

**DEPARTMENT OF MATHEMATICS**  
**Annual Report to the Board of Trustees of**  
**Rose-Hulman Institute of Technology**  
**1 June 08 -31 May 09**

1. Department Overview
2. Personnel Changes
3. Student and Alumni Highlights
  - a. Student Activities and Awards
  - b. Alumni Activities and Awards
4. Faculty and Staff Activities
  - a. Teaching, Curriculum Development, and Student Advising
  - b. Departmental Programs
  - c. Interdepartmental Faculty Clusters
5. Publications, Presentations, Awards, Consulting
  - a. Publications, Articles, Writing, Works in Progress
  - b. Conference Presentations
  - c. Awards
  - d. Consulting
6. Grant Proposals
  - a. Proposals
  - b. Continuing Grant Activities
7. Professional Development
  - a. Workshops and Conferences Attended
  - b. Student Project Mentoring
  - c. Other activities
8. Publications
9. Professional Services
  - a. RHIT and Mathematics Committee Membership
  - b. Other Professional Service and Outreach Activities

### **1. Department Overview**

This was a highly successful year for the department. In addition to good teaching, professional development, and service programs on the part of the faculty, here are some high points:

- a. Successful hiring of two visiting faculty members for sabbatical replacement and to account for growth in the department.
- b. First year for a required senior thesis/senior project for math majors. Sixteen students are completing the requirement.
- c. A new Minor in Computational Science was approved
- d. 45% or more of incoming freshman have advanced math placements, allowing them to get AP credit for one or more calculus classes. Fast Track Calculus is close to 10% of the freshman class. The math schedule accommodates all these students starting at different places in the curriculum, allowing students to take full advantage of their

- advanced placements.
- e. There is significant interest in mathematics courses beyond calculus, differential equations and basic statistics. Almost 30% of students are taking math courses “beyond the foundation” courses.
  - f. Very strong participation by students in the math seminar, both as speakers and as attendees.
    - Continuing success in undergraduate mathematics research through student research and presentations,
    - NSF-REU (21 years),
    - Undergraduate Math conference (25 years)
    - and Undergraduate Journal (152 papers and 247 authors during its 9 years of existence)
    - Thesis/Senior Project – new this year
  - g. Continuing scholarship and strong professional development
    - Books: 1, Translated Books: 1
    - Papers published/accepted: 23
    - Paper submitted/in preparation: 20
    - Presentations on and off campus: 46
  - h. Continuing support of mathematics outreach programs in High School Math Contest, hosting regional MATHCOUNTS, and administrative support for American Mathematics Competitions and MATHCOUNTS.

## 2. Personnel Changes

### *Joining Rose-Hulman*

*Michael Devasher* – converted from visiting position to tenure track position

*Allen Holder* – tenure track appointment from Trinity University in Texas

*Leanne Holder* – tenure track part-time appointment from St. Mary’s University in Texas

*Thomas Langley* – tenure track appointment from California Lutheran University

*Kim Montgomery* – one year visiting appointment coming from the University of Utah

### *Leaving Rose-Hulman*

*Michael Barg* – moved to Niagara University

*Andrea Dziubek*

### *Sabbaticals*

*Diane Evans* - on full year sabbatical at Diversified Systems, Inc. in Indianapolis working as a Quality Control Analyst and studying Six Sigma practices

*Ralph Grimaldi* – on full year sabbatical at New Mexico State attending classes on the mathematics of investments and cryptography, as well as writing a textbook on the Fibonacci and Catalan Numbers and on discrete mathematics related research.

### 3. Student and Alumni Highlights

#### 3.a Student Activities

##### *Student organizations*

*Pi Mu Epsilon Honorary Mathematics Fraternity*: New members of the Rose-Hulman student body were inducted at the Spring 2009 Initiation Banquet for the Indiana Gamma Chapter of Pi Mu Epsilon.

##### *Mathematics Competitions*

*20th Annual Alfred R. Schmidt Freshman Mathematics Competition* (advisor John Rickert). Fifteen freshmen took part in the Twentieth Annual ARS Competition. First place prize was awarded to Jeremy Nickol, second place was awarded to *Andrew Bomar, Ryan Davis* and *Yeujun Zhu*, and 3<sup>rd</sup> place was awarded to *Tim Ekl*.

*30th Annual Virginia Tech Regional Mathematics Competition* (advisor John Rickert). Nine Rose-Hulman students participated.

*68<sup>th</sup> Annual Putnam Competition* (advisor Kurt Bryan). 12 students participated in the 6 hour contest

*25th Mathematical Contest in Modeling* (advisor W. Steve Galinaitis). Three teams from Rose Hulman spent several days in February competing in this annual international modeling Contest. The teams of (1) *Rex Gutsue, Steve Torno and Chris Leibs*, (2) *Casimir Ksiasek, Tyler Gonnsen and Alec Wilson*, and (3) *Parker Schmitt, Michael Jones and Ching-chen Ma* were awarded Successful Participants.

*44th Indiana College Mathematics Competition* (advisor John Rickert). Six Rose Hulman students competed in the 2009 ICMC administered at the spring meeting of the INMAA held at IUPUI in Indianapolis. *Eric Crockett, Kyle Wilson and Arnold Yim* finished 19<sup>th</sup> out of 39. The median was 22.

##### *Student Presentations*

*January AMS meeting in Washington, D.C.*

- *Emma Snively* presented her results from her summer 2008 REU experience

*Spring meeting of the MAA at UPU*

- *Jason Sauppe* presented “A Tabu Search Algorithm for the Bandwidth Multicoloring Problem”

*26th Annual Conference on Undergraduate Mathematics*

- *Sarah Jabon* presented “Content-Based versus Semantic-Based Image Retrieval: A LIDC Case Study”
- *Jordan Phegley* presented “Enumerating Plane Partitions of Integers”
- *Jason Sauppe* presented “A Tabu Search Algorithm for the Bandwidth

## Multicoloring Problem”

### *Rose Math Seminar:*

- *Casimir G. Ksiazek III* presented “My Summer as an Actuarial Intern”, Sept. 2008
- *Sophia Sullivan* presented “Summer Experience: The Joint Program in Survey Methodology and Internal Revenue Service Statistics of Income Division”, Oct. 2008
- *Arnold Yim* presented “Algebraic Tori and their Applications”, Oct. 2008  
*Math Class MA444 Students* presented “Solutions to the Pure Parsimony Problem”, Jan. 2009

### ***Student Awards***

#### *Clarence P. Sousley Memorial Award*

presented to *Bryce D. Borchers and Jason J. Sauppe*. This is awarded to graduating mathematics majors that have demonstrated exceptional performance in their field, and is voted on by the Mathematics faculty.

#### *Theodore Paine Palmer Award*

presented to *Ching-Chen Ma* for excellence in mathematics during the freshman year, this award is voted on by the Mathematics faculty.

### **3.b Alumni Activities and Awards**

#### ***Awards***

*Floyd Yager* – received a Career Achievement Award at the May Honors and Awards Ceremony.

### **4. Faculty and Staff Activities**

#### **4.a Teaching, Curriculum Development, and Student Advising**

##### ***Enrollments***

Data for the last five years:

<i>Year</i>	<i>2008-09</i>	<i>2007-08</i>	<i>2006-07</i>	<i>2005-06</i>	<i>2004-05</i>
<i>Calculus/DE/Stats</i>	2323	2334	2409	2180	2398
<i>Post Calculus/DE/Stats</i>	687	824	853	917	852
<i>Total</i>	3010	3158	3262	3097	3250

##### ***Curriculum development groups***

The faculty is organized into four self-selected interest groups according to the four concentrations

of the degree program. The groups are:

Mathematics – convener Bill Butske

Discrete Applied Mathematics – convener Tanya Jajcay

Continuous Applied Mathematics – convener Yosi Shibberu

Statistics/OR – convener Mark Inlow

### ***New courses and topics courses.***

*Cara Brooks – MA490 Introduction to Scientific Computing*

new for fall 2008-09 AY. Made into a regular course MA332.

*Bill Butske – MA470 Introduction to Commutative Algebra (Topics in Algebra)*

Developed: Introduction to Commutative Algebra (run as Topics in Algebra, MA470).

This course was an introduction to the basic language of commutative algebra. The main objects of study were commutative unital rings and their finitely generated modules. Techniques covered in the class included localization, dimension theory, and the rudiments of homological algebra.

*Bill Butske MA470 Introduction to Arithmetic Geometry (Topics in Algebra).*

This course, was run as a successor to Introduction to Commutative Algebra (though it could stand alone). The main objects of study were Dedekind domains and their extensions. A major theme of this class was to develop a unifying language for the study of algebraic curves and rings of algebraic integers.

*David Finn - MA490 History of Mathematics new topics course Fall 2008-09*

*Josh Holden – MA490 Topics in Discrete Mathematics: Quantum Computing, new topics course Fall 2008-09*

*David Rader – MA491 Introduction to Mathematical Modeling*

required for students completing mathematics senior project, taught for the first time

### ***Curriculum development***

*Joshua Holden - Developed new technology for integrating the use of Maple with the use of wireless Tablet PCs and DyKnow Vision software and implemented it in Calculus III, revising course as appropriate.*

*Allen Holder – Developed Maple, Matlab and Octave scripts for MA221, MA222 (Differential Equations and Linear Algebra) MA444 Deterministic and MA373 Applied Linear Algebra for Engineers.*

*Roger Lautzenheiser - Taught MA371 Linear Algebra I as an online class in the summer of 2008*

*Jeffery Leader*

*MA434 Topics in Numerical analysis* (Finite Difference Methods) new topics for this course.

*MA333 Introduction to Parallel Computing* – first time given as a regular course.

*MA332 Introduction to Computational Science and MA342 Computational Modeling* – co-developed with Cara Brooks, approved by department and Institute.

***Senior Thesis / Senior Project***

Math majors will be required to complete a senior project or thesis starting with those graduating 2008-2009. Sixteen students complete a senior thesis / project and presented their work publicly in a poster session.

***Student Advising, Mentoring, and Support***

*Academic Advising*

Actuarial Sciences Advisor – *Michael DeVasher*

Statistics Concentration Advisor – *Mark Inlow*

Statistics Minor Advisor – *Michael DeVasher*

Fast Track Calculus, Summer 2008 – *Elton Graves and Roger Lautzenheiser*

Freshman Advising – *W. Steve Galinaitis, Elton Graves, Tanya Jajcay, Roger Lautzenheiser, John Rickert*

Math Sophomore Advising – *Yosi Shibberu*

Math Junior Advising – *Steve Carlson, Jeffery Leader*

Math Senior Advisor – *David Finn*

Math Double Majors and Minors advisor – *Allen Broughton*

Senior Thesis Student Advisors – *Allen Broughton, Kurt Bryan, Bill Butske, Michael DeVasher, David Finn, Steve Galinaitis, Joshua Holden, David Rader, John Rickert*

*Co-curricular Advising and support*

Martial Arts Club Advisor – *Jeffery Leader*

Math Club Advisor – *David Finn*

Mathematical Contest in Modeling Teams Advisor – *W. Steve Galinaitis*

Virginia Tech Regional Competition, Indiana Mathematics Competition - *John Rickert*

Putnam Competition - *Kurt Bryan and John Rickert*

National Society of Black Engineers, RHIT Chapter Faculty Advisor – *Yosi Shibberu*

Pi Mu Epsilon Advisor – *G. Elton Graves*

Unity – *Josh Holden*

**4.b. Departmental Programs (internal and outreach)**

*Fast Track Calculus, Summer 2008*

42 students, Director *Elton Graves*; Instructors: *Elton Graves and Roger Lautzenheiser*

*Rose-Hulman Undergraduate Mathematics Journal:*

Editor *Roger Lautzenheiser*, Assistant editor *David Rader*. (152 papers and 247 authors during its 9 years of existence)

*Rose-Hulman High School Mathematics Competition:* (forty-second annual). Organizer *John Rickert*, assisted by *Cara Brooks*, *Bill Butske*, *Allen Holder* and *Tom Langley*. Approximately 450 students participated

*Rose-Hulman Undergraduate Mathematics Conference:* (March 2009, 26th annual), co-organizers, *Steve Galinaitis* and *Kurt Bryan*. 15 student talks, about 65 conference participants

*MATHCOUNTS Regional Competition (February 2009):* *Elton Graves*, Regional Coordinator, *Denis Radecki* and *William Eccles* local co-organizers, *John Rickert* Chief judge. 155 students participated.

#### **4.c Membership in Interdepartmental Faculty Clusters**

Imaging Systems Faculty: *Allen Broughton*, *David Finn*, *Joshua Holden*

Parallel Computing Users Group: *Allen Broughton*, *Joshua Holden*, *Jeffery Leader*

Tablet Computing Group: *Dave Finn*, *Josh Holden*, *Tanya Jajcay*, *Jeff Leader*, *Dave Rader*

### **5. Publications, Presentations, Awards, Consulting**

#### **5.a Publications, Articles, Writing, Works in Progress**

*S. Allen Broughton*

- Bryan, Kurt and Broughton, S. Allen, “Discrete Fourier Analysis with Applications to Signal and Image Processing”, *Wiley*, November 2009.
- Broughton, S. Allen and Wootton, Aaron “Topologically Unique Maximal Elementary Abelian Group Actions on Compact Oriented Surfaces”, *Journal of Pure and Applied Algebra*, 213 (2009) 557-572.

*Kurt Bryan*

- Bryan, Kurt and Broughton, S. Allen, “Discrete Fourier Analysis with Applications to Signal and Image Processing”, *Wiley*, November 2008
- Bryan, Kurt and Vogelius, Michael, “Transient Behavior of Solutions to a Nonlinear Boundary Value Problem”, *Quarterly of Applied Mathematics*, March 2009

*William Butske*

- Butske, William, “Endomorphisms of the Jacobian and related finite algebras”, accepted for publication
- Butske, William, “Sato-Tate Distributions for Genus Two Curves”, submitted
- Butske, William, “Introduction to Sato-Tate”, in progress
- Butske, William and Zlotnick, Adam, (a biologist at Indiana University), as yet

untitled work involving modeling virus assembly, in progress

*Stephan Carlson*

- Carlson, Stephan, "The Quest for a Fuzzy Tychonoff Theorem," published in the *American Mathematical Monthly* 115, pp 871-887, December 2008
- Carlson, Stephan, "The Indiana Section Governor Position and its First Occupant," *Newsletter of the INMAA*, Spring 2009.

*Michael DeVasher*

- DeVasher, Michael, "Bayesian Experimental Design in Pharmacokinetics Under Prior Parameter Uncertainty", in progress
- DeVasher, Michael, "Histogram Interpretation Fallacies: Common Errors in Exploratory Data Analysis", in progress

*David Finn*

- Finn, David, "Convexity of Level Curves to Semilinear Elliptic Equations", appeared in *Communication in Pure and Applied Analysis, Volume 7, Number 6, pages 1335-1343*, November 2008
- Finn, David, "The Shape of a Slice of French Bread", submitted to *Mathematics Magazine*,
- Finn, David "Elliptical Sessile Drops", (with Emma Norbrothen and Meredith Perrie) in preparation
- Finn, David, "Modeling the Shape of a Cookie", in preparation

*G. Elton Graves*

- Graves, G. Elton, "Demonstrations that Work in the Mathematics Classroom", accepted for publication by *ASEE*, April 2009

*Ralph Grimaldi*

- Grimaldi, Ralph, "Compositions with the Last Summand Odd", *Ars Combinatoria*, accepted August 2008
- Grimaldi, Ralph, "The Distribution of 1's in Jacobsthal Binary Sequences", *Congressus Numerantium, volume 190, pages 47-64*, December 2008
- Grimaldi, Ralph, "Ternary Strings with No Consecutive 1's", *Ars Combinatoria*, accepted in 2008.

*Joshua Holden*

- Holden, Joshua, "A statistical look at maps of the discrete logarithm", *Communications in Computer Algebra*, 42:57-59, abstract published in 2008.
- Holden, Joshua, "The Arithmetic of Secrets: How some Not-too-difficult Mathematics is Essential to Spies, Banks, and Online Auctions", contract signed with *Princeton University Press*
- Holden, Joshua, Cloutier, Daniel R., and Lindel, Nathan W., "Mapping the Discrete Logarithm", in preparation

- Holden, Joshua “The Pohlig-Hellman Exponentiation Cipher as a Bridge between Classical and Modern Cryptography”, in preparation.
- Holden, Joshua, “Braids, Cables, and Cells: An Interesting Intersection of Mathematics, Computer Science, and Art”, in preparation.
- Holden, Joshua, “Teaching the Group Theory of Permutation Ciphers”, in preparation

#### *Allen Holder*

- Holder, Allen and Langley, Thomas, “A Decomposition of the Pure Parsimony Problem”, 2009, to appear in *Lecture Notes in Computer Science*.
- Holder, Allen, Acosta, R., Brick, W., Hanna A., Lara, D., McQuilen, G., Nevin, D. Uhlig, P., and Salter, B., “Radiotherapy Optimal Design: An Academic Radiotherapy Treatment Design System”, in *Operations Research and Cyber-infrastructure*, J. Chinneck, B. Kristjansson, and M. Saltzman, Eds., Springer, pages 401-425
- Holder, Allen, review of “Using and Understanding Linear Programming” and “Introduction to Optimization”, 2008, to appear in the *American Mathematics Monthly*.
- Holder, Allen, Lim, G. and Reese, J., “Fast and Robust Techniques for the Euclidean p-Median Problem with Uniform Weights”, to appear in *Computers & Industrial Engineering*,
- Holder, Allen, Lim, G. and Reese, J., “A Clustering Approach for Optimizing Beam Angles in IRMT Planning, to appear in the *Proceedings of the 2009 Industrial Engineering Research Conference*.
- Holder, Allen, Ehrgott, M., “An Introduction and Review of Operations Research Methodology in Radiation Oncology”, to appear in *Physics, Medicine and Biology*, 2009.
- Holder, Allen, Greenberg, H., Leung, M.Y. and Schwartz. R., “ Computational Biology and Medical Applications: Opportunities for Operations Research”, to appear in *OR/MS Today*.
- Holder, Allen, Blain, P., Davis, C, Silva, J, and Vinzant, C, “Diversity Graphs”, in *Clustering Challenges in Biological Networks*, part of a collected volume volume based largely on the outcome of a DIMACS conference. No volume or number.
- Holder, Allen, Almaas, E., Healy, F., Livingstone, K., O’Dea, E., Uhlig, P, Nunamaker, T., “A Mathematical Programming Perspective on Degeneracy in Flux Balance Analysis”, in progress
- Holder, Allen, Lim, G., Reese, J. and Salter, B., “A Study of Angle Characteristics for Clustering and Selection via the selection of p-Medians”, in progress

#### *Mark Inlow*

- Inlow, Mark, "An Elementary Central Limit Theorem," submitted to *Journal of Probability and Statistical Science*, January 2009
- Inlow, Mark, “An Elementary Central Limit Theorem via Induction,” to be submitted to *The American Mathematical Monthly*, May 2009

*Tanja Jajcay*

- Jajcayova, T.J. and Rodaro, E. “Maximal subgroups of amalgamated free product of finite inverse semigroups, work in progress, 2008
- Jajcayova, T. J. and Swara Kopparty “Frequency Sequences: Structure and Properties”, submitted for publication, 2008

*Thomas Langley*

- Langley, Thomas, Leavitt, D. and Rower, J, “Two Generalizations of the 5/8 Bound On Commutativity In Non-Abelian Groups”, submitted to *Math Magazine*, November 2008
- Langley, Thomas, Holder, Allen, A, “Decomposition of the Pure Parsimony Haplotyping Problem”, accepted for presentation and publication in the proceedings of the *International Symposium on Bioinformatics Research and Applications*, 5/09
- Langley, Thomas, Remmel, J. and Liese, J, “Wilf Equivalence in Generalized Factor Order mod  $k$ ”, in preparation

*Jeffery Leader*

- Leader, Jeffery – book *Numerical Analysis and Scientific Computation* was translated into Chinese , Pearson Addison Wesley, 2009

*John Massman*

- Massman, John, “4-Dimensional Non-Associative Division Algebras”, *Journal Advances in Mathematics of Communications*, March 09

*Kim Montgomery*

- Montgomery, Kim, “Multifrequency Forcing of a Hopf Oscillator Model of the Inner Ear”, *Biophys. J.* 95: pp. 1075-1079, 2008

*Yosi Shibberu*

- Shibberu, Yosi, “Efficient Symplectic-Energy-Momentum Integration” accepted for publication in the *Proceedings of the 2009 International Conference on Scientific Computing*

## **5.b Presentations**

### ***Off-Campus***

*Cara Brooks*

- “Extensions to the theory of local regularization”, AMS/MAA Joint Meetings, Washington, D.C., January 2009
- “New Techniques for the Solution of Inverse Problems”, invited talk at Wabash College, Crawfordsville, IN, April 2009

*Allen Broughton*

- “Full Automorphism Groups of Cyclic  $n$ -gonal Surfaces” UNED Geometry Seminar,

February 2009. Invited speaker

- “Classification of Pairs of Fuchsian Groups” UNED Geometry Seminar, March 2009. Invited speaker

*Kurt Bryan*

- “Thriving as a Mathematician at a Small College”, invited talk at Joint AMS/MAA meetings in Washington D.C.
- “The Mathematics of Cloaking” presented at spring MAA sectional meeting at IUPUI, Indianapolis

*Michael DeVasher*

- “What I Wish I Had Known: New Professors” Reflections and Advice for Incoming Faculty”, Rose-Hulman Center for the Practice and Scholarship of Education’s New Teacher’s Workshop

*David Finn*

- “Modeling the Shape of a Cookie”, at World Congress in Numerical Analysis
- “Convexity of Partial Differential Equations”, Ball State University
- “Convexity of Level Curves to Semilinear Elliptic Equations”, Northeastern Geometry and Analysis Seminar
- “Doing Research with Undergraduates”, Northeastern Alumni Conference

*G. Elton Graves*

- “Demonstrations that Work in the Mathematics Classroom”, INMAA fall meeting, held at Rose-Hulman

*Ralph Grimaldi*

- “Tilings, Compositions, and Generalizations”, Joint AMS/MAA Meetings, Washington, D.C., January 2009
- “Arrangements of Marked Dominoes”, 40<sup>th</sup> International Southeastern Conference on Combinatorics, Graph Theory, and Computing,

*Joshua Holden*

- “A statistical look at maps of the discrete logarithm”, Algorithmic Number Theory Symposium VIII (poster session), Banff Centre, Banff, Alberta, May 18-22, 2008. Joint work with Nathaniel W. Lindle.
- “The Pohlig-Hellman Exponentiation Cipher as a Bridge between Classical and Modern Cryptography”, MAA Session on Fascinating Examples from Combinatorics, Discrete Mathematics, and Graph Theory, MathFest, Madison, WI, August 2, 2008.
- “Braids, Cables, and Cells: An Interesting Intersection of Mathematics, Computer Science, and Art”, RHIT Math Seminar, March 11, 2009, and Indiana MAA Section Meeting, IUPUI, March 21, 2009

- “Math in Your Hands: Integrating the Use of Maple with the Collaborative Use of Wireless Tablet PCs”, Workshop on the Impact of Pen-Based Technology on Education (poster session), Purdue University, October 16, 2008.
- “Math in Your Hands: Integrating the Use of Maple with the Collaborative Use of Wireless Tablet PCs”, Indiana MAA Section Meeting, Rose-Hulman Institute of Technology, October 25, 2008.
- “Teaching the Group Theory of Permutation Ciphers”, MAA Session on Cryptology for Undergraduates, Joint Mathematics Meetings, Washington, DC, January 5, 2009.
- “Math in Your Hands: The Use of Tablet PCs and Computer Algebra Systems in a Calculus Classroom”, MAA Session on Demos and Strategies with Technology that Enhance Teaching and Learning Mathematics, Joint Mathematics Meetings, Washington, DC, January 6, 2009.
- “Braids, Cables, and Cells: An Intersection of Mathematics, Computer Science, and Fiber Arts”, AMS Special Session on Mathematics and Mathematics Education in Fiber Arts, Joint Mathematics Meetings, Washington, DC, January 7, 2009.

*Allen Holder*

- “Computational Challenges and Humble Thoughts on the Future”, 2009, Operations Research in Radiation Oncology Workshop, Keynote speaker, Deakin University, Melbourne, Australia,
- “Systems Biology: A Mini-Tutorial”, INFORMS Computing Society, 2009.
- “Radiotherapy Optimal Design”, INFORMS Computing Society, 2009
- “The INFORMS Computing Society's Education Report”, INFORMS Computing Society.
- “Degeneracy in Flux Balance Analysis”, INFORMS, 2008

*Mark Inlow*

- “Elementary Central Limit Theorems via Mathematical Induction”, Joint Annual AMS-MAA Meeting, Washington, D.C., January, 2009.
- “Two applets for Teaching IID Sampling, Sampling Distributions, and the Central Limit Theorem”, Joint AMS-MAA Meeting, Washington, D.C., January 2009.
- “Why Statistics?”, Invited talk for the Statistics Career Day held at IUPUI, November 4, 2008.

*Thomas Langley*

- “Two Generalizations of the  $5/8$  Bound On Commutativity In Non-Abelian Finite Groups”, AMS session on group theory, Joint Mathematics Meetings, Washington, D.C., January 2009
- “A Decomposition of the Pure Parsimony Haplotyping Problem”, International Symposium on Bioinformatics Research and Applications, Nova Southeastern University, Ft. Lauderdale, FL, May 2009

*John Massman*

- “4-Dimensional Non-Associative Division Algebras”, Joint AMS/MAA Meetings, January 2009

*David Rader*

- "How to introduce operations research to mathematics majors", Ball State University Faculty Colloquium, April 2009

*Yosi Shibberu*

- "Symplectic-energy-momentum integration", SIAM Annual Meeting in San Diego.

### ***Rose Math Seminar***

*Cara Brooks*

- "Linear Volterra Inverse Problems – Formulation and Regularization", February 2009

*Allen Broughton*

- "Billiards and Flat Surfaces", October 2008
- "Voronoi Tessellations, Delaunay Tessellations and Flat Surfaces", December 2008

*Kurt Bryan*

- "Inverse Problems on Resistor Networks", February 2009
- "The Mathematics of Cloaking", March 2009

*Bill Butske*

- "(Almost) The Poincare Conjecture or "What's the difference between a ball and a doughnut?", October 2008

*Michael DeVasher*

- "Nonlinear Design Problems, Model Discrimination, and Impossible Solutions", February 2009

*Joshua Holden*

- "Braids, Cables, and Cells: An Interesting Intersection of Mathematics, Computer Science, and Art", March 2009

*Allen Holder*

- "Mathematical Programming, Systems Biology, and Undergraduate Research, September 2008
- "Solutions to the Pure Parsimony Problem", presented with students from his MA444 class, January 2009

*Kim Montgomery*

- "Modeling Pattern Formation in the Auditory and Visual System", April 2009

### **5.c Faculty Honors and Awards**

## **5.d Consulting**

*Allen Broughton* Triarrow Corporation, Terre Haute

## **6. Grant Proposals and Continuing Grant Activities**

### **6.a Grant Proposals**

*Cara Brooks:*

- Applied for an Association for Women in Mathematics travel grant.

*Michael DeVasher*

- Faculty mentor with Dr. Sue Niezgoda: for Weaver Award for Supported Student Research with “Improving a Cost Based Risk Assessment Method Developed for Selecting Stream Restoration Design Alternatives”
- Submitted academic case study for the development of an Actuarial Sciences Minor “Joint Minor in Actuarial Science: A Collaboration of Economics and Mathematics”

*W. Steve Galinaitis*

- Principal Investigator, MAA Rose-Hulman Undergraduate Math Conference grant, Fall 2008.

*Joshua Holden:*

- Principal Investigator, National Science Foundation group travel grant for the Eighth Algorithmic Number Theory Symposium ANTS-VIII, DMS-0801165, 2008--2009.
- Investigator, Project to Implement Tablet PCs and DyKnow Vision Software into a Course, RHIT (IRPA), Summer 2008.
- Applied for Rose-Hulman Summer Professional Development Grant for summer of 2009, awarded

*Tanya Jajcay*

- Proposal submitted to NSF for organizing the International Conference on Geometric and Combinatorial Method on Group and Semigroup theory – Granted November 2008.
- Internal RHIT grant for tablet computing – granted

*Jeffery Leader:*

- Center for Computational Science Proposal – member on several other internal proposals

## 6.b Continuing Grant Activities (grant awarded before current academic year)

*David Finn:*

- Co-PI for Math REU

*Allen Holder*

- Co-PI on NSF proposal on optimal methods to evaluate nursing homes

*Tanya Jajcay*

- Member of the steering committee for the European Science Foundation international programme AutoMathA (Automata, mathematics and applications). Attended steering committee meeting, in Paris, France, June 2008
- Proposal submitted to NSF for organizing the International Conference on Geometric and Combinatorial Method on Group and Semigroup theory – Granted November 2008.

## 7. Professional Development

### 7.a Conferences and Workshops Attended

*Cara Brooks*

- MAA PREP workshop Wavelets and Applications: A Multidisciplinary Undergraduate Course with an Emphasis on Scientific Computing, University of St. Thomas, St. Paul, MN, June 2008
- MAA Project NExT Workshop (New Experiences in Teaching, Madison, WI, July 2008
- MAA MathFest, Madison, WI, August 2008
- MAA Indiana Section Meeting, Rose-Hulman Campus, October 2008
- AMS/MAA Joint Mathematics Joint Meetings, Washington, D.C., January 2009

*S. Allen Broughton*

- Fall meeting of the INMAA at Rose-Hulman, October 2007
- Spring Meeting of the INMAA at IUPUI March 2007
- Central Region AMS Meeting, Urbana-Champagne, March 2009
- Rose-Hulman Undergraduate Math Conference, April 2008

*Kurt Bryan*

- Fall INMAA meeting, Rose Hulman, October 2008
- AMS/MAA Joint Mathematics Joint Meetings, Washington, D.C., January 2009
- Spring INMAA meeting, Indianapolis, IN, April 2009
- Rose-Hulman Undergraduate Mathematics Conference, March 2009

*Bill Butske*

- Fall INMAA meeting, Rose-Hulman, October 2008
- Rose-Hulman Undergraduate Mathematics Conference, March 2009

*Stephan Carlson*

- MathFest 2008, Madison, Wisconsin, August 2008
- INMAA Meeting, Rose-Hulman, Terre Haute, IN, October 2008
- Joint Mathematics Meetings, Washington, DC, January 2009
- INMAA Meeting, IUPUI, Indianapolis, IN, March 2009
- Rose-Hulman Conference on Undergraduate Mathematics, March 2009

*Michael DeVasher*

- Fall INMAA meeting, Rose-Hulman, October 2008
- Rose-Hulman Center for Practice and Scholarship of Education's New Teacher Workshop, August 2008
- Rose-Hulman Undergraduate Math Conference, March 2009

*David Finn*

- World Congress of Nonlinear Analysts (WCNA), invited speaker, Orlando, FL, July 2008
- Fall INMAA meeting, Rose-Hulman, October 2008
- Northeastern Alumni Conference, invited speaker, Boston, MA, February 2009
- Rose-Hulman Undergraduate Math Conference, March 2009

*Steve Galinaitis*

- Rose-Hulman Undergraduate Math Conference, March 2009

*Elton Graves*

- Fall INMAA meeting, Rose-Hulman, October 2008
- Rose-Hulman Undergraduate Mathematics Conference, March 2009

*Ralph Grimaldi*

- AMS/MAA Joint Mathematics Meetings, Washington, D.C., January 2009
- Southeast Conference on Combinatorics, Graph Theory, and Computing, Florida, March 2009

*Joshua Holden*

- MathFest, Madison, WI, August 2008
- Workshop on the Impact of Pen-Based Technology on Education (poster session), Purdue University, October 2008
- Fall INMAA meeting, Rose-Hulman, October 2008
- AMS/MAA Joint Mathematics Meeting, Washington, D.C., January 2009

*Allen Holder*

- INFORMS annual conference, Washington DC, October 2008
- INFORMS, Computing Society's bi-annual meeting, Charleston, SC., February 2009
- Operations Research in Radiation Oncology Workshop, Deakin University, Melbourne, Australia, March 2009

- Rose-Hulman Undergraduate Mathematics Conference, March 2009

*Leanne Holder*

- An International Conference on Finite Geometry To Honor the Career of Norman L. Johnson, San Antonio, TX, March 2009
- Rose-Hulman Undergraduate Mathematics Conference, March 2009

*Mark Inlow*

- AMS-MAA Joint Mathematics Meeting, Washington, D.C., January, 2009
- Rose-Hulman Undergraduate Mathematics Conference, March 2009

*Tanya Jajcay*

- Fall regional INMAA meeting, Rose-Hulman, October 2008
- American Women in Science (AWIS) What works? Conference, Indianapolis, October 2008,
- International research workshop” Automata Theoretic Methods in Algorithmic Algebra.”, Bratislava, Slovakia, November 2008.
- Rose-Hulman Undergraduate Math Conference, March 2009
- Central Region AMS Meeting, Urbana-Champagne, March 2009

*Thomas Langley*

- INMAA Meeting, RHIT, October 2008
- AMS/MAA Joint Mathematics Meetings, Washington, D.C, January 2009
- Rose-Hulman Undergraduate Mathematics Conference, March 2009
- International Symposium on Bioinformatics Research and Applications, Nova Southeastern University, Ft. Lauderdale, FL, May 2009

*John Massman*

- INMAA fall meeting, Rose-Hulman, October 2008
- AMS/MAA Joint Mathematics Meeting, Washington, D.C., January 2009

*Kim Montgomery*

- Dynamical Systems in Physiological Modeling Conference, Purdue University, October 2008

*David Rader*

- INFORMS annual meeting, Washington, D.C., October 2008
- Fall Indiana MAA Section meeting, Rose-Hulman, October 2008

*John Rickert*

- Spring Meeting of the INMAA at IUPUI March 2007
- Rose-Hulman Undergraduate Mathematics Conference, March 2009

*Yosi Shibberu*

- Rose-Hulman Undergraduate Math Conference, April 2008

## 7.b Other professional development and student mentoring activities

### *Cara Brooks*

- Assisted with Alfred R. Schmidt Freshmen Mathematics Competition
- RHIT High School Math Competition helper
- Grader at Regional Wabash Valley MATHCOUNTS competition

### *S. Allen Broughton*

- IU Geometry Seminar, January 2009
- Visited UNED in Madrid Spain for 10 days gave two talks and consulted with colleagues. Feb/March 2009

### *Kurt Bryan*

- Continuing work with Michael Vogelius at Rutgers on the analysis of partial differential equations with nonlinear boundary conditions.
- Director of summer REU mathematics program
- Directed summer research group of four students which produced two technical reports in RHIT Undergraduate Mathematics series and presented their results @ IU as well as their home institutions
- Reviewed papers for the journal *Inverse Problems*, *SIAM Journal on Image Processing* and the *Journal on Mathematical Analysis and Applications*
- Official reader for the PhD thesis, Boundary Identification in the Domain of a Parabolic PDE" by Tom Fredman at ABO Akademi University, in Finland. Work largely based on work done by Rose-Hulman REU students of 2003

### *Bill Butske*

- Serves as mathematical consultant to Zach Haga who works in robotics at Indiana University
- Working with Adam Zlotnick, a biologist at IU, on modeling virus assembly

### *Stephan Carlson*

- Served on an NSF Panel to review proposals submitted to NSF's Math and Science Partnership program, Arlington, VA, April 2008
- Referee of mathematic papers for two journals

### *Michael DeVasher*

- Presented guest lecture on Statistical Process Control for Computer Science and Software Engineering class; cultivated possible interdisciplinary efforts between Statistics and Software Engineering
- Served as reviewer for Rose-Hulman Undergraduate Mathematics Journal
- Reviewed two textbook proposals for Wiley Publishing

*David Finn*

- Sabbatical application to "Institute for Mathematics and Its Applications at the University of Minnesota" general membership for next fall

*W. Steve Galinaitis*

- Cochaired Rose Hulman 26<sup>th</sup> Annual Undergraduate Mathematics Conference, March 2009

*Elton Graves*

- Mathematics consultant for New Tech High School, Monroe County School Corp., developing projects as learning modules.
- Immediate Past Chair Mathematics Division, ASEE
- Reviewed two articles for ASEE Mathematics Division

*Joshua Holden*

- Ongoing work on graph theory related to fiber arts
- Ongoing work on graph-theoretic structure of the discrete logarithm map.
- Ongoing work on the integration of computer algebra systems and collaborative classroom software.
- Ongoing work on the teaching and popular exposition of cryptography.

*Allen Holder*

- Initiated research collaboration with Dr. Mark Langer, an oncologist at IUPUI.
- Consultant on a Portuguese proposal on radiotherapy design, spearheaded by Matos Dias at the University of Coimbra, Portugal.
- VP-Programs for INFORMS Forum on Education Member INFORMS Computing Society Education Committee

*Tanya Jajcay*

- Collaboration with Pedro de Silva, University of Porto, Portugal: Automata theoretic methods in inverse semigroups.
- Collaboration with Robert Jajcay, ISU: Difference sets.
- Collaboration with Emanuele Rodaro on Maximal subgroups of amalgams of finite inverse semigroups.

*David Rader*

- VP-Programs for INFORMS Forum on Education Member INFORMS Computing Society Education Committee

*John Rickert*

- Constructed and administered the 20th annual Alfred R. Schmidt Freshman Mathematics Competition, November 2008
- Coordinated 30<sup>th</sup> annual Virginia Tech Regional Mathematics Competition, November 2008
- Coached two teams competing in 44th Indiana College Mathematics Competition,

March 2009

- Served on Student Affairs Committee
- Volunteer for Freshmen Laptop Orientation, August 2008
- Organizer for the 43<sup>rd</sup> Rose-Hulman High School Mathematics Competition, November 2008

*Yosi Shibberu*

- Collaborated with Professor Mark Brandt and Chemistry-Math double major, David Cooper, to conduct molecular docking studies of the estrogen receptor protein
- Developed kinetic models of Professor Brandt's estrogen receptor dimerization assay.

## 8. Publications

Accepted publications and works in progress appear in section 5.a

### Books

- Broughton, S. A, & Bryan, K (2009). *Discrete Fourier Analysis with Applications to Signal and Image Processing* Hoboken: Wiley.
- Leader, J.J (2009) *Numerical Analysis and Scientific Computation* (Chinese translation), Upper Saddle River: Pearson Addison.

### Journal Articles

- Broughton, S.A & Wootton, A (2009). Topologically Unique Maximal Elementary Abelian Group Actions on Compact Oriented Surfaces. *Journal of Pure and Applied Algebra*, 213, 557-572.
- Bryan, K.M. & Vogelius (2009). Transient Behavior of Solutions to a Nonlinear Boundary Value Problem. *Quarterly of Applied Mathematics*
- Grimaldi, R.P. (2008) The Distribution of 1's in Jacobsthal Binary Sequences. *Congressus Numerantium*, 190, 47-64
- Carlson, S.C. (2008). The Quest for a Fuzzy Tychonoff Theorem, *American Mathematical Monthly* 115, 871-887.
- Finn, D.L. (2008). Convexity of Level Curves to Semilinear Elliptic Equations. *Communication in Pure and Applied Analysis*, 7, 1335-1343.
- Holden, Joshua, A statistical look at maps of the discrete logarithm. *Communications in Computer Algebra*, 42, 57-59.
- Holder, A.G., Acosta, R., Brick, W., Hanna A., Lara, D., McQuilen, G., Nevin, D. Uhlig, P., & Salter, B. (2009). Radiotherapy Optimal Design: An Academic Radiotherapy Treatment Design System. *Operations Research and Cyber-infrastructure*, 401-425
- Massman, J (2009). 4-Dimensional Non-Associative Division Algebras., *Journal Advances in Mathematics of Communications*, March 09
- Montgomery, K(2008) Multifrequency Forcing of a Hopf Oscillator Model of the Inner Ear. *Biophysics Journal*, 95, 1075-1079

### Newsletter articles

- Carlson, S.C (2009, spring) The Indiana Section Governor Position and its First Occupant. *Newsletter of the INMAA*

## 9. Faculty and Staff Professional Service

### 9.a RHIT and Mathematics Committee Membership

#### *RHIT Committee Membership (chairs and secretaries are in bold)*

Academic Computing Implementation Commission – *Allen Broughton*  
 Academic Computing Support Group – *Mike McLeish, Darryl Mouck*  
 Academic Computing Technology Council – *Kurt Bryan*  
 Admissions and Standings Committee – **G. Elton Graves**, *Steve Galinaitis*  
 Animal Care and Use – *Mark Inlow*  
 Commission on Assessment of Student Outcomes- *Tom Langley*  
 Curriculum Committee – *Allen Broughton*  
 Diversity Council – *Yosi Shibberu*  
 Environmental Health and Safety - *Mike McLeish*  
 Faculty Affairs Committee – *Josh Holden*  
 Faculty Success Grant Applications Review Panel – *Stephan Carlson*  
 Graduate Studies Committee – *Jeffrey Leader*  
 Greek Advisory –  
 Honors and Awards Committee – *Tanya Jajcay*  
 International Programs –  
 Leaves Committee – **Kurt Bryan**  
 Library Committee – *Tanya Jajcay*  
 Potential Academic Technologies Committee – *Josh Holden, Yosi Shibberu*  
 Quality of Education Committee – *Stephan Carlson*,  
 Safety, Security, Hazardous Waste and Traffic – *Bill Butske*  
 Student Affairs Committee - *Cara Brooks, John Rickert*  
 Institute Task Force: New Knowledge Center - *Tanya Jajcay*

#### *Mathematics Committee Membership*

Computing Environment Committee *Allen Broughton, Kurt Bryan, Josh Holden, Mark Inlow, Mike McLeish*  
 Hiring Committee – *Allen Broughton, Kurt Bryan, Elton Graves, Roger Lautzenheiser, John Rickert*  
 Student Recruiting Committee - *Allen Broughton, Cara Brooks, Elton Graves, Josh Holden, Yosi Shibberu*  
 Webmaster – *Allen Broughton*

Curriculum Development Groups  
 Continuous Applied Mathematics Curriculum Development Group – *Cara Brooks, Allen Broughton, Kurt Bryan, David Finn, Steve Galinaitis, Elton Graves, Al Holder, Jeff Leader, Yosi Shibberu*  
 Discrete Applied Math Curriculum Development Group – *Josh Holden, Leanne Holder,*

*Tanya Jajcay, Tom Langley, Dave Rader, John Rickert*  
Mathematics Curriculum Development Committee – *Allen Broughton, Kurt Bryan, Bill Butske, Steve Carlson, David Finn, Josh Holden, Jeff Leader, John Rickert*  
Statistics and Operations Research Curriculum Development Group *Michael DeVasher, Diane Evans, Al Holder, Mark Inlow, Dave Rader*  
DE Course Revision Committee – *G. Elton Graves, John Rickert, Cara Brooks David Finn,*

## **9.b Other Professional Service and Outreach Activities**

*S. Allen Broughton*

- Reviewed one book

*Kurt Bryan*

- Organizer of Rose Hulman Math Seminars during school year

*Cara Brooks*

- Member of AMS, MAA, SIAM

*Stephan Carlson*

- Member of MAA Committee on Panel Sessions (through 2010)
- Member and Secretary of MAA Committee on Sections (through 2010)
- Section Historian, Indiana Section of the MAA

*David Finn*

- Memberships – Mathematical Association of America, American Mathematical Society, Society for Industrial and Applied Mathematics, American Association for the Advancement of Science
- MAA Liaison for RHIT
- Member of "Mathematics Across the Disciplines" Subcommittee of the Committee on Undergraduate Programs in Mathematics for the MAA
- Local Arrangements Coordinator for Indiana Section of the Mathematical Association of America at Rose-Hulman
- Referee for College Mathematics Journal, Transaction of the American Mathematics Society
- Reviewer for Mathematical Reviews
- Reviewed Calculus Textbook for Prentice Hall and Brooks/Cole
- Editorial Board Member for Ball State Mathematics Exchange

*William S. Galinaitis*

- Co-organized the 26<sup>th</sup> Annual Rose-Hulman Undergraduate Mathematics Conference which was very well attended
- Assisted with Indiana Regional MATHCOUNTS Competition

*Elton Graves*

- Member Mathematical Association of America

- Member American Society for Engineering Education
- Referee for Mathematics Division ASEE
- Director, Indiana State AMC 8
- Director, Indiana State AMC 10/12
- Coordinator, Francis Vigo Chapter for MATHCOUNTS

*Joshua Holden*

- Reviewer for RHIT Undergraduate Mathematics Journal and Cryptologia. Editor, Cryptologia Editorial Board.
- Member, Organizing Committee, Algorithmic Number Theory Symposium VIII, 2006-2008.
- Judge, MAA Student Paper Sessions, MathFest, Madison, WI, July 31, 2008.
- Pre-publication reviewer for new edition of *Thomas' Calculus*, Pearson Addison-Wesley.
- Pre-publication reviewer for third edition of *Introduction to Computer Theory*, Cohen, John Wiley & Sons, Inc.
- Member, Nominating Committee, Indiana MAA Section, 2009-2012.

*Allen Holder*

- Editor of the Mathematical Programming Glossary.
- Tutorials Chair for the 2009 CORS-INFORMS International Conference.
- Education Committee for the INFORMS Computing Society.
- Exploratory Committee for a thesis repository for the INFORMS Computing Society.
- Webmaster for the Health Applications section of INFORMS
- Refereed 10 articles, which were submitted to *Physics in Medicine and Biology*, *INFORMS J. on Computing*, *the 2009 Proceedings of the INFORMS Computing Society*, *Operations Research*, *Annals of Operations Research*, *OR Spectrum*, *Physics Review Letters*, and *Health Care and Management Science*.
- Refereed a Ph.D. dissertation from the University of Auckland.
- Reviewed a supplement for the Mathematical Programming Glossary.
- Program committee for the 2009 conference of the INFORMS Computing Society.
- Associate Editor for the INFORMS Journal on Computing through 3/09.

*Tanya Jajcay*

- International studies - Institute Symposium “ Study Abroad”; presented math programs (e.g. Semester in Budapest) for the students to study abroad
- Main proponent and organizer (co-organizer with Alessandra Cherubini from Politecnico di Milano and Stuart Margolis from Bar-Ilan University, Israel) of International research workshop “ Automata Theoretic Methods in Algorithmic Algebra.”, sponsored by European Science Foundation, held in Bratislava, Slovakia, November 2008, attended by top researchers in the area of Algorithmic Algebra

from 11 different countries. Web page with the most current results and open problems is maintained after the workshop as a service to the research community.

- Co-organizer of ICGS2009 an International Conference on Geometric and Combinatorial Methods in Group Theory and Semigroup Theory. It will be held at the University of Nebraska-Lincoln from May 17 to May 21, 2009.

*Thomas Langley*

- Refereed paper for Electronic Journal of Combinatorics
- Reviewed papers for Math Reviews
- Member of Editorial Board of the Rose-Hulman Undergraduate Math Journal

*Roger Lautzenheiser*

- Editor of the Mathematics Undergraduate Journal

*John Massman*

- Referee for two articles in mathematics Undergraduate Journal

*John Rickert*

- Coach and organizer of teams representing the state of Indiana at the American Regions Math League, May 2009
- Tutor at the Research Science Institute Program at MIT, summer 2008. Three of his students were finalists in the Intel Science Talent Search, one finished first in the nation.