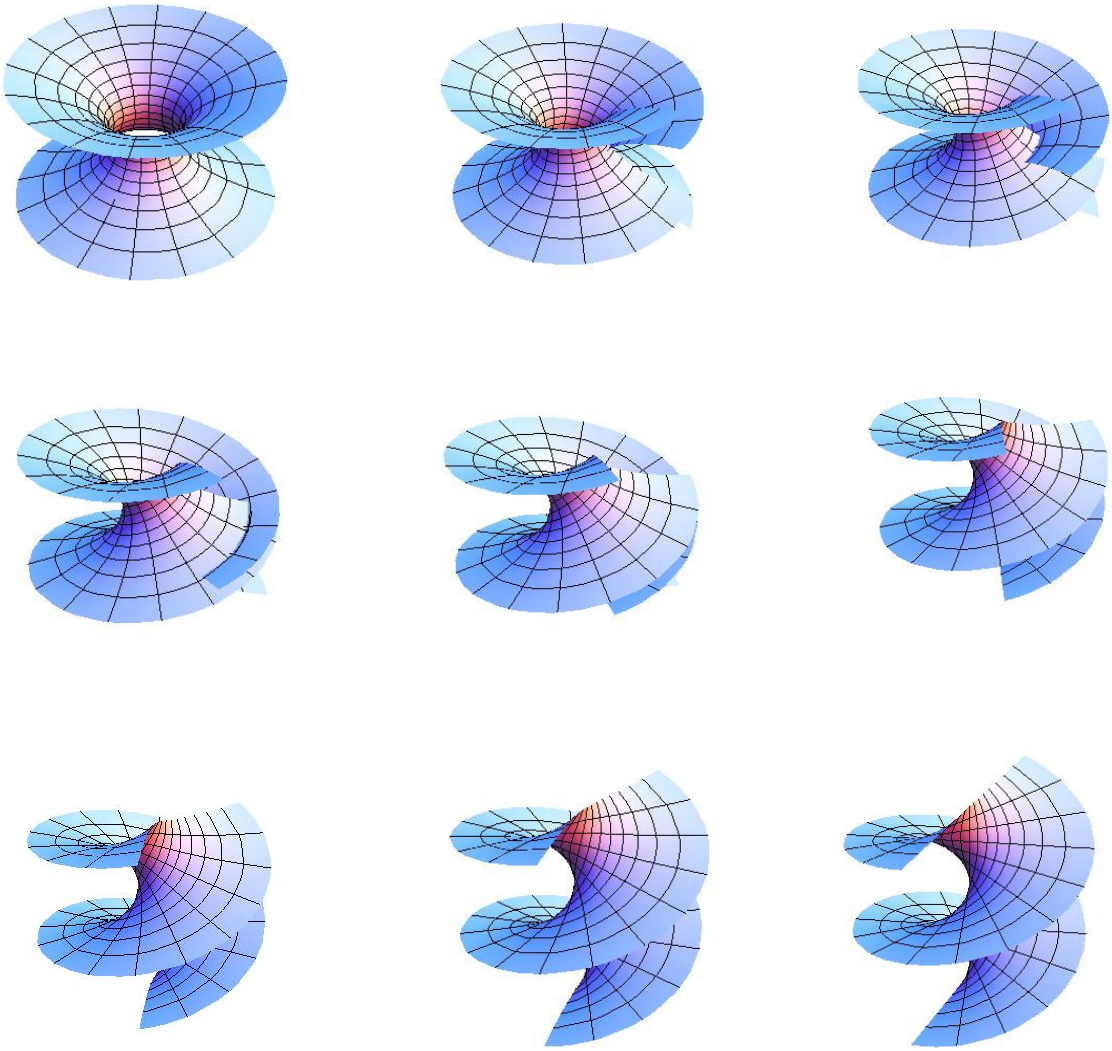
Polymath

(*Pol'e math*) A person of much or varied learning;
one acquainted with various subjects of study.

CAL POLY

Fall 2010, Number 32
Mathematics Department Newsletter
Cal Poly, San Luis Obispo, CA



The Catenoid can be continuously transformed into the Helicoid.

Minimal Surfaces

See Page 3
for
Cover Article

Contents

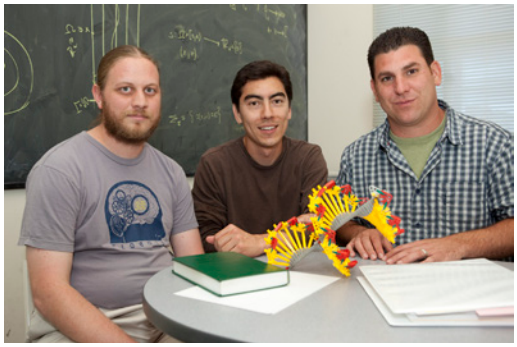
Letter from the Department Chair - Dr. Don Rawlings

In spite of furloughs and the hard economic times of recent years, I do have some very good news to report. Cal Poly has once again been rated the best public-master's university in the West by U. S. News and World Report, a distinction we've now earned 18 years in a row. At the College level, the groundbreaking ceremony for the new Center for Science and Mathematics (pictured on the left) took place on May 1. With a projected completion date of 2013, the new Center will be a powerful symbol of the primary role played by science and mathematics in our acclaimed polytechnic. Dean Bailey, who has worked tirelessly for 15 years on the realization of the new Center, is figuratively doing handstands.

At the Department level, we continue to be blessed with energetic, enthusiastic, and talented students. This past year, several of our students participated in external conferences; three made a joint presentation at the American Geophysical Union Fall 2009 Conference, four attended the joint American Mathematical Society-Mathematical Association of America meetings in January 2010, our three modeling teams made presentations at the annual meeting of the Golden Section of the Mathematical Association of America, and four of our students made presentations at the Northern California Undergraduate Conference at San Jose State University. Our students also contributed seven posters to our College's spring 2010 student research conference. You will find more details on our students' exploits inside.

Of course, Cal Poly's continued excellence relies to a large extent on those of you who support us through your donations. Your thoughtfulness is deeply appreciated by students and faculty alike. Thank You!

Cover Article: Minimal Surfaces by Ryan Ward and Richard Neufeld



Ryan Ward and Richard Neufeld with advisor Dr. Vincent Bonini

The study of minimal surfaces is deeply rooted in physical phenomena and often arises in physical applications. One of the original motivations for the development of the theory was the study of soap films that formed when dipping closed wires into soapy water. These films tend to form surfaces of least area and are minimal in the sense that their mean curvature is everywhere zero. In 1760, Joseph Lagrange recognized the connection between surfaces of least area and minimal surfaces, and he proposed the problem of showing the existence of minimal surfaces with a given boundary. This is now known as Plateau's problem, named after the Belgian physicist Joseph Plateau for his experiments with soap films. Investigations into Plateau's problem spawned new techniques in differential geometry, partial differential equations, the calculus of variations, and complex analysis.

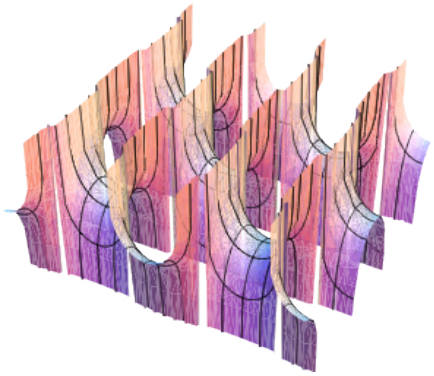
Prior to the 18th century, the only known minimal surface was the plane. This changed when Jean Baptiste Meusnier discovered the first nonplanar minimal surfaces, the catenoid and the helicoid (pictured on the cover).

The curvature of a curve parametrized with respect to arc length is defined pointwise by the magnitude of the curve's acceleration vector. Intuitively, the curvature of a curve measures how rapidly the curve is bending and can be thought of as a pointwise measure of how the curve deviates from being a straight line. The principle curvatures at a point p on a surface M in $\mathbb{R}^3$ are the extreme values of the curvature of all curves in M passing through p. The mean curvature measures the average of the principle curvatures and is defined pointwise by $H=1/2\ (k_1+k_2)$ where k_1 and k_2 denote the maximal and minimal curvatures, respectively. A minimal surface in which the mean curvature is zero everywhere therefore has a saddle point at every point.

Using the calculus of variations, it can be shown that, within the scope of normal variations, a surface is minimal if and only if it is a critical point of the area functional. In this context, it then follows that surfaces of least area with a given boundary are area minimizers and therefore are necessarily minimal surfaces. Perhaps one of the most beautiful aspects of the theory of minimal surfaces is that it provides an explicit realization of a deep connection between geometry and differential equations. In particular, surfaces that arise as the graphs of smooth functions $f(x,y)$ can be parameterized by smooth maps of the form $x(u, v) = (u, v, f(u, v))$ and a straight forward computation then leads to the minimal surface equation for graphs, $(1 + f_v^2)f_{uu} + 2f_u f_v f_{uv} + (1 + f_u^2)f_{vv} = 0$.

Cover Article (continued)

Placing algebraic and geometric restrictions on surfaces is a common theme in the classification of minimal surfaces. For example, assuming a surface is defined by a graph of a function of the form $f(x, y) = g(x) + h(y)$, one can explicitly solve the resulting differential equation to find the minimal surface solution defined locally by the graph of the function $f(x, y) = (1/a)\ln(\cos(ax)/\cos(ay))$. This surface was discovered by Heinrich Ferdinand Scherk in 1835 and is accordingly known as Scherk's minimal surface. Note that although the depicted surface can be realized locally as a graph, its domain of definition is not the entire plane.

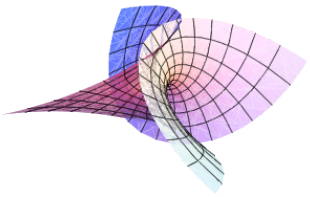


Scherk's Minimal Surface

Other geometric restrictions can be placed on surfaces that result in certain types of classifications. For instance, the catenoid can be classified as the only nonplanar minimal surface of revolution and the helicoid can be classified as the only ruled nonplanar minimal surface. Although the classification of minimal surfaces has been studied since the days of Lagrange, it is still a current topic of modern research. One of the most celebrated classification results in minimal surface theory, which pertains to all surfaces that arise as the graph of a function, is Bernstein's theorem.

Bernstein's Theorem. Let M be a minimal surface which arises as the graph of a function $f(x, y)$. If M is defined over the entire xy-plane, then M is a plane.

Perhaps one of the most elegant proofs of Bernstein's theorem follows from the Weierstrass-Enneper representation of minimal surfaces. The Weierstrass-Enneper representation has proved fundamental in relating the study of minimal surfaces to the theory of complex analysis and allows one to construct parameterizations of minimal surfaces from certain pairs of meromorphic functions. For example, the Weierstrass-Enneper data $(f,g)=(1,z)$ gives a parameterization for Enneper's surface. In fact, if $(f,g)=(1,z^n)$ for a positive integer n, then one obtains an n^{th} order Enneper surface.



First Order Enneper's Surface

Weierstrass-Enneper representations of minimal surfaces lead to infinite families of minimal surfaces and can be used to realize a continuous deformation of the catenoid into the helicoid such that every member of the deformation family is locally isometric and minimal. The continuous deformation of the catenoid into a helicoid depicted on the cover is a direct consequence of Weierstrass-Enneper representation of the associated family of minimal surfaces of the catenoid and is defined by the transformation

$$x(u,v)=\cos(t)\cos(v)\cosh(u)+\sin(t)\sin(v)\sinh(u)$$
$$y(u,v)=\cos(t)\cosh(u)\sin(v)-\cos(v)\sin(t)\sinh(u)$$
$$z(u,v)=u\cos(t)+v\sin(t)$$

where $t=0$ represents a catenoid and $t=\pi/2$ represents a helicoid.

Summer Research Program 2010

Six Cal Poly Mathematics Department faculty members and 15 undergraduate and graduate mathematics majors worked on research projects during the spring and summer of 2010. These projects were funded by the Cal Poly College-Based Fee Initiative.

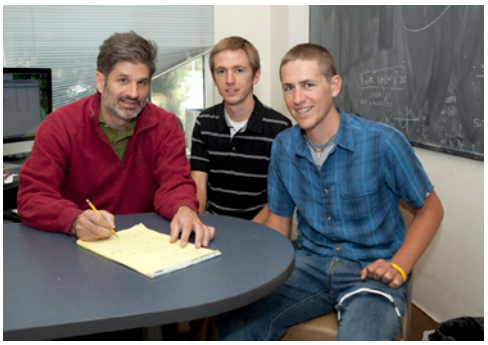
Dr. Caixing Gu (right) with Maro Tsiifte, Hugo Campos, and Emily Callahan

Dr. Gu worked with students Maro Tsiifte, Hugo Campos, and Emily Callahan on a project titled "Finding the minimal realization (algorithmically) of a class of rational functions of several variables."

The realization theory of rational functions of one variable is fundamental and important for many applications in scientific computations. The key is to find matrix A of minimal size so that

$$((p(z))/(q(z)))=b(I-zA)^{-1}c,$$

where p and q are two given polynomials with degree of p less than the degree of q, b is a row vector and c is a column vector to be found. In the one variable case, one can actually write down b,c and A explicitly in terms of the coefficients of p and q.



Dr. Mark Stankus with Wade Dillon and Sean Gasiorek

Dr. Stankus and students Wade Dillon and Sean Gasiorek worked on understanding the solution set of a variety of matrix equations.

Dr. Todor Todorov worked jointly with student James Hall on a research program on "Completeness of Totally Ordered Fields." As an application, they produced seven different settings of axioms of the reals - some of them seem to be new. Using the methods of non-standard analysis they constructed varieties of non-Archimedean fields which are either saturated or Cantor complete. They will have a manuscript ready for publication this fall.

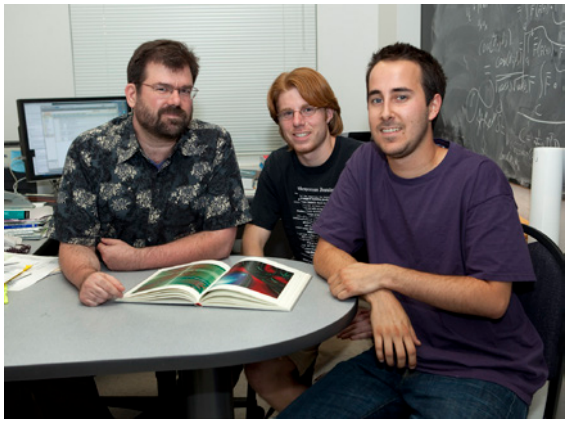
Dr. Todor Todorov with James Hall

Summer Research Program 2010 (Continued)

Dr. Mark Stankus with
Anna Kopcrak and Kevin Lamb

Two students, Anna Kopkcrak and Kevin Lamb, worked with Dr. Mark Stankus on the problem of algorithmically decomposing a non-commutative expression into a composition of two expressions where the first has a single unknown. This type of symbolic computation is important for analyzing problems in control and systems engineering.

Dr. Charles Camp worked with students Nathan Taylor and Brent Davis investigating properties of Empirical Mode Decomposition (EMD), a new time series analysis technique, and its application to climatic time series. Applying EMD to Antarctic ice cores and other paleoclimate records, they were able to identify and extract behavior associated with the Milankovitch orbital cycles of the Earth. This work was partially supported by the NSF.



Dr. Charles Camp with
Nathan Taylor and Brent Davis

Dr. Morgan Sherman with Ryan
Milhous, Erin Kelly, and Alex Bozarth

The Hilbert scheme is a parameter space lying at the heart of the rich subject of algebraic geometry. Geometrically, it can be thought of as a parameter space whose points correspond to various geometric objects all sharing some common traits. This past summer Ryan Milhous, Erin Kelly, and Alex Bozarth examined a particular type of Hilbert scheme which has been receiving a considerable amount of attention in recent years: that which parametrizes all possible configurations of n points in complex d space. Algebraically, it can be described as the set of all ideals J in the ring R of polynomials in d variables with complex coefficients such that the quotient ring R/J is a vector space of finite dimension n.

2009 - 2010 Honor Roll

HONOR ROLL OF CORPORATIONS, FOUNDATIONS & ORGANIZATIONS

The Department of Mathematics is grateful to the following corporations, foundations, and organizations who made gifts for general and special purposes and for matching gifts.

Educational Advancement Foundation
Pacific Gas and Electric Company
Microsoft Corporation
Wells Fargo & Company
IBM Corporation
Intel Corporation
Intuit
Lockheed Martin Corporation
Science Applications International Corp

HONOR ROLL OF INDIVIDUALS

The Department of Mathematics wishes to thank the following individuals for their contributions and support.

PRESIDENT'S ROUND TABLE
$5,000 - $19,999

Donald B. Gibson
Marjorie L. Hanks and
**Charles J. Hanks*

CENTENNIAL SOCIETY
$2000 - $4,999

Robert P. Balles

**Deceased*

DEAN'S HONOR ROLL
$1,000 - $1,999

Stephen J. Corcoran and
Jacqueline Wyland
David M. and Molly P. Evans
Debra L. Magana
Paul F. and Barbara J. Murphy
Gary M. Schare

COLLEGE CABINET
$500 - $999

Anonymous Donor
Victoria L. Flavell
Gary A. Gale
Myron and Sue Hood
Jennifer A. Martin
Brian K. and Susyn C. Normington

DEPARTMENT COUNCIL
$250 - $499

John W. Abbott
Anonymous Donor
Jay A. Austin
Donald A. and Sandra R. Berezin
Frank A. Blesi and
Susan L. Marietta
John L. and Nancy E. Cook
Richard L. and Ann M. Friberg
Robert J. and Barbara Gulliford
James E. Harris and Anna C. Fraker
Diane and Donald Jackson
Sharon M. Kuge
Barbara L. Martinelli
Brian M. McCay
Craig J. and Leslie V. Nelson
Charles A. Pasquini Jr.
Sharon D. Raney
Cami A. and Terry R. Reece
Mark Stankus
T. William and Khanh N. Van Oss
Andrew P. and Susan L. West

COLLEGE PARTNERS
$100 - $249

Alexis H. and Tyler M. Barry
Barbara R. Bengry
Mark J. and Ramona E. Bujulian
Eric W. Burdick
James V. and Beverly A. Carlson
Michael F. and Nancy K. Chase
Gaylen M. and George F. Clark
Douglas N. Cummings
Doren E. Curtiss
Stephen K. Davis
Rose M. De Palma
Dale R. Durran and Janice K. Tervonen
Burl E. Estes
Sandra A. Foster-Patino
Donna J. and Jay B. Fox
Randall H. Garacci
James E. Georges and
Renata M. Cioczek-Georges
John L. Glaze
Leah J. Griffith
Jody Ann S. and John W. Jacobs
Margret E. Jacoby
Edward C. and Awilda B. Jarrett
Patricia M. and Patrick M. Kawaguchi
Bob and Lisa M. Kernaghan
Kent M. and Nancy N. Kilborn
Dan E. and Nancy E. Littrell
Leslie L. Livesay
Maureen P. McDonough
Elizabeth A. and Ross I. Miyazawa
Douglas R. and Karen B. Morgan
James C. Nosler
Mary E. and Philip H. Pattengale
Richard B. and Camilla Pember
Robert O. and Ann D. Ray
Robert M. Reinsch
Kevin R. and Pamela R. Reynier
Robert H. and Carol Schmiederer
Margery L. Segraves
Florence L. and Richard D. Shahbazian
Grant T. Shimada
Laurice Sommers
Carrie A. and Kevin Starbird
Gary L. and Patricia R. Thwing
Neal R. and Lucille Townsend
Gordon S. and Ann H. Umemoto
David G. Vandermolen
Karen E. Watson
Gregory L. and Nan L. Wojcik
Brian C. and Nancy E. Wright
Christy M. and Louis A. Yaussi

Every effort has been made to list our donors correctly. If there is an error, please bring it to our attention immediately. We apologize in advance if there is an omission.

2009 - 2010 Graduates

Bachelor of Science

Matthew Robert Adams
Victoria Dyan Boden
Allan R. Boone*
Scott Norman Cairney
Adam Brandon Chambers
Brenda Elizabeth Cisneros
Stefanie Lynne Cohen
Emilie Catherine Deshon
Leigh Robert Finley
Kevin Hauenger Finn**
Marijke Maria Fox
Kimberly Dawn Francl
Logan Metheny Gantner
Thomas Ryan Harris
Lauren Jessica Huyck
Erin Elizabeth Kelly
William Troy Lewis
Sedric Chad Mart
Michael Anthony Mazzella
Max Jacob McCorkel
Clayton Edward McFerran
Ryan Hartman Milhous
Jerry B. Miszewski
Cesar H. Preciado Rodriguez
Kendall Marie Rosales***
Courtney Ann Sauers
Paul Derek Sinz*✧
Austin Lee Snyder
Minerva Soto
Sarah Elizabeth Spence
Molly Marie Stites
Mark Clifford Stolan
Raquel Ugues
Nicholas Edward Varner
John Huan Vu
Lindsay Allison Weed
Davina Elaine White

♦ ***Cal Poly Scholar***
✧ ***Honors Program***
* ***Cum laude***
** ***Magna cum laude***
*** ***Summa cum laude***

Master of Science

Allan R. Boone△
Jessica Fabricant Ellis
Thomas Ryan Harris

△ ***Graduating with Distinction***

Alumni News

Steve Strand, Masters Degree recipient in 2008, is at Portland State University.

He says that Portland State is treating him quite well. He will have finished (and passed) all of his comprehensive exams in his first year. He has some great professors to work with and study under; overall, he says it's a pretty good department. He wishes there was a bit more Math and less Ed involved in the program, but he knows it's making him a better teacher already. He's looking to focus on the teaching and learning of Calculus and Analysis.

Josh Hill, Masters Degree recipient in 2007, is at the University of California at Irvine.

Josh has now been at UCI for two years. He has passed all of his written exams and has a thesis advisor, Daqing Wan, in the area of Algebraic Number Theory. He's not yet sure what the actual area of his research will be. In the coming year, he'll be taking a class in algebraic geometry and then some reading courses. He hopes to advance to candidacy in the next year and then work on his thesis.

Bob Moss, Bachelors Degree and Masters Degree recipient in 1971-'72.

Bob just retired in January after a successful career with the County of San Luis Obispo as a systems and programming manager, and a software specialist with computer and software enterprises, also in San Luis Obispo. In the next chapter of his life, he is planning to travel, play racquetball and volunteer.

Dale Durran, Bachelors Degree recipient in 1974.

Dale is currently Professor and Chairman, Department of Atmospheric Science, at the University of Washington (he is also an Adjunct Professor of Applied Mathematics). Dale writes that after seeing the call for alumni news in the last issue of Polymath, he figured he should respond, since he has made the same request of the alumni of the Department of Atmospheric Sciences at the University of Washington, where he was the author of their annual newsletter. They use lots of mathematics in the atmospheric sciences, so he is still doing various flavors of applied mathematics. The second edition of his book, "Numerical Methods for Fluid Dynamics: with Applications to Geophysics" (Springer, Texts in Applied Mathematics) is coming out later this year. He lives in Seattle with his wife, Jan, and he manages to get his sea kayak into the water several times a year.

What's New With You?

We would love to hear from you!

Please drop us a line and let us know what you'd like to share in the "Alumni News" of *Polymath*. Please include your degree, your graduation year, and any professional and/or personal information you wish to share with the Cal Poly mathematics community. A picture of you or your family along with your story would be great!

Please return your "Alumni News" submission to *Polymath* Editor, Mathematics Department,California Polytechnic State University, San Luis Obispo, CA 93407-0403, or **E-Mail updates to**: math@calpoly.edu

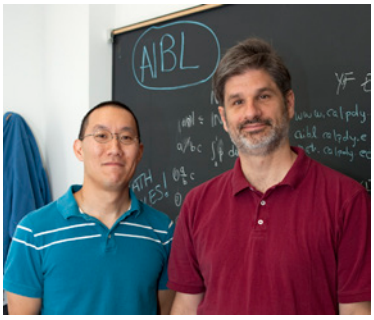
2010 Department Photo

Front Row - Left to Right:
Colleen Kirk, Staci Pearson, Wade Dillon, Suzanne Lavertu, Katie Vaughan, Kendall Rosales, Erin Kelly, Lawrence Sze, Elsa Medina, Ray Terry, Marian Robbins, Maureen Rosenberg, Sheryl O'Neill, Carole Simard, Mike Mogull and Paul Choboter.

Middle Row:
Isaac Comelli, Liz Czapla, Bill Demarest, Jeff Liese, Vincent Bonini, Al Jimenez, Joe Borzellino, Todor Todorov, Clint Hahlbeck, Don Hartig, Don Rawlings, Mike Robertson, Adrienne Riley, Casey Kelleher, Linda Patton, Harvey Greenwald, Sam Saiki, Amelie Schinck, Richard Neufeld, Nathan Taylor, Garrett Bates and Stan Yoshinobu.

Back Row:
Jonathan Shapiro, Ben Richert, Sean Gasiorek, Anton Kaul, Morgan Sherman, Tony Mendes, Mark Stankus, Dave Camp, Dylan Retsek, Todd Grundmeier, Bill Hesselgrave, and Logan Lossing.

2010 AIBL Program



Stan Yoshinobu and Mark Stankus are director and co-director of a new national organization called The Academy of Inquiry Based Learning (AIBL). AIBL is an association of professors, instructors, teachers and non-teaching supporters (such as retired professors or teachers having IBL experience, administrators, and foundation personnel) who are committed to developing and disseminating inquiry-based learning (IBL) techniques. The Academy supports instructors through conferences, workshops, mentoring, small grant programs, and curriculum development. People interested in learning more about AIBL can go to www.inquirybasedlearning.org or contact Stan Yoshinobu (styoshin@calpoly.edu).

Faculty Publications and Activities 2009-2010

Publications:

Todd Grundmeier (with C. Simard) *Influence of an Inquiry-Oriented, Technology-Based, Proof-Intensive Geometry Course on the van Hiele Levels of Prospective Mathematics Teachers,* Proceedings of the SITE Conference, San Diego, CA, March/April 2010.

Dana Paquin, (with P. Kim, P. Lee, and D. Levy), *Strategic Treatment Interruptions During Imatinib Treatment of Chronic Myelogenous Leukemia*, Bulletin of Mathematical Biology, June 2010

Linda Patton, *Norm Inequalities for Composition Operators on Hardy and Weighted Bergman Spaces*, Operator Theory: Advances and Applications, Vol. 202, 265-272, 2010.

Don Rawlings (with M. Tiefenbruck), *Consecutive Patterns: From Permutations to Column-Convex Polyominoes and Back*, Electronic Journal of Combinatorics, 17 (2010) no. 1, R62. Don Rawlings presented this paper at the Permutation Patterns 2010 conference at Dartmouth College, August 2010.

Talks and other activities:

Charles Camp was presenter for the "Science of Climate Change: Middle & High School Standards" workshop held at Cal Poly and organized by CESaME as part of the Central Coast Science Project, June 28 - July 2, 2010. This was a week-long intensive teacher workshop introducing middle and high school science teachers to the fundamentals of climate science.

Charles Camp was a lecturer for the "Summer Graduate School on Climate Change" hosted by the Institute for Mathematics Applied to Geosciences (IMAGe) at the National Center for Atmospheric Research (NCAR) in Boulder, CO, August 8-12, 2010. This was a two-week workshop introducing graduate students in mathematics to some of the central ideas and techniques of mathematical climate science and engaging them in the process of uncovering the key mathematical problems of the area.

Charles Camp was an Invited Speaker, 2010 Meeting of the Americas, Foz do Iguassu, Brazil, August 8-12, 2010; "Transient Climate Sensitivity as Constrained by Observation" in the *Scale Interactions, Climate Sensitivity, and Feedbacks: Uncertainties for Projecting Global and Regional Climate Responses* session. This international conference was sponsored by many of the geophysical associations in the western hemisphere including the American Geophysical Society.

Charles Camp is Co-PI: Mathematics and Climate Research Network grant, funded by the NSF, establishes a virtual community of researchers in mathematics and the geosciences at 13 institutions: Bowdoin College, Cal Poly, San Luis Obispo, New York and Northwestern Universities, and the Universities of Arizona, California at Berkeley, Chicago, North Carolina at Chapel Hill and at Asheville, Minnesota, Utah, Vermont, Washington. The network researchers will also work closely with climate scientists at research centers such as the National Center for Atmospheric Research, the National Climatic Data Center, and the Los Alamos and Oak Ridge National Laboratories.

Todd Grundmeier (with C. Simard) *The van Hiele Levels of Prospective Secondary Mathematics Teachers. Annual Meeting of the Association of Mathematics Teacher Educato*rs, January 30, 2010.
Award: This presentation received the National Technology Leadership Initiative (NTLI) award from AMTE.

Jeff Liese gave a talk titled *Generating Functions for Wilf Equivalence under Generalized Factor Order* at the Permutations Patterns 2010 conference at Dartmouth College, August 2010.

Jeff Liese, Anthony Mendes, and **Don Rawlings** are the local organizing committee for Permutation Patterns 2011, which will be held at Cal Poly, San Luis Obispo, in June 2011.

Don Rawlings was an invited speaker in the Special Session on Mathematical Models of Random Phenomena at the AMS 2010 Fall Western section meeting at UCLA, October 2010.

Mark Stankus received a grant from the Educational Advancement Foundation for teaching using Inquiry-Based Learning.

Putnam Math Competition 2009

In December 2009, the Cal Poly team, coached by Morgan Sherman (second from left), consisted of Paul Coombs, Allan Boone, and Kevin Lamb. A total of 15 Cal Poly students participated in this year's Putnam Competition. The team placed 114th out of 546 teams entered in the competition. The high scorer from Cal Poly was Paul Coombs (far left), with a score of 30, followed by Alex Eames (sixth from left) with 20 points.

Mathematical Contest in Modeling 2010

Cal Poly, led by coach Lawrence Sze, had three teams in the Mathematical Contest in Modeling. Team 6247 consisted of Jeremy Kun, Erin Kelly, and Molly Stites. Team 6248 consisted of Kevin Lamb, Alex Eames, and Troy Lewis. Each of these teams tackled the problem of finding a serial killer. Team 8158 consisted of Dana Duke, Nathan Taylor, and J.P. Horton. This team tried to model a baseball bat and find the sweet spot. Each team was given a "Successful Participant" designation.

You can see all of the results of the Mathematical Contest in Modeling at the following website: http://www.comap.com/undergraduate/contests/mcm/contests/2010/results/

End-of-Year BBQ and Softball

Undergraduates
VS.
Faculty and Grads

The Faculty Team won this round, 20-16 in seven innings. This extended the Faculty Team's winning streak to two games.

Seventh Annual Math Awards Banquet

Robert P. Balles Mathematics Scholarships
Jeremy Kun and James Hall, with
Department Chair Don Rawlings

Raytheon Company Scholarship
Matthew Roy, shown with
Department Chair Don Rawlings

Katrina J. Killgore Memorial Scholarships
Cierra Rawlings and Emily Peterson with
Department Chair Don Rawlings

George H. McMeen Scholarships
Arianna Kinsella, Alyssa Eubank,
Michael Ion, and Khoa Nguyen
(not shown is Jennifer Gildner) with
Department Chair Don Rawlings

Ralph M. Warten Memorial Scholarship
Hugo Campos, Jessica Meyers, Logan Lossing, and Dana Duke
(not shown is Justin Ferguson) with Department Chair Don Rawlings

Volmar A. and Viola I. Folsom Scholarships
Levi Reynaga, Shawn Garrity, Katherine Chiccone, and
Brent Davis (not shown are Elizabeth Baldwin and Ryan
Milhous) with Department Chair Don Rawlings

W. Boyd Judd Award
Matthew Roy
shown with Anita and Carol Judd

George C. Laumann Scholarships
Casey Kelleher (not shown is Ian Painter)
with Department Chair Don Rawlings

Robert Noyce Scholarships
Michelle Shaffer, Kimberly Velasquez, Lindsay
Weed, Nathan Meinert, and Elle Meulman (not
shown are Desiree Partlow and Eric Vallecillo)
shown wth Professors Todd Grundmeier
and Elsa Medina

Marie Porter Lehman Math Educator Scholarship
Kathryn Vaughn
shown with Professor Elsa Medina

Ralph E. Weston Memorial Award
Paul Coombs (not show is Alex Eames) shown with
Putnam Team Coach, Professor Morgan Sherman

Kappa Mu Epsilon Founders Award
Anna Kopcrak
shown with KME advisor
Professor Jonathan Shapiro

TC Reece Mathematics Award
Erin Kelly with Cami Reece

Outstanding Students

Outstanding Teaching Associate
Jessica Ellis
shown with Professor Todd Grundmeier

Charles J. Hanks Excellence in Mathematics Award
Paul Coombs, Nicholas Varner, and Joshua Pollitz, shown
with Department Chair Don Rawlings

Outstanding Mathematics Educator Awards
Lindsay Weed and Sarah Spence, with Professor Elsa Medina

Outstanding Junior in Mathematics
Jessica Meyers
shown with Department Chair Don Rawlings

Outstanding Seniors in Mathematics
Allan Boone, Paul Sinz, and Kendall Rosales with
Department Chair Don Rawlings

Bryant Russell Memorial Award
Logan Gantner, shown with
Department Chair Don Rawlings

Note: Please send us your new address if it differs from the one on the mailing label!

Polymath is published by the Mathematics Department.
Inquiries, suggestions and comments are welcome.

Faculty Editor, Production Editor, and Graphic Design:
Jonathan Shapiro

Photographer: Jonathan Shapiro, with photo contributions from others

Phone: 805-756-2206
FAX: 805-756-6537
E-mail: math@calpoly.edu
Web: math.calpoly.edu

CAL POLY

California Polytechnic State University
MATHEMATICS DEPARTMENT
SAN LUIS OBISPO, CA 93407-0403