Brown is the Governor of the MAA MD-DC-VA Section, and Frank Quinn is the chair of the AMS Working Group on Preparation for Technical Careers.

Members of the faculty advised three science projects involving six high school students, and other members of the faculty judged science fairs at the school, regional, and international levels.

Sue Hagen is a member of the management team of The Virginia Algebra Project and was a member of the management team of Virginia's Middle Mathematics Project.

## **Diversity**

The Mathematics Department hosted its fourteenth annual Women in Mathematics: Career Day at Virginia Tech.

Two members of the faculty are active in programs designed to enhance higher education in Africa.

Various members of the faculty serve as:

a member of the External Advisory Committee of the Alliance for the Advancement of Biomedical Research Excellence in Puerto Rico,

a member of the Minority Serving Institutions Advisory Council at Virginia Tech,

a co-leader of the Mathematics Education Mentoring Group of EDGE (Enhancing Diversity in Graduate Education for Women), and

the Summer Mathematics Director of the Center for the Enhancement of Engineering Diversity.

Andy Norton is the principal investigator on a NSF Robert Noyce Scholarship Grant, Virginia Teach: Serving Mathematics Students in Need. The grant provides scholarships for students who commit to teach in high-need schools.

## **Goals for 2009-10**

The Mathematics Department will introduce a revamped mathematical modeling course this year. The course will have a strong interdisciplinary focus.

The Mathematics Department plans to introduce a mathematical programming course this year.

The Mathematics Department is in discussions, coordinated by Kevin McDonald, intended to provide HBCU access to Math Emporium software.

The Mathematics Department is in discussions intended to lead to our offering a day-long program in mathematics for the Johns Hopkins Center for Talented Youth.

The Mathematics Department will continue to develop ways to use the data collected by our Emporium testing system and our common final exams to assess and improve teaching and learning.

## **Part 2**

### **Academic Accomplishments**

#### **Learning: Undergraduate**

We awarded 73 B.S. degrees during the period running from June, 2008, through May, 2009.

There are four degree options, with advisors who specialize in each option, as well as a department career advisor (general career advice, notification of opportunities, and assistance with individual placements) and an undergraduate research coordinator (promotes undergraduate research and advises students seeking mentors).

Eleven students participated in 9 undergraduate research projects, including 2 senior honors theses. Seven students participated in the mathematical modeling seminar, which will be transformed into a mathematical modeling class in fall, 2009. Currently 32 students are registered for the modeling class.

For the first time three Virginia Tech teams participated in the Mathematical Contest in Modeling, sponsored by the Consortium for Mathematics and its Applications. Two of the teams earned Meritorious rankings, the highest rankings ever for Virginia Tech.

Seven semester-long courses (all but two offered in fall, spring, and summer) are in full-Emporium format. Over 5500 students enroll in these courses in the fall, and over 2700 students enroll in them in the spring. During summer, 2008, we conducted a full review of Emporium operations. Among the changes arising from the review, three had immediate and visible impact. By focusing Emporium-floor instructional assistance on full-Emporium courses (while providing assistance for other courses in the Tutoring Center), we prevented almost all of the unacceptable wait times that students had encountered from time to time in the previous year. By instituting quizzes for instructional assistants, we improved the quality of instructional assistance. By increasing the size of our bank of problem types, we were able to increase the number of questions on each quiz taken by students. This latter change was in response to student requests for quizzes that offered a more comprehensive assessment of students' mastery of material.

The Math Emporium's Instructional Assistant Training Workshop has International Tutor Program Certification from the College Reading and Learning Association.

During summer, 2008, we used the adaptive testing and remediation software ALEKS as one of the paths students could use to qualify for enrollment in Math 1205. We did a thorough analysis of the Math 1205 outcomes of students, sorted by the method by which

they qualified for Math 1205. One clear conclusion was that students who qualified based on summer pre-calculus remediation had poor outcomes in Math 1205. Although ALEKS is an impressive product, our conclusion led us to choose not to use ALEKS this summer. Our analysis did suggest some changes in our qualification process. We expect the implementation of these changes to improve Math 1205 outcomes.

Susan Hagen coordinates the quantitative and symbolic reasoning component of the Earth Sustainability program.

### **Learning: Graduate**

We awarded 18 M.S. degrees and 6 Ph.D. degrees during the period running from June, 2008, through May, 2009. In addition to learning mathematics, our graduate students are trained as teachers by our extensive GTA training and mentoring program developed and led by our GTA coordinator Eileen Shugart.

Our mix of domestic students, international students (particularly from Peru, Tunisia, Algeria, and China), and German exchange students creates a diverse environment that is an effective setting for graduate student research and teaching. Of our 74 graduate students, 50 are supported as department GTA's, 1 as a start-up GTA, 6 as GRA's, 1 as a Hatcher Fellow, 1 as a 2010 Fellow, 1 as an ICTAS Fellow, 4 by their employers, and 5 by other departments at Virginia Tech.

We have exceeded previous highs in geometry and topology offerings. In 2007-2008 we offered a year-long sequence in differential topology and differential geometry. In 2008-2009 we offered a year-long sequence in algebraic topology, a year-long sequence in algebraic geometry, and a one-semester course in point-set topology. All classes had healthy enrollments.

As part of an effort to bring our math education Ph.D. program to a new level, Andy Norton started a seminar designed to provide for Math and Education math education students a common introduction to research in math education.

### **Discovery**

Total expenditures for Math and ICAM in 2008 were \$1,154,517, distributed among roughly 31 grants held by 26 faculty members.

In 2008 the faculty published over 100 refereed articles and gave over 100 invited lectures.

An assistant professor who studies numerical computation applied to complex fluids joined the department in Fall, 2008.

The department employed four visiting assistant professors during 2008.

Mark Shimozono is one of three Principal Investigators on the National Science Foundation Focused Research Group: Affine Schubert Calculus: Combinatorial, Geometric, Physical, and Computational Aspects.

Reinhard Laubenbacher is a Principal Investigator, John Burns and Lizette Zietsman are Co-Principal Investigators, and Jeff Borggaard and Henning Mortveit are Senior Personnel on the National Science Foundation Research Experience for Undergraduates: Modeling and Simulation in Systems Biology.

The Mathematics Department was one of the hosts of the Eighteenth International Symposium on the Mathematical Theory of Networks and Systems (MTNS 2008) held in Blacksburg, VA, during July, 2008. More than 300 scientists from around the world attended. Math professors Joseph Ball, Christopher Beattie, and Serkan Gugercin were among the organizers.

John Burns was a Visiting Research Fellow at the United Technology Research Center.

Michael and Yuriko Renardy were chosen to be Very Important Visitors for the 2009 program on Complex Fluids at the Institute for Mathematics and its Applications.

Seventeen members of the faculty served on 50 editorial boards.

## **Engagement**

The Virginia Tech Regional Mathematics Contest, in its thirtieth year, continued to grow, with participation by 398 students from 74 colleges. The contest is no longer regional (Harvey Mudd College represented one corner of the U.S. and Eastern Oregon University another corner.) or national (The University of Prince Edward Island competed.)

During Math Awareness Month we once again sponsored a poster contest for Montgomery and Giles County K-6 students.

Ezra Brown made four presentations to Virginia Tech alumni groups.

Ezra Brown made two presentations to the Roanoke Valley Governor's School.

Several members of the faculty served as science fair judges: Intel International Science and Engineering Fair, Blue Ridge Highlands Regional Science Fair, and Dublin Governor's School Science Fair.

Members of the faculty advised science fair projects by two students from the Dublin Governor's School and four students from Montgomery County, Radford, and Roanoke.

Reinhard Laubenbacher is the program leader of Kids' Tech University.

Frank Quinn is the chair of the AMS Working Group on Preparation for Technical Careers.

Susan Hagen is a member of the management team of The Virginia Algebra Project.

Susan Hagen was a member of the management team of Virginia's Middle Mathematics Project.

### **Diversity**

The fourteenth annual Women in Mathematics: Career Day at Virginia Tech expected 261 students from 23 middle and elementary schools. Despite weather that closed or delayed many school systems, 135 students from 13 schools participated. Two math alumnae participated in the Career Day activities.

William Greenberg served as an advisor for the Bellagio Institute Initiative for the development of academics in Africa and less developed nations.

Peter Haskell is a MentorNet mentor and an AWM mentor.

Reinhard Laubenbacher was a member of the External Advisory Committee of the Alliance for the Advancement of Biomedical Research Excellence in Puerto Rico.

Reinhard Laubenbacher is a member of the Minority Serving Institutions Advisory Council at Virginia Tech.

Gwendolyn Lloyd is a co-leader of the Mathematics Education Mentoring Group of EDGE, Enhancing Diversity in Graduate Education for Women.

Andy Norton is the principal investigator on a NSF Robert Noyce Scholarship Grant, Virginia Teach: Serving Mathematics Students in Need. The grant provides scholarships for students who commit to teach in high-need schools.

James Turner is the lead developer of the VT African Center (CESTED).

James Turner was a Spelman College ASPIRE advisory board member.

Susan Hagen has included in Math 4644 explorations of ways technology can help students with moderate to severe disabilities learn mathematics.

Heath Hart is the Summer Mathematics Director for the Center for the Enhancement of Engineering Diversity.

Two of the five outstanding seniors (overall and in degree options) were women.

## **Goals for 2009-10**

We will introduce a revamped mathematical modeling course this year. The course will have a strong interdisciplinary focus.

We plan to introduce a mathematical programming course this year.

We are in discussions, coordinated by Kevin McDonald, intended to provide HBCU access to Math Emporium software.

We are in discussions intended to lead to our offering a day-long program in mathematics for the Johns Hopkins Center for Talented Youth.

We will continue to develop ways to use the data collected by our Emporium testing system and our common final exams to assess and improve teaching and learning.

## FACULTY

### **Hatcher Professor**

Burns, John

### **Class of 1950 Professors**

Renardy, Michael

Renardy, Yuriko

### **Alumni Distinguished Professor**

Brown, Erza

### **Professors**

Adjerid, Slimane

Ball, Joseph

Beattie, Christopher

Borggaard, Jeffrey

Day, Martin

Floyd, William

Green, Edward

Greenberg, William

Hagedorn, George

Haskell, Peter

Herdman, Terry

Kim, Jong Uhn

Klaus, Martin

Kohler, Werner

Laubenbacher, Reinhard

Lin, Tao

Linnell, Peter

Lloyd, Gwendolyn

Parry, Charles

Prather, Carl

Quinn, Frank

Rogers, Robert

Rossi, John

Russell, David

Sachs, Ekkehard

Shimozono, Mark

Snider, Robert

Sun, Shu Ming

Turner, James C

Wheeler, Robert

### **Associate Professors**

De Sturler, Eric  
Gao, David  
Gugercin, Serkan  
Illiescu, Traian  
Shockley, James  
Wapperom, Peter  
Williams, Michael

### **Assistant Professors**

Elgart, Alexander  
Loehr, Nicholas  
Mortveit, Henning  
Norton, Anderson  
Ryan, Jennifer  
Pengtao Yue  
Zietsman, Lizette

### **Visiting Assistant Professors**

Afkhami, Shahriar  
Jia, Ning  
Pelley, Allen  
Ter Horst, Sanne

### **Instructors**

Agud, Diane  
Anderson, Susan  
Bourdon, Terri  
Cothren, Marlene  
Hagen, Susan  
Hanks, Lucy  
Hart, Heath  
Hodges, Charles  
Kohler, Abigail  
McQuain, Margaret  
Peters, Tom  
Powers, Linda  
Reynolds, Bernice  
Schmale, Jessica  
Shugart, Eileen  
Smith, Deborah  
Stephens, Catherine

## **GRANTS**

### **SLIMANE ADJERID**

#### CONTINUING:

Discontinuous Galerkin Methods for Partial Differential Equations, National Science Foundation, PI, \$110K, status: no cost extension, 2008-09.

Discontinuous Immersed Finite element Methods for Interface Problems, NSF, Co-PI, PI: Tao Lin, National Science Foundation, \$150K, status: continuing, 2007-10.

#### NEW:

Discontinuous Galerkin Methods for PDEs: Super convergence and a posteriori error estimation, NSF, \$180K, status: new, 2008-2011.

### **CHRISTOPHER BEATTIE**

#### CONTINUING:

“Eighteenth International Symposium on the Mathematical Theory of Networks and Systems - MTNS 2008” Air Force Office of Scientific Research, April 1, 2008 - November 30, 2008. PIs: Joe Ball, Christopher Beattie, Serkan Gugercin, Reinhard Laubenbacher, Craig Woolsey. (\$29,995)

“Eighteenth International Symposium on the Mathematical Theory of Networks and Systems - MTNS 2008” National Science Foundation - Division of Mathematical Sciences, July 1, 2008 - June 30, 2009. PIs: Joe Ball, Christopher Beattie, Serkan Gugercin, Reinhard Laubenbacher, Craig Woolsey (\$12,600)

“Data Compression and Filtering for Remote Sensing Applications” Intergovernmental Personnel Act (IPA) Agreement with NASA Stennis Space Center for Spring 2008 (\$29,813) and Fall 2008 (\$31,970)

### **JEFF BORGGGAARD**

#### CONTINUING:

Computation and Analysis of Reduced-order Models for Distributed Parameter Systems, Principal Investigator with Christopher Beattie, Serkan Gugercin and Traian Iliescu), National Science Foundation, Grant DMS-0513542, 2005-2008 (\$431, 342.00).

Reduced -Order Modeling for Optimization and Control of Complex Flows. Co-PI (with T. Iliescu), Air Force Office of Scientific Research, 2007-2010, \$391,021.

REU Site: Modeling and Simulation of Biological Networks, senior personnel (R. Laubenbacher, J. Burns, S. Faulkner, and L. Zietsman co-PI, 2008-2011, \$269,193.

## **JOHN BURNS**

CONTINUING:

2007 – Present: Computational Methods of Identification, Optimization and Control of PDE Systems, Principal Investigator with E. M. Cliff and L. Zietsman, AFOSR (\$699,117).

2007- Present: REU Grant on Modeling and Simulation of Biological Networks, Principal Investigator with S. Faulkner, R. Laubenbacher and L. Zietsman NSF (\$269,193).

## **ERIC DE STURLER**

CONTINUING:

Collaborative Research: CMG: Quantum Monte Carlo Calculation of Deep Earth Materials, NSF EAR 05-30643, Sub award from University of Illinois (2005-05100-01), \$130,618.00, 12/25/2005 – 08/31/2009, PI (this is now VT Part of original grant under 2)

Collaborative Research: CMG: Quantum Monte Carlo Calculations of Deep Earth Materials, NSF EAR 05-30643, \$320,000.00, 8/15/2005 – 8/31/2009, CoPI (received at UIUC).

Collaborative Research: Unifying mechanistic and dynamic mathematical models Of stomatal behavior and photosynthesis, IOB-0417126, \$395,155.00, 09/01/2004 – 08/31/2007, CoPI (received at UIUC), supporting postdoc at UIUC (Xinguang Zhu)

Materials Computation Center, NSF, \$3,960,000, 10/2003-09/2008, CoPI and member Of MCC Advisory Committee, (received at UIUC), supporting student at UIUC. One year extension 9/30/08 m- 9/30/2009

NEW:

One year extension of Grant 3 above.

## **ALEXANDER ELGART**

CONTINUING:

Transport in disordered media, 652,000 Israeli shekels (\$180,000) Israel Science Foundation.

Structured random matrix model for complex dynamics, other PI's: Cohen, Kottos, (\$106,000) United States – Israel Binational Science Foundation.

## **DAVID GAO**

### CONTINUING:

NSF: Division of Computer & Information Science & Engineering, Primal-Dual Method and Algorithm for Large Scale Computation with Applications in Engineering Mechanics, CCF-051768, 2005-2008: (\$180,000), (PI).

### NEW

AFOSR/NL: Division of Mathematics, Canonical Duality Theory and Algorithms For Solving Some Challenging Problems In Global Optimization and Decision Sciences, 2009-2014: \$750,000 (PI)

## **EDWARD GREEN**

### CONTINUING:

National Security Agency Research Grant #H98230-07-1-0057, 12/06-12/08 (\$65,838).

### NEW:

National Security Agency research grant for 2009 and 2010, \$48,329 (1st Year)

## **SERKAN GUGERCIN**

### CONTINUING:

NSF Division of Mathematical Sciences, Model Reduction with Rational Krylov Methods, PI's Chris Beattie, Serkan Gugercin. Extension amount in May 2007: (\$71,766), June 1, 2005- May 31, 2009 - Total Amount \$210,766.

NSF-Division of Mathematical Sciences, Computation and Analysis of Reduced-Order Models for Distributed, Parameter Systems, PI's Jeff Borggaard, Chris Beattie, Serkan Gugercin, Traian Iliescu, (\$431,342). This grant ended during the activity period, In December 2008.

NSF – Division of Mathematical Sciences, Career: Reduced-order Modeling and Controller Design for Large-scale Dynamical Systems via Rational Krylov Methods, May 1, 2007 – April 30, 2012, PI: Serkan Gugercin, (\$400,000).

### NEW:

1) Agency: AFOSR

Title: Eighteenth International Symposium on the Mathematical Theory of Networks and Systems - MTNS 2008

PIs: Joe Ball, Chris Beattie, Serkan Gugercin, Reinhard Laubenbacher, Craig

Woolsey  
Duration: April 1, 2008 - November 30, 2008  
Amount: \$29,995

2) Agency: NSF-Division of Mathematical Sciences  
Title: Eighteenth International Symposium on the Mathematical Theory of Networks and Systems - MTNS 2008  
Duration: July 1, 2008 - June 30, 2009  
PIs: Joe Ball, Chris Beattie, Serkan Gugercin, Reinhard Laubenbacher, Craig Woolsey  
Amount: \$12,600

### **GEORGE HAGEDORN**

CONTINUING:  
National Science Foundation Grant DMS – 0600944. Mathematical Studies In Quantum Mechanics. Award Amount \$243,770.00. 07/15/06-04/30/09.

### **SUSAN HAGEN**

CONTINUING:  
“Virginia’s Middle Mathematics Project.”(2007-8) Mathematics & Science Partnership grant. Partner with University of Virginia, James Madison University. Award: \$88,155.  
Principal Investigator of sub award in partnership grant to offer a professional development program for 6th and 7th grade mathematics and special education teachers. Grant also provides for the placement of a math specialist in two Roanoke City Schools.

NEW  
Evaluating Students’ Quantitative Literacy Learning Outcomes in the Interdisciplinary Earth Sustainability Project: Assessing the Impact of an Embedded Quantitative Literacy Design. (2008-9) Core Competency Grant.  
Project Members: Barbara Bekken, Charles Walter and Susan Hagen

### **TERRY HERDMAN**

CONTINUING:  
PI, Research on Mathematical and Computational Tools for Analysis, Design and Optimization of Very Large Membrane Structures with Advanced Material Models, with J. A. Burns, E. M. Cliff and D. Inman, \$1,870,000 for 3 years, DARPA/NASA LaRC/NIA 2535. The DARPA IST program was put “on hold” January 2008.

PI, Research Collaboration and Program Development, ORNL/UT Battelle LLC, \$220,000, (approximately \$20,000 for this reporting period).

NEW:

PI, Investigation and Implementation of Sparse Grids, with John Burkardt, Sandia National Laboratories. \$50,000

## **TRAIAN ILIESCU**

CONTINUING:

CMG Collaborative Research: A New Modeling Framework for Nonhydrostatic Simulations

of Small-Scale Oceanic Processes, Principal investigator (with J. Duan, P. Fischer, and T. Ozgokmen), National Science Foundation, Grant OCE-0620464, 2006 - 2009, \$147,861.

\* Computation and Analysis of Reduced-Order Models for Distributed Parameter Systems,

Principal Investigator (with C. Beattie, J. Borggaard and S. Gugercin), National Science Foundation, Grant DMS-0513542, 2005-2008, \$431,342.

\* Reduced-Order Modeling for Optimization and Control of Complex Flows, co-PI (with J. Borggaard), Air Force Office of Scientific Research, 2007-2010, \$391,021.

## **REINHARD LAUBENBACHER**

CONTINUING:

Title: Molecular fingerprinting of breast cancer development, RO1CA120170-01A2

PI: Shulaev

Co-PI: Laubenbacher, Mendes

Source of Support: NIH

Total Award Period Covered: 6/2007- 5/2010

Summary: Joint project with Wake Forest University Cancer Biology Department. The focus of the project is to study a metabolic network and its changes in breast cancer cells.

Title: BBSI: Summer Institute for Quantitative and Integrative Bioengineering, EEC-0609225

PI: Davalos

Co-PI: Laubenbacher, Faulkner

Source of Support: NSF

Total Award Period Covered: 8/2006-8/2009

Summary: Joint project of the Virginia Polytechnic Institute and State University, Wake Forest University School of Biomedical Engineering and Sciences (SBES) and the Virginia Bioinformatics Institute (VBI. The intellectual focus of the program--integrated and quantitative bioengineering--and will emphasize three major thrusts: computation systems biology, computational bio-imaging, and computational physiology.

NEW:

Title: Translational breast cancer metabolomics

PI: Shulaev

Co-PI: Laubenbacher, Akman

Source of Support: Wake Forest University Translational Science Institute (TSI)

Total Award Period Covered: 6/2008-5/2010

Summary: A joint project with Wake Forest University to discover cancer biomarkers.

Title: REU Site: Modeling and Simulation of Biological Networks, DMS-0755322-NSF

PI: Laubenbacher

Co-PI: Faulkner, Burns, Zietsman

Source of Support: NSF

Total Award Period Covered: 5/2008 - 4/2011

Summary: The objective of the proposed program is to provide a 10-week residential summer research experience in mathematical biology to undergraduate students from around the U.S. and Puerto Rico, with the goal of increasing their desire and preparation to enter a Ph.D. program in mathematics or computational biology.

## **TAO LIN**

CONTINUING:

SIRG: Highly Multiplexed Optical Fiber Sensing Networks for Infrastructure Monitoring, NSF, Sept. 2004-Aug. 2008, \$500,000 (Co-PI with A. Wang, G. Pickrell, L. Dasilva, K. Cooper of ECE)

Discontinuous Immersed Finite Element Methods for Interface Problems, NSF, July, 2007-June, 2010, \$153,000, (PI: T. Lin, Co-PI: S. Adjerdid)

## **GWENDOLYN M. LLOYD**

CONTINUING:

Improving the Learning of Preservice Secondary Mathematics Teachers through Engagement with Middle and High School Curriculum Materials, 2006-2009 (no cost extension granted through March 2010), \$100,000; National Science Foundation's Division of Undergraduate Education CCLI Program (PI Lloyd; co-PI V.R. Pitts Bannister)

NEW:

Virginia Teach: Serving Mathematics Students In Need, 2008-2013, \$750,000; National Science Foundation's Robert C. Noyce Scholarship Program (PI A. Norton; co-PI Lloyd and others)

## **NICHOLAS LOEHR**

### CONTINUING:

Symmetric Functions, Macdonald Polynomials, Quantum Combinatorics, and Nabla. NSA Young Investigator Grant, (\$30,000), 9/1/2007-8/31/2009, PI: Loehr.

## **HENNING MORTVEIT**

### CONTINUING:

Project title: REU: Modeling and Simulation of Biological Networks. Principal investigators: Reinhard Laubenbacher, John Burns, Susan Faulkner and Lizette Zietsman. Other senior personnel: Jeff Borggaard, Abdul Jarrah and Olga Pierrakos. (\$269,193) (Senior personnel)

### NEW:

Project Title: High Performance Computing Methods for Inference State Assessment and Course of Action Analysis in Large Socio-Technical Systems PI: Christopher Barrett. Source of Support: DTRA. Amount Requested: \$485k per year. Total Award period Covered: 01/01/2009-12/31/2011. Effort: 1.20 months cy. (Co-PI). Note: This proposal was selected for funding in January 2009; the exact funding amount has not been set yet.

Project Title: A Stochastic Simulation Platform for Predicting the Effects of Different Malaria Intervention Strategies. PI: Thomas Smith (Swiss Tropical Institute), Source of Support: Gates Foundation. Total Amount Requested for NDSSL: \$400,000. Total Award Covered: 01/1/09-12/31/10. Effort: 2.95 months cy (PI for NDSSL portion of the contract.) Note: Have received verbal promise of funding. The contract is to be signed in March 2009.

## **ANDERSON NORTON**

### CONTINUING:

Co-Principal Investigator for a \$500,000 Robert Noyce Scholarship Grant from NSF, Providing scholarships in order to recruit future secondary math teachers for high-need Schools in Indiana awarded for 2006-2009.

Co-Principal Investigator for \$1,500,000 DR-K12 Grant from NSF, studying restructuring of early field experiences for elementary preservice teachers, awarded 2007-2012.

NEW:

Principal Investigator for a \$750,000 Robert Noyce Scholarship Grant from NSF, "Virginia Teach: Serving Mathematics Students in Need." Awarded 2008-2013.

Co-Principle Investigator for a \$780,000 DR-K12 grant from NSF, "Untangling Mathematical KnotSS (Knowledge for Teaching Secondary School)" (PI Rebecca McGraw, UAZ). Awarded 2008-2011

Co-Principal Investigator for a \$192,000 MSP Grant from the State of Virginia, implementing a professional development program for all middle school mathematics teachers in Montgomery County (PI Jesse Wilkins, VPI). Awarded 2008-2009.

### **WAYNE PATTY**

CONTINUING:

Submitted a request and justification to NSF for a one-year no cost extension to the NSF Local Systemic Change grant. This request was approved, and the new ending date is 03/31/08.

### **MICHAEL RENARDY**

CONTINUING:

DMS 0707727, National Science Foundation (\$124,795) 8/1/07-7/31/10.

### **YURIKO RENARDY**

CONTINUING: 2003-2008: I am part of the NIH Grant 1R25GM066534-01A1 (PI Edward Smith, Department of Animal and Poultry Science) Virginia Tech Post-baccalaureate Research and Education Program (PREP).

NSF, Mathematical Sciences Priority Area of the Division of Chemical and Transport Systems (CTS) and the Division of Mathematical Sciences (DMS). DMS-0456086. Title: The development and implementation of algorithms to investigate drop fragmentation under shear for viscoelastic liquids with surfactant. Principal Investigator: Yuriko Renardy. 6/15/2005-5/31/2009.

NCSA (National Center for Supercomputing Applications, University of Illinois at Urbana - Champaign), grant TG - CTS060013N for 30,000 SU (Service Units) 6/7/2007-6/30/2008. Title: The influence of viscoelasticity on drop deformation in shear flow: transient deformation, orientation and break-up.

NEW:

National Center for Supercomputing Applications, University of Illinois-Urbana Champaign, SGI Altix grant CTS060022 for 30,000 service units, 7/23/2008-7/22/2009. Title: Numerical investigation of drop deformation in shear flow of immiscible viscoelastic liquids. P.I.: Y. Renardy.

Title: Two-fluid dynamics in polymer processing, Ferro hydrodynamics and electro wetting. TeraGrid Large Resource Allocations grant MCA08X019. 500,000 service units at Purdue University Steele cluster, 100,000 service units TeraGrid Wide Roaming Access. 10/1/2008-9/30/2009. Principal Investigators: Yuriko Renardy and Shahriar Afkhami.

### **MARK SHIMOZONO**

CONTINUING:

NSF Focused Research Group grants  
DMS-0652641, DMS-0652652, DMS-0652668, DMS-0652648, total of \$999,363. I am one of three co-PIs who co manage the umbrella grant (0652641) of \$671,270 and I am 100% responsible for the VT-only portion (0652648) of \$129,565.

### **SHU-MING SUN**

CONTINUING:

Number: DMS-0807597. Title: "Stability of Solitary Waves on Water of Finite Depth". \$118,515. Duration: September 15, 2008 - August 31, 2011. Principal Investigator: S. M. Sun.

### **JAMES C. TURNER JR.**

NEW:

Grant Title: Evaluation of Digital Compensation Mechanism for Hypersteropsis Virginia Tech Research Foundation Sponsor: ITT Industries – Night Vision Division, Roanoke, Virginia Based on the determination of deliverables by the sponsor, this project was ITAR-restricted. As a result, there was a publication restriction placed on this research project. Principle Investigator: Carole C. Inge Virginia Tech Manager: James C. Turner Jr. Funding Level: \$300,000 Period of Funding: Summer & Fall 2008

### **PETER WAPPEROM**

CONTINUING:

Simulation of injection molding of thermoplastics reinforced with micro and nanoparticles, 2005-2008,

NSF/DOE, \$360,000, PI D.G. Baird (50%), co-PI P. Wapperom (50%).

**LIZETTE ZIETSMAN**

CONTINUNG:

Burns, J. A., Cliff, E., and Zietsman, L. Computational Methods for Identification, Optimization and Control of PDE Systems, Air Force Office of Scientific Research, 2007-Present, \$448,083.

Burns, J. A., Faulkner, S., Laubenbacher R., and Zietsman, L., Research Experiences for Undergraduates: Modeling and Simulation of Biological Networks, NSF, 2007-Present, \$269,193.

## DISTINGUISHED PROFESSIONAL SERVICE

### **SLIMANE ADJERID**

Editor of Journal of Mathematical Problems in Engineering.

### **JOSEPH BALL**

Associate Editor for J. Mathematical Analysis and Applications:  
handled 29 papers in 2008.

Associate Editor for Integral Equations and Operator Theory: handled  
5 papers in 2008.

Associated Editor for Complex Analysis and Operator Theory: handled  
2 papers in 2008

### **JEFFREY BORGGAAARD**

Associate editor of Optimization and Engineering, Springer.

### **EZRA BROWN**

Governor of the MAA MD-DC-VA Section.

Associate Editor for the American Mathematical Monthly (Problems and  
Solutions Department – refereed and compiled solutions for seven problems).

Editorial Board, INTEGERS: The Electronic Journal of Combinatorial Number  
Theory.

Editorial Board, Math Horizons

### **JOHN BURNS**

Associate editor, Mathematical Problems in Engineering.

Associate editor, Journal of Dynamical and Control Systems.

Member of National Academy of Sciences panel to review NSF VIGRE program.

## **ERIC DE STURLER**

Associate Editor SIAM Journal on Numerical Analysis.

Editorial Board Applied Numerical Mathematics.

Editorial Board International Journal on Computational Science and Engineering,

Editorial Board Open Applied Mathematics Journal.

## **DAVID GAO**

Co-Editor-in-Chief for book series on Modern Mechanics and Mathematics,  
published by Taylor & Francis

Co-Editor-in-Chief for book series of Advances in Mechanics and  
Mathematics, published by Springer.

Associate Editor for Journal of Global Optimization. Springer.

Editor for Discrete and Continuous Dynamical Systems, Series B. An  
International Journal Bridging Mathematics and Sciences. AIMS Press

Associate Editor for Journal of Industrial and Management Optimization.

Associate Editor for Optimization Letters, Springer.

Associate Editor of Electronic Journal of Mathematics and Technology.

## **BILL GREENBERG**

Editor Board: Journal of Transport Theory and Statistical Physics.

Editor Board: International Journal of Evolution Equations.

## **TERRY HERDMAN**

Associate Editor - Journal of Integral Equations and Applications.

## **REINHARD LAUBENBACHER**

Member, Editorial Board, Journal of Algebra

Member, Editorial Board, Bulletin of Mathematical Biology.

Member, Editorial Board, Journal of Symbolic Computation

Member, Editorial Board, Applied Mathematical Sciences book series, Springer Publishing

Member, Editorial Board, Mathematical Modeling: Theory and Applications book series, Springer Publishing

Vice-president for Science Policy, SIAM.

### **TAO LIN**

Served as a regional editor for the International Journal of Information & System Sciences.

### **GWENDOLYN LLOYD**

Guest Editor, 4 manuscripts in 2008, Journal for Research in Mathematics Education (2007-present)

Member, JRME Editorial Panel (2005-2008), Chair (2007-2008).

Co-Editor, Mathematics teachers at work: Connecting curriculum materials and classroom instruction (research volume with J. Remillard and B. Herbel-Eisenmann)

### **MICHAEL RENARDY**

Editor, Zeitschrift fuer angewandte Mathematik und Physik.

Co-Editor, Mathematical Methods in the Applied Sciences.

Co-Editor, SIAM Problems and Solutions (electronic publication).

Co-Editor, International Journal of Pure and Applied Mathematics.

Co-Editor, Zeitschrift fuer angewandte Mathematik und Mechanik.

Co-Editor, Qualitative Theory of Differential Equations and Applications

I joined the editorial board of International Journal of Mathematics and Computation.

## **YURIKO RENARDY**

I am a member of the editorial board for the Journal of Non-Newtonian Fluid Mechanics, published by Elsevier.

I am associate editor for the IMA Journal of Applied Mathematics.

I am on the Advisory Board for Acta Mechanica.

## **ROBERT ROGERS**

Editorial Board Member – ZAMP

## **DAVID RUSSELL**

Associate Editor; Journal of Mathematical Analysis and Applications (processed about 40 papers during 2008).

Associate Editor; Discrete and Continuous Dynamical Systems, Series B (processed just a few papers during 2008).

Honorary Editor: International Journal for Information Systems and Sciences.

## **EKKEHARD SACHS**

Member of the Editorial Board for Computational Optimization and Application.

Member of the Editorial Board for Optimization, Methods and Software.

Member of the Editorial Board for the Journal of Industrial and Management Optimization.

Member of the Editorial Board of SIAM book series on Advances in Design and Control.

## HONORS, AWARDS

### **DIANE AGUD**

Promoted to Senior Instructor- 2008.

### **SUSAN ANDERSON**

Promoted to Senior Instructor -2008.

### **TERRI BOURDON**

Promoted to Senior Instructor – 2008

Received Outstanding Instructor Award, Department of Mathematics -2008

### **JOHN BURNS**

Named Visiting Research Fellow at United Technology Research Center for 2007-2008.

### **GEORGE HAGEDORN**

Nominated for the Dannie Heinemann Prize for Mathematical Physics (administered jointly by the American Physical Society and the American Institute of Physics).

### **SUSAN HAGEN**

Promoted to Senior Instructor - 2008

### **TERRY HERDMAN**

Member of the NASA LaRC Large Space Systems Team and was awarded a Langley Center Team Award, May 2008, for contributions in the development and testing of inflation deployed, rigidizable space structure and materials.

### **ABIGAIL KOHLER**

Nominated as a Favorite Faculty, March 2008.

## **NICHOLAS LOEHR**

Virginia Tech Math Club Professor of the Year, 2008.  
Certificate of Appreciation, Alpha Chi Omega sorority, April 2008.

## **MARGARET MCQUAIN**

Promotion to Advanced Instructor in Spring, 2008.  
Nominated and honored at Favorite Faculty Reception, April 2008.

## **DAVID RUSSELL**

Honored at the International Conference on Mathematical Control Theory  
on the occasion of celebrating of his 70th birthday.

## **EILEEN SHUGART**

Promoted to Senior Instructor – 2008

## **SHU-MING SUN**

Awarded as Senior Research Fellow and Visiting Professor by the Korea University,  
South Korea, from Oct. 24, 2008 – Dec. 10, 2008.

## **LIZETTE ZIETSMAN**

Selected as (one of two) Professors of the Year by the Math Major undergraduate  
students.

## **Bradley Shapiro**

Graduate student Bradley Shapiro won a NSF Graduate Research Fellowship.

## **MCM contestants**

The team of undergraduates Patrick Lafond and Toby Shearman and the team of  
undergraduates Pat O'Neil, Will Frey, and Evan Menchini were awarded Meritorious  
rankings in COMAP's Mathematical Contest in Modeling. These rankings put the teams  
in the top 18% of the 1676 teams that competed in this international contest.

## **Phi Beta Kappa**

Nine math majors were invited to join Phi Beta Kappa.

## **UNDERGRADUATE DEGREES AWARDED 2008**

Andrews, Nicholas O. – Dual – Spring 2008  
Beheiter, Robert – Dual – Summer II 2008  
Bonnell, Elizabeth A. – Dual – Spring 2008  
Bumgarner, John O. – Spring 2008  
Chen, Sisi – December 2008  
Coimbra, Timothy M. – Dual – Spring 2008  
Cox, Jason – Spring 2008  
DeForge, Jason – Dual – December 2008  
Donner, Michael – December 2008  
Duffy, James M. – Spring 2008  
Fick, Katherine E. – Spring 2008  
Follweiler, Zachary S. – Spring 2008  
Forys, John F. – Spring 2008  
Fox, Collin M. – Spring 2008  
Gerstmyer, Erika – Summer I 2008  
Gill, Devin – Dual – December 2008  
Gipprich, Kelly E. – Spring 2008  
Givens, Kelly E. – Spring 2008  
Givler, Amy – December 2008  
Haleem, Md Mehtab – December 2008  
Hameed, Rabeea – Spring 2008  
Henslee, William L. – Spring 2008  
Huret, Nicole D. – Spring 2008  
Hutton, Richard S. – Spring 2008  
Johnson, Wilson S. – Dual - Spring 2008  
Joyce, Hannah Jo – December 2008  
Kaczanoski, Jonathan E. – Spring 2008  
Kaiser, Lisa M. – Spring 2008  
Kane, Jennifer – December 2008  
Kesner, Jonathan L. – Spring 2008  
Kidd, Paul – Summer I 2008  
Klawitter, Justin A. – Spring 2008  
Kline, Jessica M. – Spring 2008  
Laski, Andrew J. – Dual – Spring 2008  
Lennartz, Erin A. – Dual – Spring 2008  
Lurie, Michael B. – Dual – Spring 2008  
Lust, Jennifer – Summer II 2008  
Martin, Tara J. – Dual – Spring 2008  
McCarthy, Johann K. – Dual – Spring 2008  
McMorrow, Julian – December 2008  
Mikailoff, Stefan – Dual - Summer I 2008  
Miller, Kyle F. – Spring 2008

Minor, Kyle S. – Dual – Spring 2008  
Mitchell, Stephen – December 2008  
Morrissey, Jason M. – Spring 2008  
Motta, Christopher B. – Spring 2008  
Mudd, Jason – Dual – December 2008  
Overstreet, Angela – Spring 2008  
Page, Dana M. – Spring 2008  
Paparatto, Steven – December 2008  
Roberts, Erik W. – Spring 2008  
Robertson, Michael W. – Dual – Spring 2008  
Rudolph, Bryan P. – Spring 2008  
Rudolph, Shawn C. – Spring 2008  
Sanchez, Jorge – Summer II 2008  
Shadrach, Richard H. – Spring 2008  
Shelor, Joshua A. – Spring 2008  
Simmons, Jacob R. – Dual – Spring 2008  
Simpson, Adam L. – Spring 2008  
Siviy, Sharon M. – Spring 2008  
Slye, Giselle M. – Spring 2008  
Strickhouser, Amanda E. – Spring 2008  
Sylvester, Susanna L. – Spring 2008  
Traube, Philip J. – Spring 2008  
Waddell, Miranda – Dual – December 2008  
Waldt, Ryan – Summer II 2008  
Walker, Stephanie – Summer I 2008  
Whitley, Jessica L. – Spring 2008  
Wright, Phillip D. – Spring 2008

**X. Undergraduate Semester Course Offerings  
Fall '08 and Spring '09**

<u>Course Number</u>	<u>Title</u>	<u>Number of Sections</u>
1015	Elementary Calculus with Trig. I	13
1015*	Elementary Calculus with Trig. I	3
1015**	Elementary Calculus with Trig. I	2
1016	Elementary Calculus with Trig. I	16
1016*	Elementary Calculus with Trig. I	3
1016**	Elementary Calculus with Trig. I	2
1114	Elementary Linear Algebra	20
1114H	Elementary Linear Algebra	3
1114**	Elementary Linear Algebra	2
1205	Calculus	34
1206	Calculus	27
1224	Vector Geometry	51
1224H	Vector Geometry	2
1525	Elementary Calculus with Matrices	9
1526	Elementary Calculus with Matrices	10
1535	Geometry & Math of Design	4
1536	Geometry & Math of Design	4
1614	Number and Computing for Teachers	1
1624	Geometry and Computing for Teachers	1
2015	Elementary Calculus with Trig. II	20
2016	Elementary Calculus with Trig. II	3
2214	Intro Differential Equations	26
2214H	Intro Differential Equations	2
2224	Multivariable Calculus	36
2224H	Multivariable Calculus	1
2534	Introduction to Discrete Mathematics	2
2644	Mathematical Tutoring	1
2984	SS:ES Math Applications	1
3034	Introduction to Proofs	6
3124	Modern Algebra	4
3134	Applied Combinatorics & Graph Theory	6
3144	Linear Algebra I	4
3214	Vector Calculus	8
3224	Advanced Calculus	5
4044	History of Mathematics	1
4124	Introduction to Abstract Algebra	2
4134	Number Theory	1

4164	Advanced Discrete Mathematics	1
4175	Cryptography	1
4176	Cryptography	1
4225	Elementary Real Analysis	2
4226	Elementary Real Analysis	1
4234	Elementary Complex Analysis	1
4254	Chaos and Dynamical Systems	1
4334	College Geometry	2
4404***	Applied Numerical Methods	1
4414	Issues in Scientific Computing	1
4425	Fourier Series PDE	1
4426	Fourier Series PDE	1
4445	Introduction to Numerical Analysis	2
4446	Introduction to Numerical Analysis	2
4564	Operational Methods for Engineers	6
4574	Vector and Complex Analysis for Engrs.	4
4625	TS: Math for Secondary Teachers	1
4626	TS: Math for Secondary Teachers	1
4644	TS: Secondary Math w/Tech	1
4654	Capstone Thesis and Seminar	1
4664	TS: Senior Math Education Seminar	1
4984**	SS: Teach Math Early Field Exp	1

\*VTASP Sections

\*\*On-Line Course

\*\*\* Taught by AOE

**XI.****Graduate Course Offerings  
Fall 2008 and Spring 2009**

<u>Course Number</u>	<u>Title</u>	<u>Number of Sections</u>
5125	Abstract Algebra	1
5126	Abstract Algebra	1
5135	TS: Algebraic Number Theory	1
5214	TS: Stochastic Processes	1
5225	Real Analysis	1
5226	Real Analysis	1
5235	Complex Analysis	1
5236	Complex Analysis	1
5245	Differential Equations	1
5246	Differential Equations	1
5344	Topology & Geometry	1
5344	TS: General Topology	1
5425	Ap Par Diff Equations	1
5426	Ap Par Diff Equations	1
5454	Graph Theory	1
5464	Combinatorics	1
5465	Numerical Analysis	1
5466	Numerical Analysis	1
5474	Finite Difference Mathematics	1
5484	Finite Element Methods	1
5485	Numerical Analysis & Software	1
5515	Model & Simulation of Bio Systems	1
5524	Matrix Theory	1
5545	Calculus of Variations	1
5546	Calculus of Variations	1
6125	TS: Intro Alg Geom	1
6126	TS: Intro Alg Geom II	1
6225	TS: Spectral & Perturbin Theory	1
6226	TS: Stochastic Processes II	1
6255	Functional Analysis	1
6256	Functional Analysis	1
6324	TS: Algebraic Topology II	1
6425	TS: Partial Differential Equations	1
6426	TS: Partial Differential Equations II	1
6426	TS: Approx Dynamical Systems	1

### Enrollment Summary, Fall 2008 - Spring 2009

	Number of Sections	Enrollment	Average Section Size
*Courses below level of calculus	48	4,548	94.75
**First year calculus courses	116	6,121	52.77
Other undergraduate courses	200	9,111	45.56
Graduate courses	35	358	10.23
Total	399	20,138	50.47

Number of Undergraduate Majors: 325

Number of Graduate Students: 72

\* courses included: 1015, 1114, 1525

\*\* courses included: 1016, 1205, 1224, 1526

## **GRADUATE DEGREES AWARDED**

### **MASTER OF SCIENCE**

Robert Ackermann\*  
Rachel Arnold\*  
Dimitris Katsoridas\*  
Ke Le\*  
Mary Wilkerson\*  
Haofeng Yu\*

Edward Diggs

Austin Amaya  
Branimir Anic  
Matt Durham  
Soyoun Kim  
Christina Koelling

Courtney Baber  
David Collins  
Dhun Doongaji  
Kasie Farlow  
Garret Flagg  
Richard Hutton  
Jessica Kline  
Carrie McNeil  
Lacey Ore  
Bradley Shapiro  
John Wallace  
Sarah Wyatt

The intent is to list graduate degrees from June, 2008, through May, 2009. Those listed with an \* received degrees in May, 2008, but were not included in last year's report due to delays in the university's data entry.

### **DOCTOR OF PHILOSOPHY**

Shengfu Deng  
Quanlei Fang  
Mark Herman

Xiaoming He  
Miroslav Stoyanov  
Thomas Weinhart



