Summer School on Applicable Algebraic Geometry: Additional Funding

CONTENTS

Summary

For the three weeks, July 22, 2007 through August 10, 2007, the PIs will organize the 2007 Institute for Mathematics and its Applications (IMA) Participating Institutions Summer Graduate Program on the topic "Applicable Algebraic Geometry". This event is currently limited to graduate students from IMA participating institutions as it is funded by those institutions. Many leading mathematics departments are among the 37 IMA participating institutions, but many are not. For example, UC Berkeley, UC Davis, University of Washington, University of Nebraska, Stonybrook, Cornell, MIT, University of Massachusetts, and the University of North Carolina are not IMA participating institutions, yet they all have faculty and graduate students with interests related to the topic of the Summer School. Many graduate students not affiliated with IMA participating institutions have expressed strong interest in this program, and we are seeking additional funding to enable broader participation in this summer program.

The program will be structured around a course in applicable algebraic geometry, treating foundational material and current applications. The foundations will include Gröbner bases, toric varieties, and real algebraic geometry, while the applications will be drawn from optimization, non-linear computational geometry, algebraic statistics, and mathematical biology. We will emphasize computational aspects by including computer tutorials and laboratories on relevant software. We will also have guest lectures explaining current research topics. This multi-tiered menu, ranging form introductory material through current research, will ensure that every student gains something from their experience.

Intellectual Merits. Recent years have seen applications of many ideas and techniques from algebraic geometry to problems in applied mathematics and engineering. Part of this is a recognition of essential algebraic structures in applied problems and part is a need in applications for exact/certifiable results. It is also due in no small measure to modern, simplified presentations of algebraic geometry, interest in particular examples, and the growing use of computers in algebraic geometry. The 2006–2007 IMA thematic year "Applications of Algebraic Geometry" is showcasing these trends and will lead to further, deeper applications of algebraic geometry. The purpose of this summer graduate program is to prepare the ground for the future by introducing graduate students to some of these exciting developments and new perspectives. The purpose of this proposal is to widen this dissemination to graduate students who are not necessarily studying at IMA participating institutions.

Broader Impacts. This project will directly fund the participation of at least 13 additional students, one postdoc mentor, and one lecturer. It will enable more students to take advantage of its unique program. This increased attendance will benefit all participants through the resulting increased activity. It will also ensure a wider and deeper dissemination of current developments in applicable algebraic geometry to future researchers.

Project Description

This Project Description will first describe the summer school, then discuss the merits of expanding its participant base, and then finally explain its budget.

1. The 2007 IMA PI Summer Graduate Program on "Applicable Algebraic Geometry"

The 2007 Institute for Mathematics and its Applications Participating Institutions Graduate Student Summer Program will be organized by Frank Sottile and Laura Matusevich of Texas A&M University and Thorsten Theobald of the Technische Universität Berlin. It will be held on the campus of Texas A&M University in College Station, Texas, and run from Monday, July 23 through Friday, August 10 in 2007. It follows the 2006-2007 IMA thematic year on Applications of Algebraic Geometry, and is intended to complement that program.

As this graduate student program follows the IMA thematic year, its curriculum will incorporate the most current and interesting trends in the applications of algebraic geometry. It will take advantage of Texas A&M faculty who have interests in these applications of algebraic geometry and also will exploit their expertise in organizing conferences and instructional workshops.

1.1. **Outline of Program.** The core of this summer graduate program will be two series of lectures. One by Sottile and Theobald will consist of 25 lectures, provide foundational background, and also cover current applications in optimization and in non-linear computational geometry. Serkan Hoşten and Seth Sullivant will give a joint series of 10-15 lectures on algebraic statistics and applications to biology. Both lecture series will include regular assigned problems and a joint daily discussion section, run by young researchers acting as mentors.

Many applications of algebraic geometry are facilitated by computer experimentation, calculation, and user-friendly software. Because of this, some problems from the course will include computer work, in levels varying from the simple computation of examples, to full-blown computer laboratory projects. To familiarize the students with this aspect of the course, we will hold regular tutorials on installing and using relevant mathematical software, (such as Maple, Singular, Macaulay 2, 4ti2, PHCpack, Bertini, SosTools, and GloptyPol).

Since our goal is applications, we will have a guest lecture series, in which we invite 4-8 experts to each give a 2-part lecture on some application of algebraic geometry in their work. While some will be professors at Texas A&M, we will also invite outside experts.

The curriculum in this summer school is unique. We do not know of any course at any institution in the world which develops algebraic geometry with an eye toward applications and then treats a wide array of applications.

1.2. **Course Syllabus:** The lecture series of Sottile and Theobald will consist of five parts, each taking roughly 5 lectures. The first three parts are foundational and the last two are advanced topics.

I. Introduction to basic concepts from algebraic geometry that will be used throughout the course. Projective and affine varieties, ideals, Gröbner bases, and standard examples.

II. Basic ideas and algorithms from real algebraic geometry. Sturm sequences and Positivestellensatz, real solutions to polynomial equations, and enumerative real algebraic geometry. This prominence of real algebraic geometry is because in applications, real solutions are often much more important than complex ones.

III. Deformation and numerical techniques in algebraic geometry. Introduction to toric varieties, Kushnirenko and Bernstein theorems, deformation techniques for polynomial equations, and the polyhedral homotopy method.

IV. Connections between real algebraic geometry (positivity of polynomials) and semidefinite programming in optimization. Schmüdgen and Putinar Theorems, sum-of-squares relaxations of problems in class NP, and convergence to optimal solutions.

V. Algebraic geometry in nonlinear computational geometry and geometric modeling. Stewart platform and other kinematic manipulators, line problems, and the representation and implicitization of Bézier curves and surfaces.

Sottile and Theobald are currently developing a graduate textbook on Applicable Algebraic Geometry. The lectures in this series will be based upon some parts of that book, and participants will be provided with copies of the text. We also plan to send the participants copies of the undergraduate text "Ideals, Varieties, and Algorithms", by Cox, Little, and O'Shea, which is the required background reading.

The lecture series of Hoşten and Sullivant will consist of 10 to 15 lectures, delivered in the last two weeks of the program. Part will be on algebraic statistics, which uses algebraic geometry for making statistical inferences, as many statistical models for discrete random variables are classical algebraic varieties. The course will explain this connection and discuss some of the interesting geometry, as well as the statistical consequences of the algebraic analysis such as in maximum likelihood estimation. The second part of the course will be in computational biology, particularly on the relevance of algebraic statistical models to genome sequence analysis.

A common theme in these applications is the role of symbolic computation and of classical and concrete algebraic varieties, such as toric varieties. Also, although this is not apparent from the course descriptions, geometric combinatorics, particularly polytopes and vector configurations, play a fundamental role. Throughout the lectures of both courses, there will an emphasis on symbolic computation, classical varieties, and the role of geometric combinatorics in applicable algebraic geometry.

1.3. **Lecturers.**

Sottile and **Theobald** are two organizers of the IMA workshop on Non-Linear Computational Geometry, scheduled for May/June of 2007. Both have prior experience organizing large-scale scientific meetings and giving advanced short courses. In November 2003, Sottile co-organized a Oberwolfach-Seminar on computational algebraic geometry (a short course for European students), he chaired the organization of the 2004 MSRI semester on Topological Aspects of Real Algebraic Geometry, and he gave a short course on "Real Solutions to Equations from Geometry" in November 2005 at the Institut Henri Poincaré. (Notes are available at `www.math.tamu.edu/~sottile/pdf/IHP.pdf`.) Theobald gave a

3-week graduate course on semidefinite programming methods in Berlin in May 2006 as part of a graduate school on optimization methods in discrete geometry which he helped organize.

Hoşten and **Sullivant** are two organizers of the IMA workshop on Applications in Biology, Dynamics, and Statistics, scheduled for March 2007. Hoşten is an Associate Professor at San Francisco State University and an experienced organizer. Sullivant gave a short course on algebraic statistics in June of 2006 at the Sophus Lie Centre in Norway. He is currently a Junior Fellow at Harvard, and already a leader in algebraic statistics.

1.4. **Program.** The two courses will have a total of 35-40 one-hour lectures, and there will be 6-8 guest lectures of 2 hours each. This will result in 3 to 4 hours each day of classroom instruction and lectures. We expect also to schedule one hour each day for a discussion session and one hour each day for a computer lab. We will likely schedule informal evening sessions for students to work together on their assignments. This program will be organized around coffee breaks, and the lecturers will be available outside of lectures.

2. Facilities

The lecture rooms, a common room, and the mathematics department computer labs are all located in Blocker Hall, a modern building which also houses the mathematics department. It is very close to the conference housing at the Traditions dormitory in North Gate, the commercial district adjacent to the University.

Blocker Hall has a variety of computer laboratories, including five CalcLab rooms with varying capacities from 24 to 56 student computer workstations and two University open access computer classrooms, with 56 student computer workstations each. We will book one of the large labs for our scheduled sessions and a smaller lab for work outside of class hours. Students will have computer accounts, and we will make provisions for students who bring their own laptops. In fact, we shall encourage students to bring their own computers. Our experience at previous short courses, particularly the Oberwolfach Seminar which Sottile helped to organize and Theobald attended, demonstrated that having participants bring their own computers increases the level and intensity of the activity. In particular, the Traditions dormitory rooms all have internet connections.

2.1. **Experience in related programs.** We will take full advantage of the extensive experience that the staff and faculty in the Department of Mathematics at Texas A&M possess at running summer programs. For instance, every summer for the past six years the Mathematics Department has run a successful REU program with 20 students divided into two or three groups. Indeed, the REU grant at Texas A&M was recently renewed. Moreover, the Department is also very experienced at running regular conferences, including a recent IMA-funded conference on Geometric Group Theory and a yearly summer conference in Linear Analysis.

In May of 2002, our department hosted a CBMS conference featuring Bernd Sturmfels who lectured on "Solving Polynomial Equations" (now a book). It was preceded by a short course for graduate students to bring them up to the level of the main lectures, where the lectures were given by members of our faculty. At that meeting, there was an extremely successful computer lab involving installing and running some mathematical

software, in which both Sottile and Theobald participated. That experience was the genesis of our plan to have significant, hands-on-computer work as part of our Summer Graduate Program.

Last May 2006, our department organized another school for graduate students and recent Ph.D.s'. Professor John Little of Holy Cross College gave a 3-day short course on algebraic geometry codes, as part of the Texas Algebraic Geometry Seminar, a yearly weekend meeting of algebraic geometry faculty, postdocs, and students from Texas.

2.2. **Housing:** The participants will stay in off-campus conference housing, the Traditions dormitory, which is also used for summer REU programs. Among the amenities offered are community kitchens, pool and fitness center, aerobics room, multimedia room, big-screen TV lounges and surround sound movie theater. There are also individual and group study rooms with ethernet, and ten computer study rooms.

3. Merits of expanding the participant base

Because this summer school is funded by the IMA participating institutions, it is naturally limited to students who are affiliated with IMA participating institutions. Within a week of the first anouncement being put on the web, we received several inquiries from students who were interested, but were not from IMA participating institutions. We then contacted some of our colleagues at other (non-IMA PI) universities to guage potential interest among their students, and received a large and positive response. People at UC Berkeley, Stonybrook, Virginia Tech, UC Davis, and Texas Tech all expressed interest in sending 2-5 students, if there were funding. We also contacted people at Kansas, but they had no students who were interested. With this positive response (people at 5 of 6 departments expressing interest), we expect 20-30 additional students to apply to us for funding. Because of this, and the ceiling of $25,000 for this type of NSF grant, we also plan to ask the National Security Agency for funding.

The purpose of this proposal is to bring the benefits of this summer school to more students. In parallel with the IMA's registration process for students at IMA participating institutions, we will also accept applications from graduate students. This will not be limited to students whose institution does not currently participate with the IMA; we will consider applications from any US institution, including students at IMA participating institutions, as some will want to send more than two students. While we are asking for funds to support 13 additional student participants, we will consider offering some students partial support if conditions merit.

There are other reasons to increase the participant base and support the infrastructure of this program, besides interest among students and their advisors. The organizers and lecturers of this summer school are investing considerable time and effort in this project as a service to the mathematical community. Naturally we would like to see the benefits of our efforts shared widely. Furtermore, these students will be making friendships and contacts outside of their institutions which will be valuable in their future careers. Increasing the numbers from the 36 students the IMA expects to closer to 50 will increase such network effects. Also, paying directly for another postdoc mentor and, by supporting a speaker, freeing up funds for an additional mentor and for visits by outside experts will have a positive effect on the school as a whole.

This proposal asks for funding for the infrastructre of the summer school. One reason is for fairness to the IMA participating institutions, who are paying for the program. Assuming that 36 students come from IMA participating institutions, they will provide $70,000 to the program, of which $52,488, or 74.9% is to cover the expenses of the students, about $12,000 for the lecturers and assistants, with the remainder for social events. It is necessary that we preserve this ratio of about 75% to 25% between spending on student participants and on shared resources and program infrastructure. It is also clear that more students require more instructional support, and we have decided that the most cost-effective way to do that is to bring in postdocs (we have already contacted some who are interested). The postdocs will provide a link between the students and the faculty and give the summer school more of the feel of a true academic community.

Budget Justification

This proposal is requesting $25,000 for the following purposes:

Serkan Hoşten	$2954[1]
Postdoctoral mentor	$2768[2]
Miscellaneous	$324[3]
13 Students @ $1458[4] each	$18954

We are asking for 18954/25000 = 75.8% toward direct support of students and the remainder toward shared resources for the full Summer School. This reflects the breakdown in the use of the IMA Participating Institution funds. Our budget includes paying for an additional postdoctoral mentor; the additional student participants should not dilute the experience of the students from the IMA Participating Institutions.

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[1] $550 Transportation, $1404 = 13 days (hotel+perdiem=$69+$39). $1,000 Speaker Fee.

[2] $500 Transportation, $2268 = 21 days (hotel+perdiem=$69+$39).

[3] Photocopying, paper, supplies. Copies of the draft manuscript "Applicable Algebraic Geometry".

[4] $400 Transportation, $557 Dorm room ($27/day), $441 Meals ($21/day),
$50 Cox, Little, and O'Shea.

Provisional budget for the program

We describe the current budget for the IMA PI Summer Program (without any additional funding).

The Participating Institutions of the IMA will provide the bulk of the funding for the Summer School, $70,000. (Assuming 36 students come from IMA Participating Institutions). In addition, both the Mathematics Department and the College of Science at Texas A&M University have pledged $2,000, so that we have $74,000 available for the meeting.

Sottile will have approximately $3,000 remaining in his CAREER grant (DMS-0538734) in the category "Participant Support", which will be used where needed.

The $70,000 from the IMA and $4,000 from Texas A&M are is cost sharing.

Here is our current plan for spending this money.

Speakers:	
Sottile	No cost
Theobald	$2019[1]
Hosten	$2954[2]
Sullivant	$2954[2]
Theobald's assistant	$3468[3]
Outside expert	$724[4]
Students $1458[5] $\times$ 36	$52488
Social Events	$3000
Break food	$6000
Miscellaneous	$393[6]

[1] $1200 Transportation from Berlin and $819 for 21 days meals.

[2] $550 Transportation, $1404 = 13 days (hotel+perdiem=$69+$39). $1,000 Speaker Fee.

[3] $1200 Transportation from Berlin, $2268 = 21 days (hotel+perdiem=$69+$39).

[4] $400 Transportation, $324 = 3 days (hotel+perdiem=$69+$39).

[5] $400 Transportation, $557 Dorm room ($27/day), $441 Meals ($21/day), $50 Cox, Little, and O'Shea.

[6] Photocopying, paper, supplies. Copies of the draft manuscript "Applicable Algbraic Geometry".

Biographical Sketches

Biographical Sketch and Relevant Publications: Frank Sottile

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Texas A&M University
College Station, TX 77843, USA
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Phone: (979) 845-4169
FAX: (979) 845-6028
sottile@math.tamu.edu
Citizenship: U.S.A.

Professional Preparation

Michigan State University, Honors B.S. in Physics, 1985.
University of Cambridge, CPGS, Maths Tripos Part III, with distinction, 1986.
University of Chicago, S.M. Mathematics, 1989, and Ph.D. in Mathematics, 1994.

Appointments

Professor, Texas A&M University, Since September 2006.
Professuer Invité, Université Paris 6, November 2005.
Associate Professor, Texas A&M University, August 2004–August 2006.
Clay Mathematical Institute Senior Researcher, January–June 2004.
Assistant Professor, University of Massachusetts at Amherst, 2000–2004.
Van Vleck Assistant Professor, University of Wisconsin at Madison, 1999–2000.
MSRI Postdoctoral Fellow, Autumn 1998.
MSRI Postdoctoral Fellow, 1996–1997.
Term-Limited Assistant Professor, University of Toronto, 1994–1998.

Publications most related to project

(1) *Numerical Schubert calculus*, with B. Huber and B. Sturmfels, J. Symb. Comp., **26** (1998), 767–788.
(2) *Rational curves on Grassmannians: systems theory, reality, and transversality*, in "Advances in algebraic geometry motivated by physics (Lowell, MA, 2000)", E. Previato, Ed., Contemp. Math., **276**, Amer. Math. Soc., Providence, RI, 2001, 9–42.
(3) *Enumerative real algebraic geometry*, in Algorithmic and Quantitative Real Algebraic Geometry, L. Gonzalez-Vega and S. Basu, eds., DIMACS series volume 60, AMS, 2003. 139–180.
(4) *Toric ideals, real toric varieties, and the moment map*, in "Topics in Algebraic Geometry and Geometric Modeling", ed. by R. Goldman and R. Krasuaskas, Contemp. Math. 334, 2003. 225–240. (Proceedings of AGGM, Vilnius, Lithuania.)
(5) *New fewnomial upper bounds from Gale dual polynomial systems*, with Frédéric Bihan, Moscow Mathematical Journal, submited. `math.AG/0609544`.

Other publications

(1) *Intersection theory on spherical varieties*, with W. Fulton, R. MacPherson, and B. Sturmfels, J. Alg. Geom., **4** (1995), 181–193.
(2) *Schubert polynomials, the Bruhat order, and the geometry of flag manifolds*, with Nantel Bergeron, Duke Math. J., **94** (1998), 273–423.
(3) *Real rational curves in Grassmannians*, J. Amer. Math. Soc., **13** (2000), 333–341.

(4) *Lower Bounds for Real Solutions to Sparse Polynomial Systems*, with E. Soprunova. Advances in Mathematics, **204**, (2006), 116–151.
(5) *The recursive nature of cominuscule Schubert calculus*, with K. Purbhoo. Submitted. `math.AG/0607669`.

Synergistic Activities

(1) Taught short course of 8 lectures (12 hours) on "Real solutions to equations from geometry" at the Institut Henri Poincaré, November 2005.
(2) Chair of organizing committee (with Emiris, Goldman, and Theobald), IMA workshop on Non-Linear Computational Geometry, 29 May – 2 June, 2006.
(3) Chair of organizing committee, MSRI semester on "Topological Aspects of Real Algebraic Geometry". January – May 2004.
(4) Organizer, "Geometric Modeling and Real Algebraic Geometry", MSRI, 3–4 April, 2004.
(5) Co-organizer (with Prof. Dr. F.-O. Schreyer and C. Lossen) of DMV Oberwolfach-Seminar on Computational Algebraic Geometry. MFI Oberwolfach, 16–22 November 2003.

Collaborators in past four years:

M. Aguiar (Texas A&M)
N. Bergeron, (York University, Toronto)
F. Bihan, (Chambéry, France)
H. Brönniman, (Brooklyn Polytechnic)
L. Chen, (Ohio State)
H. Everett, (INRIA, Nancy, France)
J. E. Goodman, (CUNY)
C. Haase, (Freie Universität Berlin)
A. Holmsen, (Bergen, Norway)
C. Lenart, (SUNY Albany)
G. Megyesi, (Manchester, England)
R. Pollack, (Courant)
K. Purbhoo, (U. of British Columbia)
B. Reznick, (Illinois)
S. Robinson, (No affiliation)
L. Sgheri, (CNR, Firenze, Italy)
E. Soprunova, (Cleveland State)
S. Whitesides, (McGill University)
M. Beck, (San Fransico)
B. Bertrand, (Genève, Suisse)
T. Braden, (Massachusetts)
A. Buch, (Rutgers)
O. Devillers (INRIA, Sophia, France)
L. Garcia, (Texas A&M)
J. Griggs, (South Carolina)
C. Hillar, (Texas A&M)
S. Lazard, (INRIA, Nancy, France)
M. Longinetti, (Firenze, Italy)
A. Ortiz-Rodríguez, (UNAM, Mexico)
V. Powers, (Emory University)
K. Ranestad, (Oslo, Norway)
J. Ruffo, (Texas A&M)
C. Scheiderer, (Konsanz, Germany)
Y. Sivan, (Massachusetts)
T. Theobald, (Berlin)
A. Yong, (Minnesota)

Thesis Advisor: William Fulton.
Postdoctoral Advisors: Askold Khovanskii, Nantel Bereron, and Bernd Sturmfels.
Graduate Students: (All are current) Jim Ruffo, Corey Irving, and Abraham Martin Del Campo-Sanchez.
Postdoctoral Advisees: Greg Warrington (2000-3), Evgenia Soprunova (2002-2004), Frederic Bihan (2004), Seongchun Kwon (2004), Luis Garcia (current), Christopher Hillar (current), Maria Belk (current).

Laura Felicia Matusevich

Biographical Sketch

Professional Preparation:

Undergraduate institution		
Universidad Nacional de Córdoba, Argentina	Mathematics	Licenciada en Matemática, 1997.
Graduate institution		
University of California, Berkeley	Mathematics	Ph.D. 2002.
Postdoctoral institutions		
Mathematical Sciences Research Institute	Commutative Algebra	Postdoctoral fellow, Fall 2002.
Harvard University	Combinatorics and Algebraic Geometry	Benjamin Peirce Assistant Professor, Spring 2003 – Spring 2004. NSF Postdoctoral Fellow, Fall 2003 – Spring 2004.

Appointments:

- Texas A&M University, Assistant Professor (tenure-track) and NSF postdoctoral fellow, Fall 2005 – current.
- University of Pennsylvania, Assistant Professor (tenure-track) and NSF postdoctoral fellow, Fall 2004 – Spring 2005.
- Harvard University, Benjamin Peirce Assistant Professor (non tenure-track) and NSF postdoctoral fellow, Spring 2003 – Spring 2004 (my NSF Fellowship started on the Fall 2003).

Publications:

(Project-related)

1. Laura Felicia Matusevich and Uli Walther, *Arbitrary rank jumps in A-hypergeometric systems through Laurent polynomials.* To appear in *Journal of the LMS,* 2006.
2. Laura Felicia Matusevich, Ezra Miller and Uli Walther, *Homological methods for hypergeometric families. Journal of the AMS,* **18** (2005) 919–941.
3. Alicia Dickenstein, Laura Felicia Matusevich and Timur Sadykov, *Bivariate hypergeometric D-modules. Advances in Mathematics,* **196** (2005) 78–123.
4. Ian Dinwoodie, Laura Felicia Matusevich and Ed Mosteig, *Transform methods for the hypergeometric distribution. Statistics and Computing* **14** (2004) 287–297.

5. Laura Felicia Matusevich, *Exceptional parameters for generic A-hypergeometric systems. International Mathematics Research Notices,* **22** (2003) 1225–1248.

(Other significant)

6. F. Alberto Grünbaum and Laura Felicia Matusevich, *An identification problem for multiterminal networks: Solving for the traffic matrix from input-output measurements.* To appear in *Internet Mathematics,* 2006.
7. F. Alberto Grünbaum and Laura Felicia Matusevich, *A network tomography problem related to the hypercube. Contemporary Mathematics* **362** (2004) 189–197
8. F. Alberto Grünbaum and Laura Felicia Matusevich, *Explicit inversion formulas for a model in diffuse tomography. Advances in Applied Mathematics*, **29** (2002) 172–183.
9. Laura Felicia Matusevich, *Rank jumps in codimension* 2 *A-hypergeometric systems. Journal of Symbolic Computation,* Special issue on effective methods in rings of differential operators, **32** (2001) 619–641.
10. Laura Felicia Matusevich, *Rational summation of rational functions. Beiträge zur Algebra und Geometrie* **41** (2000) 531–536 .

Synergistic Activities:

Referee for four mathematical journals.

Organizer for the following conferences:

- *Bay Area Discrete Mathematics Day*, MSRI, Berkeley, October 2002.
- *Special session on hypergeometric functions: combinatorial and algebro-geometric aspects*, 2004 Fall Eastern Section Meeting, Pittsburgh PA, November 2004. Co-organizers: Eduardo Cattani, Alicia Dickenstein.
- *Special session on algebraic and enumerative combinatorics*, Joint Mathematics Meetings, San Antonio TX, January 2006. Co-organizers: Marcelo Aguiar, Joseph Kung, Catherine Yan.
- IMA Participating Institution Graduate Student Summer Program: *Applicable Algebraic Geometry*, Texas A&M University, July 23 – August 10, 2007. Co-organizers: Frank Sottile, Thorsten Theobald.

Collaborators in the past 2 years:

- Alicia Dickenstein, Universidad de Buenos Aires, Argentina.
- F. Alberto Grünbaum, University of California at Berkeley.
- Ezra Miller, University of Minnesota.
- Timur Sadykov, Krasnoyarsk State University, Russia.
- Uli Walther, Purdue University.

Other Affiliations:

- Thesis advisor: Bernd Sturmfels, University of California at Berkeley.
- Postdoctoral sponsor: Joseph Harris, Harvard University.
- Postdoctoral sponsor: Herbert Wilf, University of Pennsylvania.
- Postdoctoral sponsor: Catherine Yan, Texas A&M University.

Current and Pending Support of the PIs

Current and Pending Support of Sottile

National Science Foundation, DMS-0538734, CAREER Award, 2002-2007,
'Computation, Combinatorics, and Reality in Algebraic Geometry,
with Applications',
Investigator: Frank Sottile
Estimated Amount: $ 344,577.
Expiration Date: July 31, 2007.
Person-Months devoted to project: 3 acad. 2 summer.
Location: Texas A&M University.

"Applicable Algebraic Geometry: Real Solutions, Applications, and Combinatorics"
Investigator: Frank Sottile
Estimated Amount: $ 469,147.
Award period: 1 August 2007 — 31 July 2010.
Submitted to National Science Foundation,
Algebra, Combinatorics and Number Theory.
Person-Months devoted to project: 3 acad. 2 summer.
Location: Texas A&M University.

"Summer School on Applicable Algebraic Geometry"
Investigators: Frank Sottile and Laura Matusevich
Estimated Amount: $ 25,000.
Submitted to the National Science Foundation,
Algebra, Combinatorics and Number Theory.
Duration of award: July–August 2007
Location: Texas A&M University.

"Summer School on Applicable Algebraic Geometry"
Investigators: Frank Sottile and Laura Matusevich
Estimated Amount: $ 15,000.
Submitted to the National Security Agency
Duration of award: July–August 2007.
Location: Texas A&M University.

Current and Pending Support of Matusevich

National Science Foundation Postdoctoral Research Fellowship DMS-0303232
Investigator: Laura Felicia Matusevich
Start Date: July 1 2003
Expires: June 30 2007
Grant amount: $108,000
Location: Texas A&M University.

"Multivariate Hypergeometric Functions and Equations"
Investigator : Laura Felicia Matusevich
Estimated Amount : $199,968
Award Period : July 1 2007 – June 30 2010.
Submission planned in near future to National Science Foundation,
Algebra, Number Theory and Combinatorics.
Person-Months devoted to project: 3 academic years,
summer support for 2 months each of three summers.
Location: Texas A&M University

"Summer School on Applicable Algebraic Geometry"
Investigators: Frank Sottile and Laura Matusevich
Estimated Amount: $ 25,000.
Submitted to the National Science Foundation,
Algebra, Combinatorics and Number Theory.
Duration of award: July–August 2007
Location: Texas A&M University.

"Summer School on Applicable Algebraic Geometry"
Investigators: Frank Sottile and Laura Matusevich
Estimated Amount: $ 15,000.
Submitted to the National Security Agency
Duration of award: July–August 2007.
Location: Texas A&M University.