Annual Report
Mathematics Department
2011-2012
Learning: “The Life of the Mind”

- Faculty and departmental teaching awards (incl. college, university and national awards):

- Undergraduate student achievements and awards (e.g., Goldwater Scholars, Man/Woman of the Year):

- Graduate student achievements and awards (incl. college, university and national awards):

  Zhu Wang was a finalist in the third BGCE Student Prize competition at the SIAM Computational Science and Engineering meeting in 2011.

- Grants in undergraduate teaching and learning (e.g., PhysTec):

- Grants in graduate education (e.g., IGERTS):

- One to two notable events or programs related to undergraduate education (e.g., first year of a signature course or FYE):

  The Math Department introduced Mathematics in a Computational Context, a year-long ten-credit course integrating multivariable calculus, differential equations, and linear algebra with attention to the ways in which computing informs and extends the applicability of these subjects.
One to two notable events or programs related to graduate recruitment and/or education:

Examples of research experiences and experiential learning opportunities for undergraduates:

The Mathematics Department awards an annual Layman Prize for the best undergraduate research project, as presented in written and spoken format.

Examples of international experiences for undergraduate students:

Examples of international experiences for graduate students:

Each year the Math Department hosts two or three graduate students in year-long visits from the Karlsruhe (Germany) Institute of Technology.

Any additional examples that address goals in Virginia Tech’s “Plan for a New Horizon”:

- Ways in which computational science and skills for managing and analyzing complex data sets are integrated across a wide range of disciplines


- Use of technology in classrooms and examples of distance-learning opportunities

The Math Emporium makes extensive use of technology in support of student learning. The Math Department is adding short video clips of lectures to the Math Emporium online materials. These video clips will enhance the experiences of students on campus while the suitability of the course materials for distance learning. Emporium courses are offered in distance-learning format during the academic year when there is demand, and they are serving a rapidly increasing population of distance learners during the summers.
Jeff Borggaard continues to develop the distance-learning components of the graduate math course Principles and Techniques of Applied Mathematics, and engineering graduate students doing off-campus research take the distance-learning version of this course.

- Incentives for teaching and learning through distance education
- Creation of flexible classroom spaces that fully support e-learning components

The Math Emporium offers 60 hours per week of short-response help, 25 hours per week of long-response help, and one weekly problem discussion section in each of five courses, all in a setting in which e-learning is fully supported via the presence of 537 computers and VT-written online textbooks and online problems, for which student answers get immediate online responses that include links back to relevant lessons.

- Quality and availability of academic advising from orientation through graduation

Every student has a faculty advisor with whom (s)he is invited to meet at least twice annually.

- Examples of STEM-related activities fostering entrepreneurship, science and technology policy, and ethics

**Research and Innovation**

- Faculty awards/honors (e.g. Humboldt Fellowships; NSF CAREER awards, etc):

- Notable new research awards in 2011-12 (incl. PIs, Amount, Title and Funding Agency)


- **Number of manuscripts, number of books and book chapters (CY 2011); list high impact papers:**
  - 80 journal articles.
  - 14 refereed conference proceedings papers.
  - 2 book editorships.
  - 1 book.
  - 7 book chapters.

  We do not do citation analyses on an annual basis.

- **Number of presentations (CY 2011); notable invited lectures:**
  - 130 presentations.

  Ezra Brown, The many names of (7,3,1) and the unity of discrete mathematics, Carriage House Distinguished Lecture Series, MAA Headquarters, Washington DC.

  Eric de Sturler, Forward Looking Panel, Householder Symposium XVIII (plenary with two co-panelists), Granlibakken Conference Center, Tahoe City, California.

Math faculty members Reinhard Laubenbacher and Henning Mortveit have primary appointments at VBI.

Ph.D. student Adam Bowman was an ICTAS fellow.

Ph.D. student Erich Foster was supported by ICTAS for one semester.

ICTAS played a role in coordinating the VT proposal that led to the DOE Energy Hub grant on which John Burns and other ICAM mathematicians are co-PI’s.

- **Number of post-doctoral positions in STEM-H research areas:**

One endowed postdoctoral position (Patricia Ann Caldwell Post-Doctoral Fellowship).

Three postdocs supported on research grants.

- **Examples of links with NCR for research into issues of security and resiliency:**

- **Examples of partnerships with external collaborators which have enabled VT to compete more effectively for external funding:**

The DOE Energy Hub grant (J. Burns and other ICAM members, co-PI’s) was awarded to a consortium of 24 partners, including Penn State, United Technologies, Lawrence Livermore National Laboratory, and IBM.

**Engagement: “The Virginia Tech Experience”**
Faculty service (Editorships, NSF/NIH program managers or panel members, leadership positions in professional societies):

14 members of the faculty served in 39 editorial positions.

Ezra Brown:
- Member, MAA Committee to Select the Recipients of the Merten Hasse Prize for Expository Excellence, 2009 to present (committee chair since December 2011)
- Member, MAA Committee to Select the Recipients of the Henry L. Alder Award for Distinguished Teaching, 2010 to present.
- Member, MAA Committee on Invited Paper Sessions, 2010 to present.
- Chair, MAA Search Committee for the Editor of Math Horizons, December 2011 to present.

John Burns:
- Member of Member of SIAM Committee on Science Policy, 2010 – Present
- Member of SIAM Committee on Why Do Math Project 2007 – Present.

Terry Herdman:
- Member Education Committee, Society for Industrial and Applied Mathematics.
- Co-chair Visiting Lecturer Program, Society for Industrial and Applied Mathematics.
- Member SIAM Careers and Professional Development Committee.
- Council Member, Coalition for Academic Scientific Computation.
- Board Member, SURA.
- Board Member, Mu Alpha Theta.
- Council Member, Oak Ridge Associated Universities.
- Board Member and Vice Chair, Oak Ridge Associated Universities.

Reinhard Laubenbacher:
- Vice President for Science Policy, Society for Industrial and Applied Mathematics, 2009- 2013
- Chair, Committee on Science Policy, Society for Industrial and Applied Mathematics, 2009-2013
Member, Scientific Advisory Committee, Mathematical Biosciences Institute,
Ohio State University, 2011-2013

Yuriko Renardy:

I was a member of the Selection Committee for the American Physical Society
Division of Fluid Dynamics Fellows.

Reporting of panel memberships inconsistent due to expectation of some agencies that
such service remain confidential.

➢ Examples of economic development (e.g., industrial partnerships, patents):

➢ Study Abroad programs:

➢ PK-12 STEM programs:

Andy Norton:

Principal Investigator for a $890,307 Robert Noyce Scholarship grant from NSF,

Co-Principal Investigator for a $900,388 DRK-12 grant from NSF, “Untangling

Co-Principal Investigator for a $1,499,884 DRK-12 grant from NSF, Iterative
Model Building, studying restructuring of early field experiences for elementary
Co-Principal Investigator for a $1,940,000 NSF DRK-12 grant, “Gateways to Algebraic Motivation, Engagement and Success (GAMES): Supporting and Assessing Fraction Proficiency with Game-Based, Mobile Applications and Devices.” Awarded 2011-2014.

- **Examples of Community and Student Engagement:**

- **International collaborations and programs (include description along with region and country):**

- **Any additional examples that address goals in Virginia Tech’s “Plan for a New Horizon”:**
  
  - Partnerships with businesses and government that “address critical and complex problems by co-locating researchers and practitioners in ‘living labs’ where users, in partnership with researchers, drive problem formulation and research design”
  
  - Examples leveraging the strengths of our business programs to provide a competitive advantage
  
  - Examples of strategic global investment, development of research programs on energy and critical technologies, informatics, infrastructure, policy and planning at VT’s international centers

**Diversity**

- **One to two notable activities by students, faculty and/or staff activities promoting diversity:**

Susan Anderson is faculty advisor to Womanspace.

- **Diversity awards and honors (e.g., MAOP scholarships; McNair Scholars):**
The Math Department and several members of the faculty won Excellence in Access and Inclusion awards from Services for Students with Disabilities.
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
Hagedorn, George
Haskell, Peter
Herdman, Terry
Kim, Jong
Klaus, Martin
Kohler, Werner
Laubenbacher, Reinhard
Lin, Tao
Linnell, Peter
Prather, Carl
Quinn, Frank
Rogers, Robert
Rossi, John
Russell, David
Shimozono, Mark
Sun, Shu Ming
Turner, James C

Associate Professors
De Sturler, Eric
Gugercin, Serkan
Illiescu, Traian
Loehr, Nicholas
Mortveit, Henning
Norton, Anderson
Wapperom, Peter
Zietsman, Lizette

**Assistant Professors**
Chaturantabut, Saifon
Ciup, Stanca
Elgart, Alexander
Mihalcea, Leonardo
Wawro, Megan
Yue, Pengtao

**Instructors**
Agud, Diane
Anderson, Susan
Bourdon, Terri
Chung, Myungsuk
Clemons, Joshua
Cothren, Marlene
Gardner, Nicholas
Guerra-Huaman, Moises
Hagen, Susan
Hanks, Lucy
Hart, Heath
Hester, Hubert
Kline, Jessica
Kohler, Abigail
McQuain, Margaret
Peters, Tom
Robinson, Kelly
Savel’ev, Evgeny
Schmale, Jessica
Shugart, Eileen
Smith, Deborah
Stephens, Catherine
Wilson, Jason
Zwiesler, Albert

**GRANTS**

**SLIMANE ADJERID**

CONTINUING:


**JOSEPH BALL**

NEW

BSF "Noncommutative Function Theory and its Applications" (with Dmitry Kaliuzhnyi-Verbovetskyi (Drexel University) and Victor Vinnikov (Ben Gurion University), starting date: 10/2011; 4-year duration at $22,000 per year: funds for travel by the PIs between the US and Israel.

**CHRISTOPHER BEATTIE**

CONTINUING:

“Interpolatory Model Reduction for Coastal Ocean Hydrodynamics” Naval Research Laboratory, February, 2010 – December, 2010 ($132,424)

**JEFF BORGGAARD**

CONTINUING:

Improved Parameterization of Groundwater Flow Models using Interferograms and Adjoint Sensitivity Analysis, Senior personnel (T. Burbey PI), National Science Foundation, 2010-2012, $260,000.


Iliescu, M. Marathe and L. Zietsman), Department of Energy (through Penn State University GPIC), 2010-2015, $5,000,000. 
1A follow up work was also submitted to the AIAA Flow Control Conference along with Imran Akhtar

JOHN BURNS

CONTINUING:


2010-Present “Computational Methods for Identification, Optimization and Control of PDE Systems”, Principal Investigator (with E. M. Cliff and Lizette Zietsman), AFOSR ($600,000).


ERIC DE STURLER

CONTINUING:

Materials Computation Center, NSF, $3,960,000, 10/01/2003 – 9/30/2012, member of MCC Advisory Committee/CoPI, (received at UIUC), extended again (and again) to 9/30/2012


MRI-R2: Acquisition of a Heterogeneous Supercomputing Instrument for Transformative Interdisciplinary Research, NSF $1,992,527, 7/01/10 – 6/30/13, senior personnel.

ALEXANDER ELGART
CONTINUING:

Rigorous Studies in Quantum Mechanics, National Science Foundation Proposal DMS– 0907165, $337,000 (co-PI with George Hagedorn

SERKAN GUGERCIN

CONTINUING:

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


GEORGE HAGEDORN

CONTINUING: Principal Investigator, Rigorous Studies in Quantum Mechanics. (co–Principal Investigator, Alexander Elgart) National Science Foundation Grant DMS–0907165. $337,000

TERRI HERDMAN

CONTINUING:

2005-2011, Research Collaboration and Program Development, Principle Investigator, ORNL/UT Battelle LLC.

2010-2011, Test and Analysis of Border Interdiction Technology, Principle Investigator (with J. Wingo), Department of Homeland Security

2010-2012, Principle Investigator, DHS IPA J. Wingo, Department of Homeland Security

**TRAIAN ILIESCU**

CONTINUING:
CMG Collaborative Research: Ocean Modeling by Bridging Primitive and Boussinesq Equations (with J. Duan, P. Fischer and T. Ozgokmen), National Science Foundation, Grant DMS-1025314, 2010-2013, $208,348.

Computational Algorithms for Model Reduction of Complex Flows (with J. Borggaard), National Science Foundation, DMS-1016450, 2010-2013, $110,000.


**REINHARD LAUBENBACHER**

CONTINUING:
U.S. Army Research Office
Laubenbacher (PI)
8/2009-7/2013 Computational Biomathematics: Toward Optimal Control of Complex Biological Systems
CMMI-0908201-NSF Laubenbacher (PI) 10/2009-9/2012
Polynomial dynamical systems over finite fields: from structure to dynamics.

GRANTS –NEW

NCI-NIH
Laubenbacher (PI) 8/1/2011-7/30/2013
A Systems Approach to Iron Metabolism in Cancer Cells

DMS-1062878-NSF Laubenbacher (PI)

TAO LIN

CONTINUING:

PETER LINELL

CONTINUING
NSA 091019-Linnell standard grant May 2011-June 2012 (2 years, second year conditional on satisfactory first year), $54853

HENNING MORTVEIT
CONTINUING:


NEW:

Project Title: Rigorous Approaches for Validation and Verification of Networked Systems. PI: Madhav Marathe Co-PIs: Christopher Barrett, Stephen Eubank, Henning Mortveit Source of Support: DTRA Total Amount Awarded: $1,190,969 (VBI Portion: $1,190,969) Total Award Period Covered: 06/01/11-05/31/14 Effort: 0.60 months per calendar year. (Co-PI)

Project Title: Synthetic Information Systems for Better Informing Public Health Policymakers. PIs: Stephen Eubank, Madhav Marathe. Source of Support: NIH Total Amount Awarded: $3,933,969 (VBI Portion: $3,315,332) Total Award Period Covered: 05/01/11-04/30/16. Effort: 1.20 calendar months per year. (Senior personnel)

ANDERSON NORTON

CONTINUING:
Co-Principal Investigator for a $5,000 Engaged Department grant, proving preservice teachers with experiences engaging with ELL students. Awarded, 2010-2011.


Co-Principal Investigator for a $1,499,884 DRK-12 grant from NSF, Iterative Model Building, studying restructuring of early field experiences for elementary preservice teachers (PI Enrique Galindo, IUB). Awarded 2007-2012.

NEW:

Co-Principal Investigator for a $1,940,000 NSF DRK-12 grant, “Gateways to Algebraic Motivation, Engagement and Success (GAMES): Supporting and Assessing Fraction Proficiency with Game-Based, Mobile Applications and Devices.” Awarded 2011-2014.

MICHAEL RENARDY

CONTINUING:

NSF DMS-1008426

YURIKO RENARDY

CONTINUING:


National Science Foundation Division of Mathematical Sciences 0907788.

Participant in VT-PREP/IMSD (P. I. Ed Smith, College of Agriculture and Life Sciences), for the GBCB students (http://www.apsc.vt.edu/academics/vtimsd/mentors-research/genetics.html)

MARK SHIMOZONO

CONTINUING:


SHU-MING SUN

CONTINUING:


PETER WAPPEROM

CONTINUING:

PENGTAO YUE

NEW:

National Science Foundation Division of Mathematical Sciences 0907788. Title: Computational study of drop deformation in systems with two immiscible liquids. Principal Investigator: Yuriko Renardy. Co-Principal Investigator: Pengtao Yue. 6/1/2009-5/31/2012. $247,880.

LIZETTE ZIETSMAN

CONTINUING:


DISTINGUISHED PROFESSIONAL SERVICE
JOSEPH BALL

Associate editor for:
Integral Equations and Operator Theory


Complex Analysis and Operator Theory (handler of 1 submission in 2011)

Banach Journal of Mathematical Analysis (handler of 1 submission in 2011)

Multidimensional Systems and Signal Processing (appointed to 3 year term beginning in October 2011).

JEFF BORGGAARD

Associate editor of Optimization and Engineering, Springer.
Associate editor of ISRN Applied Mathematics, Hindawi Publishing.

ERZA BROWN

Associate Editor for the American Mathematical Monthly (Problems and Solutions Department).


JOHN BURNS

Associate Editor – Mathematical Problems in Engineering, 2008 – Present.

Associate Editor - Journal of Dynamical and Control Systems, 1994-Present.
ERIC DE STURLER

Editorial Board Applied Numerical Mathematics

Editorial Board International Journal on Computational Science and Engineering

Editorial Board Open Applied Mathematics Journal

SERKAN GUGERCIN

Associate Editor for Systems and Control Letters

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 Verlag
Member, Editorial Board, Mathematical Modeling: Theory and Applications book series, Springer Verlag
Editor, Special issue, Bull. Math. Biol. 73, 2011, Algebraic Methods in Mathematical Biology

PETER LINNELL

Editor of London Math Society

ANDERSON NORTON

Editorial Panelist, Journal for Research in Mathematics Education (the top ranked international journal in mathematics education).
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, Zeitschrift fuer angewandte Mathematik und Mechanik.
Co-Editor, Qualitative Theory of Differential Equations and Applications
Co-Editor, International Journal of Mathematics and Computation
I joined the editorial board of Evolution Equations and Control Theory.

YURIKO RENARDY


Advisory board of Acta Mechanica.

DAVID RUSSELL

Associate Editor, Journal of Mathematical Analysis and Applications
(handled about 50 papers during 2011)

Associate Editor, Discrete and Continuous Dynamical Systems (very little work).

SHU-MING SUN

Associate Editor for the Journal of Applied Mathematics and Physics (ZAMP) in 2011 (handled two papers).
HONORS, AWARDS

SUSAN ANDERSON

I received an Excellence in Access and Inclusion Award on April 25.

SUSAN HAGEN

Instructor of the Year (2010 – 11)

PETER HASKELL

Excellence in Access and Inclusion Award.
Sally Bohland Award for Exceptional Leadership in Access and Inclusion.

TRAIAN ILIESCU

Invited to join the editorial board of “ISRN Applied Mathematics.”

Zhu Wang, my student, was a finalist in the third BGCE Student Prize competition at the SIAM Computational Science and Engineering meeting in 2011, a prestigious international competition, as well as a winner of the SIAM SEAS Student Paper Prize in 2010.

JESSICA KLINE

Favorite Faculty Award, S11

SSD Excellence in Access and Inclusion Award, S11

MARLENE COTHERN

25 years of teaching service at VT.
ANDERSON NORTON

Virginia Tech “Favorite Faculty Award

BS DEGREES AWARDED 2011

Addesa, Jacqueline R. – Dual – Spring 2011
   Alison, Christopher – Fall 2011
   Allen, Dawson – Spring 2011
   Anderson, Travis S. – Summer I
Andrews, Jeremy J. – Dual – Summer I
   Baldwin, Kelly S. – Spring 2011
   Baldwin, Matthew Z. – Spring 2011
   Ballagh, Jordan E. – Spring 2011
   Bien, Carolyn A. – Spring 2011
   Bloemeke, Steven – Spring 2011
   Borba, Daniel F. – Summer I
   Boswell, Regan – Spring 2011
   Boyd, Patrick S. – Dual – Spring 2011
   Carome, Rebecca M. – Spring 2011
   Casola, Joseph – Spring 2011
   Cheatham, Grant – Dual – Spring 2011
   Cooper, Thomas H. – Dual – Spring 2011
   Coulter, Rachel A. – Spring 2011
   Dubbs, Joy E. – Spring 2011
   Durney, Clinton – Dual – Spring 2011
   Duvall, James M. W. – Spring 2011
   Enright, Shannon – Spring 2011
   Foglietti, Michael – Spring 2011
   Frey, John H. – Dual – Spring 2011
   Fuqua, Steven – Dual – Spring 2011
   Garcia, Jordan J. – Spring 2011
   Gough, Meaghan R. – Spring 2011
   Hafich, Micah J. – Spring 2011
   Hall, Melanie – Summer I
   Harvey, Christopher H. – Spring 2011
   Haun, India – Spring 2011
   Heatter, Douglas – Spring 2011
   Herbst, John – Spring 2011
   Hoffman, John – Dual – Spring 2011
   Holcombe, Valerie – Spring 2011
   Honig, Ryan – Dual - Fall 2011
Hope, Megan – Spring 2011
Hudson, Joshua – Spring 2011
Jackson, Devin – Spring 2011
Jaffa, Emily B. – Fall 2011
James, Adam – Spring 2011
Jenkins, Brian S. – Fall 2011
Johnson, Ashley – Spring 2011
Jojic, Anais – Spring 2011
Ko, Christina – Fall 2011
Kordula, Joanna – Fall 2011
Latham, William – Summer II 2011
Lee, Sung-tae – Dual – Summer II 2011
Long, Ross – Summer II 2011
Neely, Geoffrey – Summer II 2011
Klose, Kevin – Spring 2011
Magruder, Caleb – Dual – Spring 2011
McCormick, Philip – Spring 2011
McNish, Ciara – Spring 2011
Menchini, Evan – Spring 2011
Monahan Daniel – Spring 2011
Moorefield, Carson – Fall 2011
Noble, Nathan – Summer I
O’Neil, Patrick – Spring 2011
Pedemonte, Karin A. – Spring 2011
Pettusl, Hakeem O. – Summer II 2011
Pinkard, Jordan – Spring 2011
Puffenberger, Owen – Spring 2011
Quinlan, Brian – Dual – Spring 2011
Rajotte, Matthew – Spring 2011
Rankin, Valerie – Spring 2011
Reid, Benjamin W. – Dual – Spring 2011
Reagan, Andrew – Fall 2011
Schaefer, Michael – Dual – Spring 2011
Southard, Daniel – Spring 2011
Street, Andrew – Dual – Spring 2011
Stucki, Bryce – Spring 2011
Suarez, Emmanuel – Spring 2011
Sullivan, Joseph – Spring 2011
Sumrell, Tatiana – Spring 2011
Thorpe, Kadeem – Summer I
Tilashalski, Melissa – Spring 2011
Tiwari, Vikram – Summer II 2011
Venkat, Siddharth – Dual – Spring 2011
Wallace, Henderson – Summer I
Wells, David R. – Dual – Spring 2011
Westrom, Joshua – Summer I
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Title</th>
<th>Number of Sections</th>
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<tbody>
<tr>
<td>5114</td>
<td>Specialized Topics in Algebra</td>
<td>1</td>
</tr>
<tr>
<td>5125</td>
<td>Abstract Algebra</td>
<td>1</td>
</tr>
<tr>
<td>5126</td>
<td>Abstract Algebra</td>
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<tr>
<td>5144*</td>
<td>Inverse Theory &amp; Applications</td>
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<tr>
<td>5225</td>
<td>Real Analysis</td>
<td>1</td>
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<tr>
<td>5226</td>
<td>Real Analysis</td>
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<tr>
<td>5235</td>
<td>Complex Analysis</td>
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<tr>
<td>5236</td>
<td>Complex Analysis</td>
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<tr>
<td>5245</td>
<td>Differential Equations</td>
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<tr>
<td>5246</td>
<td>Differential Equations</td>
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<tr>
<td>5344</td>
<td>Topics in Topology &amp; Geometry</td>
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<tr>
<td>5415</td>
<td>TS: Viscous Flows</td>
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<tr>
<td>5415</td>
<td>TS: Discrete Dynamical Systems</td>
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<tr>
<td>5415</td>
<td>TS: Math Challenges Model/Design</td>
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<td>5415</td>
<td>TS: Stoch Differential Equations</td>
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<td>5425</td>
<td>Ap Par Diff Equations</td>
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<tr>
<td>5426</td>
<td>Ap Par Diff Equations</td>
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<tr>
<td>5435</td>
<td>Prin Tech Appl Math</td>
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<tr>
<td>5435**</td>
<td>Prin Tech Appl Math</td>
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<tr>
<td>5444</td>
<td>Numerical Methods for ODE</td>
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<tr>
<td>5454</td>
<td>Graph Theory</td>
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<tr>
<td>5465</td>
<td>Numerical Analysis</td>
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<tr>
<td>5474</td>
<td>Finite Difference Mathematics</td>
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<td>5484</td>
<td>Finite Element Methods</td>
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<td>5485</td>
<td>Numerical Analysis &amp; Software</td>
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<td>5486</td>
<td>Numerical Analysis &amp; Software</td>
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<tr>
<td>5515</td>
<td>Model &amp; Simulation of Bio Systems</td>
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<td>5516</td>
<td>Model &amp; Simulation of Bio Systems</td>
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<td>5524</td>
<td>Matrix Theory</td>
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<tr>
<td>5545</td>
<td>Calculus of Variations</td>
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<tr>
<td>5546</td>
<td>Calculus of Variations</td>
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<tr>
<td>5614**</td>
<td>TS: Num &amp; Oper for K-8 Teachers</td>
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<tr>
<td>5984</td>
<td>SS: Res Undergrad Math Education</td>
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<tr>
<td>6255</td>
<td>Functional Analysis</td>
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<tr>
<td>6256</td>
<td>Functional Analysis</td>
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</tr>
<tr>
<td>6324</td>
<td>Adv Topology/Geometry</td>
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</tr>
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</table>
GRADUATE STUDENT DEGREE STATUS

MASTER OF SCIENCE

Nabil Chaabane
Boris Kraemer
Rosana Azpiroz
Christopher Jarvis

DOCTOR OF PHILOSOPHY

Kapil Ahuja
Katrina Conrad
Brian McBee
Haofeng Yu
Austin Amaya
Rachel Arnold
Garret Flagg
Idir Mechai
Hans-Werner Van Wyk
Xiaojun Wang
Zhu Wang
Mary Wilkerson
Sarah Wyatt
Edgar Saenz Maldonado
## Enrollment Summary, Fall 2011 - Spring 2012

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Number of Sections</th>
<th>Enrollment</th>
<th>Average Section Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Courses below level of calculus</td>
<td>53</td>
<td>4,332</td>
<td>81.74</td>
</tr>
<tr>
<td>**First year calculus courses</td>
<td>131</td>
<td>6,040</td>
<td>46.11</td>
</tr>
<tr>
<td>Other undergraduate courses</td>
<td>231</td>
<td>9,495</td>
<td>41.1</td>
</tr>
<tr>
<td>Graduate courses</td>
<td>38</td>
<td>336</td>
<td>8.84</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>453</td>
<td>20,203</td>
<td>44.6</td>
</tr>
</tbody>
</table>

Number of Undergraduate Majors: 397
Number of Graduate Students: 64

* courses included: 1015, 1114, 1525
** courses included: 1016, 1205, 1224, 1526