

DEPARTMENT OF MATHEMATICS AND STATISTICS

IN THIS ISSUE

Red Raider Mini-Symposium

by Peder Thompson

During the Fall of 2017, a mini symposium in commutative and homological algebra was held October 26-28 in the Department of Mathematics & Statistics at Texas Tech University. The conference, entitled "Structures on Free Resolutions," had 40 participants and featured 15 speakers and 2 workshop events. One goal of the conference was to bring together researchers whose work involves the theme of free resolutions, aiming to both identify future research directions in the area as well as to give an access point to graduate students interested in pursuing research in these topics.

The talks and discussions at the conference were grounded in current progress related to

the many beautiful structures that free resolutions have to offer. Free resolutions, one of the foundational tools in commutative and homological algebra, were first introduced by Hilbert in the 1890s, extending the notion of a presentation of a module. A free resolution is a sequence of free modules and linear maps, which is built sequentially to resolve the relations between generators of a module, and relations among those relations, continuing indefinitely. The idea is to unwind the structure of a module into a sequence of linear maps between free modules.

Mark Walker of the University of Nebraska-Lincoln set the stage for the conference by giving a colloquium talk about his fantastic recent progress on the "Total Rank Conjec-



ture," a classical conjecture involving the ranks of free modules in a minimal free resolution.

See Red Raider on inside



TexPREP Summer Program

The Department will hosts its 32nd mathematicsbased, enrichment program for middle and high school students this summer.

New Colleagues

Warm welcomes to our newest faculty members!

Student News

Departmental student organizations remain in full Swing! See updates from SIAM and MAA student chapters.

2017 PUBLICATIONS





 $\mathbf{3}$ = The # of new book chapters

Revisited books, new editions:



Chair's Corner

by Magdalena Toda

The Department of Mathematics and Statistics is one of the largest departments on campus, with 46 tenured and tenure track faculty (of whom 44 are actively working in the department and 2 serve in upper administrative positions: TTU President Lawrence Schovanec, and W. Brent Lindquist, Dean of College of Arts and Sciences).

In addition, the department includes 8 postdoctoral associates (including an NSF-funded postdoc), and 9 instructors. The graduate enrollment has been at an average of 150 graduate students per year, since 2015. Of them, 100 are currently supported full time as graduate parttime instructors, teaching assistants or research assistants. Five new faculty hires were added in Fall 2017: three as Assistant Professors on tenure-track (Dr. Wei Guo, Dr. Dmitri Pavlov, Dr. Wenjing Zhang), one as Full Professor with tenure (Dr. Svetlozar (Zari) Rachev, who also held a Visiting Professorship in Spring 2017 in our department), and another one as Associate Professor with tenure (Dr. Dimitri Volchenkov). In January 2018, Dr. Min Wang joined the department as Associate Professor with tenure. In Fall 2018, Dr. Chunmei Wang will join our department as Assistant Professor on tenure-track. The department is very proud of its new hires, whose scholarly profiles are very high.

The department started an internally-funded 3-year postdoctoral program in 2016, resulting in a total of 8 hires that took effect in 2016 and 2017, and 3 incoming postdoctoral associates who just accepted our offers and will be hired effective Fall 2018. This is a position that combines teaching and research. The junior scholars proved themselves highly productive in research, and excellent in their teaching duties.

The department awarded its 1st Master's degrees in 1930 and, since then, over 1100 Master's degrees have been awarded. The Ph.D. program was approved in 1965. Since then, the department has awarded over 230 Ph.D. degrees. The department has been placed by the American Math Society classification in the Math Public Medium Group, based on its average count of Ph.D. degrees granted between 2000-2010 (under 6.8 per year in average). According to the AMS Survey, if we keep the current pace, we will be included in the top doctoral granting department tier (Math Public Large Group), that is currently based on a 10-year average of over 6.8 doctoral degrees conferred each year. The estimate and forecast for our doctoral degree count average is of 10 Ph.D. recipients/year for the interval 2011-2020. We eagerly look forward to this reclassification in 2020. The department carries the largest teaching load of any single department at Texas. Over the past 3 years, the department has taught an average of about 87,000 SCH per year. Enrollment in mathematics courses continues to rise.

The department has an ambitious and productive faculty. The department currently includes two Paul Whitfield Horn Professors, Dr. Linda J. Allen and Dr. Jay Conover. Dr. Bijoy Ghosh is appointed as the Dick and Martha Brooks Endowed Professor. Over the past two years, faculty members have been recognized at the university and local levels as recipients of the Barnie E. Rushing Jr. Faculty Distinguished Research Award (A. Solynin, 2017), President's Award for Excellence in Teaching (A. Trindade, 2017), Excellence in Research Award of the College of Arts and Sciences (L. Christensen, 2016; S. Ghosh, 2017), and several other distinctions. Horn Professor Linda J. Allen was named SIAM Fellow, Class 2016. Over the past 3 years, there has been a significant increase in the number of publications jointly produced by

faculty, postdocs and students, which is strongly related to the active collaboration between these categories. The department has a good record of publications (above 2 refereed publications per faculty member per year) since 2015.

The amount of External Funding corresponding to our department for the calendar years 2014-2017, according to the ORS Reports, is \$2,820,232.95, corresponding to a total of 24.40 awards (and shares of awards). Of this amount, about \$2,000,000 represent mathematical research funding, while about \$800,000 are associated to outreach and education funds. The research award recipients include the following faculty members, in alphabetical order: L.J. Allen, E. Aulisa, G. Bornia, L. Christensen, S. Ghosh, L. Huang, A. Ibragimov, R. Iyer, D. McCarthy, A. Peace, A. Solynin, J. Su, J. Surles, M. Toda, A. Trindade. Special thanks are due to R. Barnard, J. Brown, L. Drager, J. Dwyer, R. Higgins-Siwatu, K. Pearce, G.B. Williams for their contributions to our outreach and education funding, which has represented one of the strengths of our department, as part of a STEM promoting institution.

The department makes a concerted effort to maintain strong ties with alumni and friends. Efforts in this area have been rewarded by a significant growth in departmental endowments in recent years.

The department has hosted Distinguished Lecturer Series and Red Raider Mini Symposia, which were supported through the generosity of Horn Professor Linda J. Allen. Some of the symposia also received NSF funding. Dr. Bijoy Ghosh brought and supported distinguished speakers each year, in particular under the W. Dayawansa Lecture Series that he sponsors. Dr. Jay Conover has generously contributed to the SIAM Colloquium and Emmy Noether Day, along with the SIAM and MAA Chapters, and other friends of this event.

The 16th Red Raider Mini-Symposium entitled Structures on Free Resolutions took place October 26-28, 2017 at TTU, organized by Postdoctoral Associate Peder Thompson and Prof. Lars Christensen. It was funded by an NSF grant and by Dr. Linda J. Allen's endowment. This workshop brought together 40 participants, and the meeting included 15 speakers and 2 workshop events.

On April 28, 2017, the SIAM Chapter at TTU hosted the West Texas Applied Math Graduate Mini Symposium, which was featured in the National SIAM Newsletter. The keynote speaker was Professor Max Gunzburger, from Florida State U. Students and postdocs gave 25 min contributed talks. The next West Texas Applied Math Graduate Mini Symposium will be held on April 14, 2018 - and the keynote speaker is Professor Mary Wheeler, from UT Austin.

The department has hosted the Texas Geometry and Topology Conference (TGTC) in 2002, 2005, 2008, 2011, 2014, 2017, and has signed up for a continuing 3-year rotation, as part of a consortium of 7 research universities in Texas, that is funded by NSF. This year's edition included over 40 participants, with 7 distinguished speakers.

The department is involved in local and professional outreach and service. It has been the home of TexPREP-Lubbock since 1986. This summer enrichment program was targeted toward, but not limited to, students who are members of minority groups or females. Its main organizer is Mr. James Brown, who has obtained funding from several foundations. Since 2003, the department has hosted the Emmy Noether High School Mathematics Day, each year. More than 200 female junior high and high school students along with their teachers have registered to attend the 16th edition of this event, to be held on May 16, 2018. This short message allows me to highlight only a small fraction of the outstanding work of our vibrant department. I would like to thank everyone for their productivity and efforts in research, teaching, professional service and outreach! From here, it's possible!

Red Raider

Continued from Cover page

Walker also led an engaging workshop event that allowed all participants to grapple with related conjectures. Another event, led by Daniel Erman of the University of Wisconsin-Madison, explored the question of how researchers go about finding open questions—which many early career researchers found especially helpful with the goal of generating new directions in research related to the topics of the conference.

In addition, several other speakers talked about their recent work on topics such as regularity, Betti numbers, Dynkin graphs, Golod homomorphisms, symbolic powers, complete intersection and Koszul properties, Macaulay inverse systems, and much more. Many participants found the talks, workshops, and the discussions that arose to be both valuable and interesting.

The event was funded by the National Science Foundation and by Horn Professor Linda Allen; it was organized by Lars Winther Christensen and Peder Thompson.

TexPREP Summer Program

by James Brown

TexPREP (Texas Pre-Freshman Engineering Program) is a summer program for sixth through twelfth grade students, consisting of seven-week sessions over four summers. The Texas Tech University Department of Mathematics and Statistics has hosted it since 1986 (as part of a statewide program originated at UTSA). Both undergraduate and graduate math majors at Tech work for the program. Some of them plan to be teachers, so they gain valuable experience while helping the students.

Since the beginning of the Lubbock program in 1986, 1,526 students have completed one or more levels of the program. We especially recruit, but are not limited to, students who are minorities or female, because they have traditionally been underrepresented in math, science and engineering areas. About half of the participants are females, and in recent years more than half have been minorities. Furthermore, almost half of the students come from families where neither parent has a college degree, so we are reaching many firstgeneration college students. At one time a few years ago, we had four math majors at Texas Tech who had attended TexPREP!

TexPREP is a creative program where students develop lifelong learning skills that enhance their individual success and work force readiness. They gain the intellectual skills needed to succeed in high school, college, and careers in engineering, mathematics, and science. They also learn the personal and social skills needed to work cooperatively with others, in school and at work.



TexPREP students with their Sierpenski Pyramid .

Students participate in many classes and activities over the four-year period. The regular classes include mathematical logic, basic algebra, abstract algebra, probability and statistics, pre-calculus, calculus, computer science, introduction to engineering, robotics, basic science, physics, technical writing, astronomy, ecology, life skills (leadership and social and behavioral skills), and university readiness (career awareness and preparation for college). The program integrates course material through special events, projects, and field trips. We have local trips (such as museum visits) in PREP 1 and 2, and out-of-town trips (such as McDonald Observatory) in PREP 3 and 4.

TexPREP challenges students to develop their critical and divergent thinking skills and to apply mathematical ideas. The program is so strong academically that the Texas Education Agency awards one elective high school credit for each summer of attendance at TexPREP.

There is no tuition fee, so that students from all cultural and economic backgrounds can attend. The program is funded primarily from grants, so all donations are welcome!

Applications and more information are on our web site at

http://www.math.ttu.edu/texpre

Mathematical Toxicology Workshop

By Angela Peace



Angela Peace co-organized an NSF funded workshop at the National Institute for Mathematical and Biological Synthesis (NIMBioS) in January 2018. During this workshop, experts from ecology, toxicology, and applied mathematics shared insights from across their fields and discussed incorporating multiple elements and contaminates in ecotoxicological models.

Welcoming New Colleagues



Dr. Dmitri Pavlov Assistant Professor

Research focus: Quantum Field Theory, Homotopy theory and higher category theory, and Differential and Algebraic Geometry





Dr. Wei Guo

Assistant Professor

Plasma Simulations

Research focus: Numerical Analy-

sis, Scientific Computing, Compu-

tational Fluid Dynamics, and

Dr. Svetlozar Rachev Associate Professor

Research focus: Finance, Econometrics, Probability, Statistics, and Actuarial Sciences



Dr. Wenjing Zhang Assistant Professor

Research focus: Disease dynamics, Bifurcation theory, Geometric singular perturbation theory and Scientific computation



From June 26 to July 15, 2017, Linda and Ed Allen were invited

visiting scientists at the University

Dr. Dimitri Volchenkov

Associate Professor

Research focus: Data Analysis, Stochastic Non-linear Dynamics, Complexity and Uncertainty in real-world systems.



Dr. Min Wang Associate Professor

Research focus: Bayesian Statistics, Statistical computing, Bayesian modeling, Dynamic model selection, Statistical consulting

Workshop in Sri Lanka

By Linda Allen

of Kelaniya in Sri Lanka. The visit was arranged by D.K. Mallawa Arachchi, Senior Lecturer at of Kelaniya and visitor and lecturer in our department for 2018. While visiting U of Kelaniya, Linda and Ed gave a series of lectures to faculty and students on stochastic modeling in mathematical biology. In particular, they helped co-organize and lectured in a 2-day workshop at the U of Kelaniya for participants from local universities and industrial partners, conducted a 5-day short course for special degree students, and initiated collaborative research projects with several faculty. In addition, Linda and Ed gave invited lectures at the nearby U of Peradeniya. During their visit, Linda and Ed were very pleased to talk with several former students who are working in academia in Sri Lanka and elsewhere & current students who are now in TTU's PhD program.



From left: Thanuka Hansameenu, Sujeeva Wijesiri, Linda Allen & Kumudu Mallawa Aarachchi. Photo taken by Ed Allen.

Book Announcements



Willmore Energy and Willmore Conjecture By Magdalena Toda

This book is the first monograph dedicated entirely to Willmore energy and Willmore surfaces as contemporary topics in differential geometry. While it focuses on Willmore energy and related conjectures, it also sits at the intersection between integrable systems, harmonic maps, Lie groups, calculus of variations, geometric analysis and applied differential geometry. Rather than reproducing published results, it presents new directions, developments and open problems. It addresses questions like: What is new in

Willmore theory? Are there any new Willmore conjectures and open problems? What are the contemporary applications of Willmore surfaces?

As well as mathematicians and physicists, this book is a useful tool for postdoctoral researchers and advanced graduate students working in this area.



Regularity and Stochasticity of Nonlinear Dynamical Systems

By Dimitri Volchenkov and Xavier Leoncini

This book presents recent developments in nonlinear dynamics and physics with an emphasis on complex systems. The contributors provide recent theoretic developments

and new techniques to solve nonlinear dynamical systems and help readers understand complexity, stochasticity, and regularity in nonlinear dynamical systems. This book covers integro-differential equation solvability, Poincare recurrences in ergodic systems, orientable horseshoe structure, analytical routes of periodic motions to chaos, grazing on impulsive differential equations, from chaos to order in coupled oscillators, and differential-invariant solutions for automorphic systems, inequality under uncertainty.

Upcoming Events

Emmy Noether High School Mathematics Day May 16, 2018

Nearly 200 students from local high schools and junior high schools (grades 9-12) and their teachers will gather together to attend this years 16th Emmy Noether High School Mathematics Day on May 16, 2018. It will be an event packed day with student and teacher workshops, competitions, lunch, career panel, and an award ceremony. This event provides women students with a unique, high-quality experience designed to foster interest in mathematics and careers in mathematics, engineering, and science.



Dr. Jerry Dwyer presenting a previous Emmy Noether High School Mathematics day



Dr. Raegan Higgins is a lead organizer of the 2018 EDGE program.

TTU will host this year's EDGE program

The EDGE (Enhancing Diversity in Graduate Education) Program, funded primarily by the National Science Foundation, is designed to strengthen the ability of women and minority students to successfully complete graduate programs in the mathematical sciences. The 2018 EDGE summer session will be held June 4th-30th, 2018. Young women accepted into PhD programs around the nation will join our department this summer for two four-week core courses; a mini-course on a selected area of mathematical research; and problem sessions

aimed at preparing participants for graduate qualifying exams. The purpose of the EDGE Program is to increase the number of women and minority students who successfully complete graduate programs in the mathematical sciences.

Book Release: Grammar of Complexity

Februarv. 2019

Dr. Dimitri Volchenkov has a new book coming February, entitled "Grammar Of Complexity: From Mathematics To A Sustainable World". The book is an

introduction, for both graduate students and newcomers to the field of the modern theory of mesoscopic complex systems, time series, hypergraphs and graphs, scaled random walks, and modern information theory. As these are applied for the exploration and characterization of complex systems. Our self-consistent review provides the necessary basis for consistency. We discuss a number of applications such diverse as urban structures and musical compositions.



SIAM News

By Giacomo Capodaglio

The Texas Tech Chapter of the Society of Industrial and Applied Mathematics (TTU SIAM) is a graduate student organization affiliated with the Math & Stats Department, whose goal is to promote mathematical research and foster social interaction.

Traveling to conferences is fundamental for young researchers, as the creation of a solid professional network is of major importance for an effective job search.

The travel funding we provided through the years has helped many graduate student members attend conferences all over the country, alleviating the burden of registration fees and expensive airfares.

Only last year, TTU SIAM awarded thousands of dollars for travel reimbursement and this year we expect to be giving no less than last year's amount.

Travel reimbursement is not the only research support service provided by our student organization. Many academic events are organized throughout the year to help our members stay in touch with the latest research trends and get to know researchers that may join their professional network. On Saturday, April 14, we are organizing the second edition of the West Texas Graduate Minisymposium (WTAMGM2), a one day event addressed to all graduate students and post-docs in the area of applied mathematics. Last year the event was a success, and many people from other universities joined. An article about it has been featured on the July/August issue of SIAM News.

For what concerns social events, TTU SIAM is the promoter of many activities meant to improve the social interaction among its members.

Every Fall, we organize a Thanksgiving Luncheon, while in the Spring we set up an end of the year barbecue event. Both initiatives are open to the entire department.

Many other events are usually organized, such as movie nights and bowling socials.

In conclusion, anyone who is not yet involved with TTU SIAM is very welcome to contact any officer to gather information on membership application and upcoming events.



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MAA Student Chapter

By Alexis Gomez

The Texas Tech Student Chapter of the Mathematical Association of America (MAA) continues to provide encouragement in the mathematical sciences as well as social activities for our undergraduate math majors and minors, as well as non-majors interested in math.



From left: Alexis Gomez, Abubakarr Yillah, Afnan Rahim, Eileen Barry, Kelsi Ruckman , Blake Hardesty, Madeline Lockhart, James Blanton, Casey Brito

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Graduate Degree Recipients

Spring 2016

Fall 2016

Bo Li

Wenzhen Fan

Lee Gunderson

PhD

MS

PhD	PhD Pritha Chakraborty	
	Elias Gonzalez	
	Odin Jesse	
	Jie Ma	
	Thanuka Wijenayaka	
	Pathiranage	
MA	Samah Qadah	
	Richard Sandon	
MS	Aruna Adikari	
	Lale Asik	
	Katie Bishop	
	Bimali Jayasinghe	
	Sanjeewa Karunarathna	
	Gregory McKinney	
	Pushpi Paranamana	
	Saikanth Ratnavale	
STAT	Sara Biesiadny	
	Pansujee Dissanayaka	
	Manjari Dissanayake	
	Gouthaman Thar-	
	mathasan	
	Matthew Tichenor	
	C	

Summer 2016

PhD Emine Celik Ashley Cherry Chandani Dissanayake Pratheepa Jeganathan Ashley Meek Takafumi Oki Thanuja Paragoda

Chalani Prematilake MA Monica Chen Susan Geer Shirley Kitchens Megan Miglioretto Samantha Spray

MS Hum Bhandari Guoyi Ke Ashley Meek Aadrita Nandi Supem Samarasiri Michelle Walty

Patrick Oconnell Christopher Sauer Natalie Welcome Sara Calandrini Giacomo Capodaglio Miuran Dencil Shih-Yu Lee STAT William Tritch Yang Cai Hong Li Lewis Owens Chamila Perera Monir Uz Zaman

Spring 2017

PhD Xu Niu MA Katherine Ehnis Keely Green Sandi Hansen Taylor Kirkpatrick Chen Miranda MS Anthony Gruber MD Nazmul Hassan Kaniz Fatema Nipa Kristen Weasenforth STAT Xiao Feng Basitha Hewa Wellalage Kallie Judge Dana Nasser

Quinn Pearce

Huiyan Shao

Zhigang Yu

Summer 2017

- PhD Joshua Mayer Iresha Premarathna Michelle Walty Yang Zhang
- MA Sarah Blazier Victoria Brayer Jaclyn Doyal
- MS Joseph Heinrich Annabel Meade STAT Yujia Pan

Li Sun Yumin Xie

Fall 2017

PhD Gangadhar Acharya Mihiri De Silva Rangana Jayawardhana Shiva Rai

Hongwei Wang

- MA Jianna Davenport
- MS Xiao Feng Dilini Fonseka Quan Hoang Nadeesha Vidanage
- STAT Megan Burns Fang Chen Farzana Nasrin Yiling Qian

Qing Xu





Department of Mathematics & Statistics

Math&Stats notes

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