

VIGRE Third-Year Assessment

Department of Mathematics

University of Wisconsin – Madison

The University of Wisconsin–Madison began its VIGRE program in September, 1999. In this document we describe how our program has supported the long-range goal of increasing the number of U.S. citizens, nationals, and permanent residents who receive training for and subsequently pursue careers in the mathematical sciences. Crucial to this goal are (1) the broader preparation of undergraduate & graduate students and postdoctoral fellows for the multitude of career opportunities available with training in the mathematical sciences and (2) the initiation of educational activities that promote integration with research and education among students and faculty across academic age and departmental standing.

In our self-assessment we address the eight overlapping items as required by the National Science Foundation.

I. How well has the integration of research and education been achieved at all levels?

Traditionally, research and education have been well-integrated in our graduate and postdoctoral programs. Our graduate students take courses and participate fully in research seminars (as speakers, listeners, and discussants). They teach elementary undergraduate courses first as a leader of a discussion section associated with a faculty lecture, with the faculty member and an experienced TA coordinator acting as mentors, and later as the sole instructor of a class with a faculty member acting as general coordinator and mentor. Many graduate students participate, from time to time, in the Undergraduate

Math Club. Our graduate students do research, report on that research in seminars, and write theses, all under the supervision of a faculty member.

Our postdoctoral fellows (Van Vleck Visiting Assistant Professorships – usually 3 year appointments) are offered fellowships on the basis of strong promise of research in an area of interest to at least one faculty member. A quality teaching experience is also crucial in the selection process. Each postdoctoral fellow is assigned a faculty mentor in her or his area of research interest. This faculty member acts as mentor in both research and teaching, and plays a crucial role in the fellow's subsequent search for a tenure-track university appointment or a position in government or industry. Postdoctoral fellows participate fully in seminars where they come into contact with graduate students and often act informally as mentors for them. Most postdoctoral fellows are afforded an opportunity to teach a graduate course in their area of expertise. Postdoctoral fellows are encouraged to attend department meetings where they can participate in the discussion but are not allowed to vote; some fellows have taken great advantage of this educational opportunity to learn how a academic department functions.

Our undergraduate students have not been as fully integrated in the research and education activities of the department. We have had and continue to have many strong and effective programs. This begins with Wisconsin high school students (even some gifted middle school students) who participate in our

- *Math Talent Search Program*: 4 or 5 problems sets per year requiring ingenuity for their solution are sent to high schools (and are also available on the web); students work on the problems and send in their solutions that are subsequently read by some of our faculty. An Honors Day is held in Madison in the spring; the best 25 or so students are invited and they receive prizes and are recognized by faculty. They are also given an opportunity to compete for a 4 year \$16,000 scholarship to attend UW-Madison.

It continues with several other departmental programs:

- *Wisconsin Emerging Scholars Program*: a honors program in calculus with a goal of increasing the success of women, under-represented minorities, and rural students in calculus, thereby making available to them careers in the mathematical and other sciences.

- *Math Honors Sequence in Calculus and Linear Algebra (Math 275-6-7)*: a select sequence of courses for the brightest math students, intended to encourage students to eventually seek graduate degrees in the mathematical

sciences.

- *Math Club, Putnam Exam, Pi Mu Epsilon meetings, Wisconsin MAA meetings*: activities with faculty mentors and undergraduate and graduate participants, all meant to encourage and sustain interest in mathematics.

- *Applied Math, Engineering, & Physics (AMEP) Program*: an interdisciplinary program for broad training in mathematics, engineering and physics.

Except for some isolated cases, what has not been very prominent in the past is integration of research and other scholarly activity into our undergraduate program. Our VIGRE program has made substantial integration possible.

In 1999-2000 six undergraduates worked on a research project with individual faculty members, four supported by VIGRE funds and two receiving degree credit. In addition, thirteen undergraduate students, two graduate students (one of whom was on a VIGRE graduate fellowship) were part of Professor James Propp's *Spatial Systems Laboratory* – an Undergraduate Group Research Experience.

In 2000-01, four students worked on a research project with individual faculty members. In addition, six undergraduates, one non-VIGRE graduate student, and one VIGRE postdoctoral fellow participated in the Spatial Systems Laboratory run by Professor David Griffeath. In the spring of 2001, Professor Propp again ran the Spatial Systems Laboratory with nine undergraduates and one non-VIGRE graduate student.

[The Spatial Systems Laboratory (SSL) is a gathering of undergraduates, graduate students, and UW faculty engaged in exploring mathematical systems drawn from or inspired by the real world. These models are simple enough to simulate and prove theorems about, but rich enough in phenomena that one can expect explorations to generate insights that may be of interest to people outside of mathematics. In the fall semester of 2000-01 (D. Griffeath), SSL focused on deterministic and probabilistic cellular automata, interacting particle systems, percolation, and related models for complex spatial processes. The featured project for the spring semester (J. Propp) of 2000-01 was a team research effort focusing on a class of models called abelian sandpile models (though they have been invented several times, under names such as "the probabilistic abacus" or "the chip-firing game").]

Dr. Dan Knopf, one of our VIGRE postdoctoral fellows, is leading this year's Undergraduate Group Research Experience, the *Minimal Surfaces Lab*, with fourteen undergraduates. Two of our other VIGRE postdoctoral fellows,

Dr. Christopher Raymond and Dr. Rebecca Field, are also involved, and the members of the department's VIGRE committee act as mentors to them. In addition, there are at present two additional undergraduates working on individual research projects with a faculty member, and another taking an advanced reading course on a topic related to some work he did at an REU.

[The Minimal Surfaces Laboratory (MSL) will have both a pure-math and an applied-math interpretation. The motivation comes from the following practical problem. Suppose one is given the task of building an underground tank to store a prescribed quantity of liquid. Suppose too that the liner is the most expensive part of the project. If the cost of the liner is proportional to area, then it is well known that costs will be minimized if the tank has the shape of a sphere. (This is equivalent to the classical isoperimetric problem in differential geometry.) If the cost of the liner is not uniform, but varies with the depth and width of the tank, then one is led to consider the following problem: Given a cost function, find the shape of the tank that minimizes the expenses arising from surface area. A variety of cost functions will be considered. By starting with a sufficiently simple function, one can develop and test methods by rediscovering known results. Then unsolved questions that arise when one consider more general cost functions are to be investigated.]

II. How is our VIGRE program broadening education at all levels?

New courses have been developed in our undergraduate program that attract both undergraduates and graduate students (often from other mathematical sciences and engineering departments). These courses expose students to important mathematics used in industry and government agencies. With both undergraduate and graduate students in these courses and with students from several disciplines, interaction is promoted across areas and academic ages.

- *Math 415 Applied Dynamical Systems, Chaos, and Modeling*: an interdisciplinary course concerning flows, bifurcation theory, chaos, nonlinear problems, ... Reference is made to applications in mechanics, population dynamics, geophysical flows, chemical oscillators, ... Offered each academic year. Developed by Paul Milewski and others.

- *Math/CS/ECE 435 Cryptography*: an interdisciplinary course developed by three departments (Mathematics, Computer Sciences, and Electrical & Computer Engineering) on both classical and modern cryptosystems, including public key cryptography, the Data Encryption Standard (DES), and the

Advanced Encryption Standard (AES) recently approved by NIST. Offered each academic year by a faculty member in one of the three departments. Developed by Eric Bach, Richard Brualdi, and John Gubner.

- *Math 615 Mathematical Modeling and Consulting*: a new course aimed at graduate students in Mathematics and other fields. In this course faculty and researchers from other areas of science are invited to present unsolved problems and experimental data that they believe can be modeled mathematically. The focus is on researchers in areas where mathematical modeling is emerging as a vital tool: Life Sciences, Finance, Medicine. If the problems appear to be well defined for modeling, the students are grouped to work on their problem of interest (groups consist of a combination of mathematics students and students from the area of application). The course is led by a faculty member (Paul Milewski who is developing the course) together with a VIGRE postdoctoral fellow (Christopher Raymond for Spring 2000), and class time is spent with a combination of lectures on classical modeling tools, numerics, and discussions of the proposed problems. Examples of the topics of research in the first year were: Models for Currency Exchange Rates, Modeling of Immunogold Staining Rates, Gaseous Pesticide Dissemination in Soil, Dynamics of Faunal Population in an Experiment of Lake Acidification. The most successful project, on Immunogold Staining with Christopher Raymond (VIGRE postdoctoral fellow), Meta Voelker (Mathematics PhD student) and Ralph Albrecht (Professor, College of Agriculture and Life Sciences) has led to important new models for this problem and started new long term collaborations (Raymond and Albrecht are now collaborating in a research proposal through the NSF and NIH).

- *Math 319 Techniques in Ordinary Differential Equations* and *Math 322 Introduction to Partial Differential Equations*: The content of these two basic undergraduate courses has been modernized by Paul Rabinowitz with the introduction of a more active use of computers and the creation of sets of supplementary problems requiring computer computation.

In 1999-2000 and 2000-01, there was a biweekly VIGRE seminar over the lunch hour in which various faculty members, VIGRE postdoctoral fellows, graduate students, and undergraduate students talked about their research areas, or the research in which they were involved, at a level understandable to non-specialists. Two of the meetings were on education: use of technology in the classroom, and mathematics education in 2010 (prompted by an article that appeared in the AMS Notices by former NSF Math Sciences Head,

Don Lewis). Introductory talks on the use of mathematics were also given by people in the Departments of Biostatistics & Medical Informatics, Astronomy, Computer Sciences, and Business. In addition there were talks by a NW Airlines Consultant on practical aspects of the design and development of decision support system, by a Staff Research Scientist of the GM Research and Development Center of Manufacturing, Robotics, and Computational Geometry, and a talk by a faculty member of the Department of Engineering Physics on Tutankhamun's Chariots.

A talk by Professor Peter Lax on the paradox of education is scheduled for the VIGRE seminar in 2001-02. In this seminar we will have a series of talks by faculty on introduction to research areas within the department, and a series of talks by faculty in other departments who use mathematical modeling in their research.

These new courses and our seminar have had the effect of broadening the available education for both undergraduates and graduate students, and at the same time have exposed them to possible career opportunities outside of academia.

III. How has our VIGRE program improved the instructional training and communications skills of students and postdocs?

Before the fall semester begins, new TAs participate in a teacher training program in which they both observe and practice good teaching technique with faculty members and experienced TAs. During their first teaching experience they are assigned an experienced TA, a peer mentor. In addition, the faculty lecturer meets with the TAs regularly in order to discuss instructional issues.

Our graduate students are encouraged to participate in colloquia and seminars where they observe good (and sometimes not so good) communication practices. In addition, graduate students speak in seminars - including our VIGRE seminar - where they are critically observed by other seminar participants. Graduate theses are critically reviewed by advisors and undergo many revisions in general.

Undergraduates have improved their communication skills by working with faculty on either individual or group research projects that are funded by VIGRE, and then writing up their findings which are then critically reviewed by their faculty mentor. Our undergraduates have presented their findings at local Pi Mu Epsilon and Wisconsin MAA meetings, and also at Undergraduate Research Conferences at UW-Madison. Some of our under-

graduates have participated in, and have made presentations at, national and international conferences.

Each postdoctoral fellow has an assigned mentor in the fellow's area of expertise. This mentor acts as both teaching and research mentor. In addition, each course has a faculty coordinator who acts as mentor to those teaching the course. Our postdoctoral fellows teach a range of course from freshman level lecture courses to small, intermediate and advanced, classes, to graduate topics courses in their special research area. In the latter, there is usually at least one faculty member sitting in on the course who provides important feedback.

This year, one of our VIGRE postdoctoral fellows, assisted by two others, is leading an undergraduate research lab. This will require development of a very high level of skill in communication. Several faculty members are acting as mentors for this lab.

IV. What has been the effect of the mentoring programs that have been developed?

Our VIGRE program has enhanced and energized the mentor programs that have been in place in our Department for a long time. The VIGRE seminar, with attendance by undergraduate students, graduate students, postdoctoral fellows, and faculty has increased interaction across academic ages, and this interaction often takes the form of mentoring. In addition, this interaction has encouraged students and postdoctoral fellows to seek out, beyond the seminar, faculty for advice on educational, professional, and research concerns. To increase our effectiveness in mentoring our postdoctoral fellows, the Department, with cooperation from the VIGRE committee, has instituted group meetings of all postdoctoral fellows with the Chair and others to address concerns and provide information and advice.

An important component of our individual and group undergraduate research activities, which have increased tremendously as a result of our VIGRE program, is mentoring of students.

The new course Math 615 provides a forum for close mentoring (and interdisciplinary collaboration) of graduate students by postdoctoral fellows and faculty, and of postdoctoral fellows by faculty.

Our VIGRE postdoctoral fellows organize from time to time, late afternoon gatherings with VIGRE graduate fellows where educational, professional, and research issues are discussed.

V. How has our VIGRE program promoted recruitment into the

mathematical sciences?

- **With mathematics majors?**

Our VIGRE program for undergraduates, which has made research opportunities available to undergraduates, has made mathematics into a more visible and economically-viable major on campus. The responses that have been received from announcements about research opportunities (e.g. the Spatial Systems Lab and the Minimal Surfaces Lab) have been impressive, as have the contributions these undergraduates have been able to make. In addition, these programs have encouraged closer contact between undergraduates, and graduate students, postdoctoral fellows, and faculty and thus with the mathematics profession. Being part of the creation process in mathematics and, at the same time, getting paid for their work has both broadened mathematics education of undergraduates and shed new light on “the mathematician at work.” Undergraduates have also become aware of the fellowship opportunities for graduate study and for postdoctoral work made possible by VIGRE programs throughout the country. These fellowships act as important incentives for undergraduate students to pursue graduate study in mathematics.

- **With graduate students?**

The availability of fellowships for graduate study and for postdoctoral work has made graduate study in mathematics more attractive and financially possible. In the last three years the percentage of graduate students in mathematics who are U.S. citizens or permanent residents has been 54.1% (66), 72% (72), and 63.9% (74), respectively.

- **With minorities and other under-represented groups?**

Many of our VIGRE graduate fellowships have been awarded to women. Rebecca Field is one of our VIGRE postdoctoral fellows, and she is acting as a mentor for women in the Minimal Surfaces Lab. In the last three years the percentage of women among our graduate students has been 23.8% (29), 19% (23), and 22.4% (26), respectively.

VI. What is our VIGRE program doing to affect time to degree?

Although it is too early to give decisive figures about time to degree, VIGRE graduate fellowships have allowed many of our graduate students to concentrate more fully on their course work, qualifying exams, speciality exams, and thesis work, and consequently to decrease the time for completion

of these important milestones. (Dissertator status implies that a student had completed all course work and exams and is working on a thesis problem.)

In Appendix I under the Graduate Students heading, progress for those students receiving VIGRE fellowship support. This appendix includes information on both graduate students who were awarded VIGRE fellowships on entry and on-grounds graduate students awarded fellowships on the basis of making good progress towards the PhD. As is evident from this data, many of our students are on course to obtain the PhD in five years or less.

VII. Has there been effective dissemination to the mathematical sciences community of the results of this activity?

Information on our VIGRE program and activities is available on the website: <http://www.math.wisc.edu/~brualdi/vigre.html> Also our faculty attend many conferences and often VIGRE programs are discussed and compared.

VIII. Can we identify other changes that VIGRE made possible and that may not have occurred without VIGRE?

There is a new awareness among a substantial portion of our faculty that we need to pay more attention to seeking out and nurturing undergraduates with mathematical talent and encouraging them to continue on to graduate school in the mathematical sciences, and that interdisciplinary work in mathematics is vital for its continued development and public support.

Appendix I.

Previous institution and the placement institution for each recipient of a VIGRE stipend during the past two years.

Undergraduate Students at UW-Madison

- Lydia Diemer (Graduated with a joint degree in mathematics and art. Currently working for a high tech company. Plans to attend graduate school in about a year.)
- Ann Scheels (Currently a graduate student in mathematics at the University of Chicago)
- Paul Brodhead (Currently fulfilling a missionary obligation for the Mormon Church in Los Angeles. Expected to attend graduate school in mathematics upon its completion.)
- Suzanne Reichel (Currently a mathematics instructor at Wayland Academy)
- Kendra Nelsen (Current undergraduate at UW-Madison.)
- Brian Behlendorf
- Semmi Pasha (Current undergraduate at UW-Madison.)
- Blake Butkowski (Current undergraduate at UW-Madison.)
- Mark Chapman
- Adam Engelhart (Current undergraduate at UW-Madison.)
- Yu-Shan Fung (Working in information technology.)
- Geir Helleloid (Current undergraduate at UW-Madison.)
- Abraham Smith (Current undergraduate at UW-Madison.)
- Sandy Welander
- Jonah Johnson (Current undergraduate at UW-Madison.)
- Nick Pongratz (Current undergraduate at UW-Madison.)
- Rachel Dahl (Current undergraduate at UW-Madison.)
- Dominic Johann-Berkel (Completed a math major and graduated. Currently back in school to get secondary school certification for teaching mathematics.)
- Yang Qiao (Current undergraduate at UW-Madison.)

- Hal Canary (Currently working for Epic Systems Corporation, a software company in Madison. Plans to attend graduate school after some work experience.)
- Kristin Jehring (Current undergraduate at UW-Madison.)
- Dan Luu (Current undergraduate at UW-Madison.)

Graduate Students

- Timothy Cookson (Bach. Deg., Univ. Maryland 1997), Graduate Student at UW-Madison, 1997- . Dissertator status Aug. 2000.
- James Hamblin (Bach. Deg., Cornell Univ. 1997), Graduate Student at UW-Madison, 1997- . Dissertator status Aug. 2000.
- Matthew Petro (Bach. Deg., Univ. Michigan, 1997), Graduate Student at UW-Madison, 1997- . Dissertator status Aug. 2001
- James Cossey (Bach. Deg., Univ. Chicago, 1999), Graduate Student at UW-Madison, 1999- . Passed both qualifying exams.
- Kathryn Temple (Bach. Deg., Univ. Washington, 1999), Graduate Student at UW-Madison, 1999- . Passed both qualifying exams.
- Michael McQuistan (Bach. Deg., Univ. Nebraska, 1999), Graduate Student at UW-Madison, 1999- . Passed both qualifying exams.
- Scott Kempen (Bach. Deg., Marquette Univ. 1999), Graduate Student at UW-Madison, 1999- . Passed one of two qualifying exams.
- Joshua Ruston (Bach. Deg., Univ. Idaho 1999), Graduate Student at UW-Madison, 1999- . Passed both qualifying exams.
- Susan Forray (Bach. Deg., Whitman College 1999), Graduate Student at UW-Madison, 1999- . Passed one qualifying exam. Now an Acturarial Consultant at Milliman and Robertson.
- Aaron Weinberg (Bach. Deg., Willimas College 1999), Graduate Student at UW-Madison, 1999- . Passed both qualifing exams.
- Neils Schoenfelder (Bach. Deg., Univ. Alaska 1999), Graduate Student at UW-Madison, 1999- . Passed both qualifying exams.
- Matthew Bloss (Bach. Deg., Carleton College 1998), Graduate Student at UW-Madison, 1998- . Dissertator status Aug. 01.
- Aaron Miller (Bach. Deg., Bowling Green State Univ. 1998), Graduate Student at UW-Madison, 1998- . Dissertator status Jan. 2001.
- Andrew Raich (Bach. Deg., Williams College 1998), Graduate Student at UW-Madison, 1998- . Passed both qualifying exams.
- Paul Taylor (Bach. Deg., Univ. Saskatchewan 1998), Graduate Student at UW-Madison, 1998- . Passed both qualifying exams.

- Matthew Boylan (Bach. Deg., Univ. Wisconsin 1999), Graduate Student at Penn State Univ. 1999-2000, Graduate Student at UW-Madison, 2000- . Passed both qualifying exams.
- Rohit Chatterjee (Bach. Deg., Univ. Texas 2000), Graduate Student at UW-Madison, 2000- . Passed both qualifying exams.
- Michael Evans (Bach. Deg., Penn State Univ. - Erie, 2000), Graduate Student at UW-Madison, 2000- . Switched to Statistics.
- Clark Good (Bach. Deg., Univ. Texas 2000), Graduate Student at UW-Madison, 2000- . Passed one of two qualifying exams.
- Noah Kieserman (Bach. Deg., Dartmouth College 2000), Graduate Student at UW-Madison, 2000- . Passed one of two qualifying exams.
- Derek Moffit (Bach. Deg., Washington Univ. - St. Louis 2000), Graduate Student at UW-Madison, 2000- . Passed two qualifying exams.
- Emilie Wiesner (Bach. Deg., Washington and Lee Univ. 2000), Graduate Student at UW-Madison, 2000- . Passed one of two qualifying exams.
- Jaclyn Anderson (Bach. Deg. Univ. Nebraska 2001), Graduate Student at UW-Madison. 2000- . Passed one of two qualifying exams.
- Aaron Greenblatt (Bach. Deg. Duke Univ. 2001), Graduate Student at UW-Madison. 2000- .
- Asher Kach (Bach. Deg. Univ. Illinois 2001), Graduate Student at UW-Madison. 2000- .
- Trent Lalonde (Bach. Deg. Clarkson Univ. 2001), Graduate Student at UW-Madison. 2000- .
- Karl Mahlburg (Bach. Deg. Harvey Mudd College 2001), Graduate Student at UW-Madison. 2000- .
- Stephen Griffeth (Bach. Deg. Carleton College 2001), Graduate Student at UW-Madison. 2000- .

Postdoctoral Fellows

- Dan Knopf (PhD, University of Wisconsin - Milwaukee, 1999), VIGRE Postdoctoral Fellow at UW-Madison, 1999-2002.
- Christopher Raymond (PhD, Northwestern University, 1999), VIGRE Postdoctoral Fellow at UW-Madison, 1999-2002.
- Rebecca Field (PhD, University of Chicago, 2000), VIGRE Postdoctoral Fellow at UW-Madison, 2000-03.
- Jeremy Lovejoy (PhD, Penn State University, 2000), VIGRE Postdoctoral Fellow at UW-Madison, 2000-03.
- Charles McCoy (PhD, University of Notre Dame, 2000), VIGRE Postdoctoral Fellow at UW-Madison, 2000-03.

Appendix II.

A list of the faculty who participated in the VIGRE program during the past year, and their roles in the project.

- Richard A. Brualdi: Chair of Department's VIGRE Committee (VIGRE Grant PI)
- Marshall Slemrod: Member of Department's VIGRE Committee (VIGRE Grant PI); Mentor to VIGRE postdoctoral fellow Christopher raymond.
- Eric Bach: Member of Department's VIGRE Committee.
- Thomas Kurtz: Member of Department's VIGRE Committee.
- Paul Milewski: Member of Department's VIGRE Committee; Mentor to VIGRE postdoctoral fellow Christopher Raymond.
- Ken Ono: Member of Department's VIGRE Committee, mentor to VIGRE postdoctoral fellow Jeremy Lovejoy. Advisor of VIGRE graduate student.
- Paul Rabinowitz: Member of Department's VIGRE Committee.
- Donald Passman: Department Graduate Coordinator.
- Alejandro Adem: Mentor to VIGRE postdoctoral fellow Rebecca Field.
- Patrick Ahern: Advisor of a VIGRE graduate student.
- Sigurd Angenent: Mentor to VIGRE postdoctoral fellow Dan Knopf.
- Amir Assadi: Supervisor of, and mentor to, two VIGRE undergraduates in research.
- Georgia Benkart: Advisor of a VIGRE graduate student.
- Carl de Boer: VIGRE seminar participant. Member of panel on the impact of technology on undergraduate education.
- Mikhail Feldman: Mentor to VIGRE postdoctoral fellow Dan Knopf. Advisor of a VIGRE graduate student.

- David Griffeath: Organized the Spatial Systems Lab in Fall of 2000. Also supervisor of a VIGRE undergraduate in research.
- I. Martin Isaacs: Member of panel on the impact of technology on undergraduate education. Advisor of a VIGRE graduate student.
- Ken Kunen: Advisor of a VIGRE graduate student.
- Steffen Lempp: Mentor to VIGRE postdoctoral fellow Charles McCoy. Advisor of a VIGRE graduate student.
- Arnold Miller: Advisor of a VIGRE graduate student.
- Alex Nagel: Advisor of a VIGRE graduate student.
- Peter Orlik: Advisor of a VIGRE graduate student.
- James Propp: Organized the Spatial Systems Lab in Spring of 2001.
- Arun Ram: Supervisor of, and mentor to, a VIGRE undergraduate in research. Mentor to VIGRE postdoctoral fellow Rebecca Field. Advisor of a VIGRE graduate student.
- Joel Robbin: Advisor of a VIGRE graduate student.
- Amos Ron: VIGRE seminar participant.
- Andreas Seeger: Advisor of a VIGRE graduate student.
- Patrick Speissegger: Advisor of a VIGRE graduate student.
- Robert Wilson: VIGRE seminar participant. Member of panel on the impact of technology on undergraduate education.
- Tonghai Yang: Advisor of a VIGRE graduate student.