



# Quaternion

Department of Mathematics Newsletter

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## CHAIRMAN'S COMMENTS

Recently, I have been reading some interesting papers that pose questions that should be of interest to all who are involved in teaching and learning mathematics. The questions relate to (a) how people learn mathematics and (b) what is the nature of mathematics. According to Ed Dubinsky of Purdue University, for each mathematics educator there is an intimate relation between his/her beliefs and answers to these questions and how he/she teaches mathematics.

Here are four possible beliefs about how people learn: spontaneously, inductively, constructively, and pragmatically. Each belief has implications for teaching. If students learn individually and spontaneously, there is little that can be done directly to help them except provide them with good material in written, verbal, and pictorial form. If students learn inductively, then the approach to teaching might be to present many examples from which common features and important ideas can be extracted and organized in the students' minds. If students learn by making mental constructions to handle mathematical ideas, then the teacher will want to study these mental constructions to discover how to help students make them.

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## DEPARTMENT NEWS

Dr. R. Darling attended the U.S. - France Workshop on Stochastic Analysis at Rutgers Univ. in April. From May 17-23, he gave a course of lectures at the Bulgarian Academy of Sciences, Sofia, on "Stochastic Calculus on Manifolds";

also he gave a lecture about U.S.F. to 30 prospective Mathematics Graduate Students. On May 24, he gave a Seminar at E.T.H., Zürich, Switzerland on "Dimension-free Estimates for Martingale Exit Probabilities". On May 27-June 4, Dr. Darling attended the Probabilistic Methods in Differential Equations Workshop in Haifa, Israel; there he gave an invited talk on "Martingales on Manifolds and Nonlinear PDE" Also in June he attended a conference in honor of Moshe Zakai, Technion, Israel. In October, he attended the Steven Orey Memorial Symposium, University of Minnesota.

Dr. A. Goodman is scheduled to present a paper on Modular Monotone Functions at the January meeting of the AMS in Baltimore.

Dr. M. Ismail has been appointed editor for the series of books for the Encyclopedia of Mathematics published by Cambridge University Press. His duties are to put together a program for forthcoming books in the areas of Special Functions, Approximation Theory, and related topics. Dr. Ismail will begin serving as problem editor for the American Mathematical Monthly in January and is also serving as program director for the SIAM activity group in Special Functions. The group has a newsletter and organizes minisymposia and conferences within the SIAM organization. Dr. Ismail will organize a minisymposia on Special Functions for the annual meeting in July, 1992. Along with George Andrews and Paul Nevai, Dr. Ismail is an invited editor for a special issue of SIAM journal on

Mathematical Analysis. The issue will be dedicated to R. Askey and F. Olver.

Dr. A. Mukherjea presented an invited talk on "A Law of Large Numbers for Random Affine Maps" at the Doeblin Conference held at Blaubeuren, Germany during November 2-6. He also presented an invited talk on September 23 at the mathematics department colloquium at the University of Florida.

Dr. K. M. Ramachandran attended the International Conference on Industrial and Applied Mathematics held in Washington, D. C. last July. At the conference, he conducted a special session entitled Weak and Strong Convergence and Applications to Stochastic Systems. He also gave a half hour presentation entitled "Weak Convergence of Differential Games with a Small Parameter", and gave an contributed presentation entitled "Average Cost per Unit Time Problems for Heterogeneous Queues in Heavy Traffic."

Dr. E. Saff took time from his work as graduate research professor to participate in the New York marathon. He completed the 26.2 miles in the impressive time of four hours, twenty-three minutes. It was his first marathon race, and he received a bronze medal for finishing 16,881 out of 25,683 runners. Dr. Saff reports that 39% of all runners have attended graduate school and 24 runners were mathematicians.

Dr. Y. You gave three presentations at the International Conference on Industrial and Applied Mathematics held in Washington, D. C. last July. They were "Optimal Control of



Ginzburg-Landau Equations for Superconductivity", "Long-time Behavior of Dissipative Generalized KDV Equations", and "Invariant Manifolds for Semilinear Wave Equations with Retarded Perturbation." Dr. You was also an invited speaker of the Control Science and Dynamical Systems Seminar last May at the University of Minnesota where his talk was "Global Dynamics and Control of Nonlinear Elastic Systems." Last August, he was a visiting fellow at the Army High Performance Computing Research Center in Minneapolis.

### STUDENT NEWS

Since the last issue, the following degrees have been awarded:

#### *B.A. in Mathematics*

Thomas J Amodio, Summa Cum Laude  
Theresa Bates  
Phyllis Cipriani  
Gina Giacinto  
Charlene Griffith  
Marnie Hatton, Summa Cum Laude  
Montse Jorba  
Mark Nusekabel  
Stephen Ross  
John Ryan  
Wesley Skinner  
Tina Tremmel, Magna Cum Laude  
Anthony Zerruto

#### *M.A. in Mathematics*

James Bishop  
Terry Blakey  
Janice Campbell  
Tracie DeVoe  
Gaochao Ren

#### *Ph.D. in Mathematics*

Gregory Budzban  
Xisheng (Matthew) He  
Jung-Fang Sun

### CENTER FOR MATHEMATICAL SERVICES

Last summer, the Center conducted three programs for gifted secondary school students in the Tampa Bay area. The "Mathematics and Engineering Program" was directed by Dr. Joseph Liang with Drs. Kranc and Nagle instructing. It had 26 first year students, 19 second year, and 4 third year. The following students received an Award of Overall Excellence: Katy King, Chamberlain HS; Michael Pippin, Gaither HS; E. Jason Riedy, Gaither HS. The "Biomedical and Life Science Program" was directed by Dr. Robert Potter in Chemistry with Mr. Brian Hill also instructing. It had 17 first year students, 10 second year, and 4 third

year. The following student received Awards of Overall Excellence: Suzette Peng, Chamberlain HS. The junior high "Mathematics and Science Program" was directed by Dr. Manoug N. Manougian with Drs. Clapp, Rao, Allmon, Defant, and Mrs. Margaret Yoder and Jun Cao instructing. It had 56 first year and 22 second year students. The following students received an Award of Overall Excellence: Andrew Knight, McLane JHS; Steven Lyons, Zephyrhills HS; Philip Sherman, River Ridge HS.

Last year in the "Lectures on Mathematics in Today's World" lecture program we gave 149 lectures to approximately 5,400 students in the neighboring 11 counties. There were 8 business professionals involved in the program representing GTE Data Services, IBM, Publix Supermarkets, Tampa Electric, and U.S. Sugar Company. USF lecturers included: Drs. Darling, Manougian, Nagle, Pedersen, Pothoven, Williams, and Zerla. This program is sponsored by a grant from the Center for Excellence in Mathematics, Science, Computers, and Technology. The 1991-1992 lecture program is started. Contact Dani Bagarella at (813) 974-4068 to schedule a free lecture.

### INSTITUTE OF CONSTRUCTIVE MATHEMATICS

The Institute for Constructive Mathematics has received matching support of \$20,000 from Hercules Defense Electronics Systems for its Florida High Technology Council grant proposal. The money will assist the investigators (Professors Edward B. Saff, John Pedersen, Vilmos Totik, and Richard W.R. Darling) in their work on fractal and wavelet-based image processing algorithms. The focus will be on mathematical issues arising in image compression and object identification.

### MAA NEWS

The sixteenth Suncoast Regional Meeting will be held at the St. Petersburg Campus of St. Petersburg Junior College on December 6. Dr. Fredric Zerla is the Coordinator for these meetings. Participation from USF includes presentations by Dr. Zerla on "The Department of Mathematics in Plato's Academy" and Dr. Gregory McColm on "The Great Barrier Reef of Computer Science". The twenty-fifth Annual Meeting of the Florida Section of the MAA will be held at the University of

North Florida in Jacksonville on March 6 & 7, 1992.

### STUDENT CLUBS

The Florida Epsilon Chapter of Pi Mu Epsilon and the USF Student Chapter of the MAA are meeting jointly again this year. At the first meeting, Christina Dwyer, President of Pi Mu Epsilon, spoke on "The 'Cars & Goats Paradox' introduced by Marilyn Vos Savant in 'Parade Magazine'". At the second meeting, Dr. Kenneth Pothoven told of "Teaching Innovations in Mathematics". Dr. Mourad Ismail spoke about "Special Functions, and What Makes Them Special" at the third meeting. Dr. Boris Shekhtman spoke on "What is a Triangle" at the fourth meeting. The Mathematics Clubs sponsored a picnic for math students and teachers at USF's Riverfront Park on October 26.

### FACULTY PROFILE

Dr. Vilmos Totik was born in Hungary in 1954 and had his mathematical training there. He joined our faculty in 1989 on a joint appointment with USF and Attila Jozsef University in Szeged, Hungary. He is sharing his time at these two places. He holds a chair in Szeged and is a Full Professor at both Universities. His wife, Veronika works for the city council in Szeged. They have a daughter (Orsolya) and a son (Zoltan).

Dr. Totik completed his studies at the University of Szeged in 1978 and received his University Doctoral Degree in 1979. His first main research area was strong approximation of Fourier series, which is on the boundary of approximation theory and classical Fourier-harmonic analysis. His results in the subject settled several open problems and were subsequently incorporated into a monograph by L. Leindler. For these results he received in 1980 the "Candidate of Mathematical Sciences" degree (equivalent of Ph.D.) from the Hungarian Academy of Sciences.

Soon after that he became interested in approximation properties of operator processes. He introduced a new modulus of smoothness which has turned out to be the "right one" to measure smoothness of functions. A similar measurement was introduced independently by Z. Ditzian from Edmonton, and their collaboration resulted in a 1987 monograph "Moduli of Smoothness" by Springer Verlag, which consists of new results many of which



have been open for a long time. For these and related results he received in 1986 the "Doctor of the Mathematical Sciences" degree from the Hungarian Academy.

In 1983-85 he visited Ohio State University for two years, where he started working on orthogonal polynomials and related subjects. In 1987-88 he spent one year in our department, where he got interested in logarithmic potential theory. He and Dr. E. B. Saff are preparing a monograph on the subject. Another research monograph, jointly authored by him and H. Stahl (from Berlin), on general orthogonal polynomials and potential theoretical methods concerning them is about to appear in the Encyclopedia Mathematical series by Cambridge University Press.

Dr. Totik has written about 110 research papers on the subjects mentioned before, as well as in the theory of orthogonal series, probability theory, complex analysis, differential equations, fixed point theory, and combinatorics. He is an ardent problem solver. In his earlier studies he successfully participated in several national and international mathematical contests. He won the prestigious Miklos Schweitzer Mathematical contest twice (1978 and 1979) and received several mathematical awards in Hungary, among others the G. Grunwald and G. Alexits awards. Since coming to our University, he has twice received NSF grants.

Dr. Totik serves on the editorial board of four journals (*Acta Scientiarum Mathematicarum*, *Analysis und Ihre Anwendungen*, *Constructive Approximation*, *Journal of Approximation Theory*) and served as the technical editor of *Analysis Mathematica* for two years. He is on the Mathematical Committee of the Hungarian Academy, and served as Vice Dean at Szeged University in 1986-87. He has been among the main speakers for several international mathematical conferences. In his spare time he likes to listen to classical music, to work in the garden, and to engage in sports - soccer and tennis are his favorites.

#### ALUMNI NEWS

Stephen Bean (Ph.D. 1979) was on the faculty of the University of Central Florida from 1979 to 1982, and then decided to pursue a spiritual life as an Ashram for eight

years. However, for the last year he has been a full-time management consultant in probability and statistics, and has just accepted a two-year posting to Australia.

Michael Katehakis (M.A. 1978) is currently an Associate Professor in the Graduate School of Management at Rutgers University, Newark, N.J.

Zachariah Sinkala (Ph.D. 1989) is an Assistant Professor at Middle Tennessee State University. He presented a paper entitled "Existence of Solutions to First Order Ordinary Differential Equations" at the January meeting of the AMS in San Francisco.

Jinyong Chen (M.A. 1989) won the Slutsky Award for the best first year student at the University of Florida, where he is a Graduate Research Assistant.

Ina Howell (Ph.D. 1981) is a Lecturer in the Department of Stastics at Florida International University in Miami, Florida.

Chi-Chang Lo (Ph.D. 1989) is an Assistant Professor at Clearwater Christian College in Clearwater, Florida. He traveled to HangZhou, China, this summer visiting friends and relatives.

#### CHAIR'S COMMENTS

(From page 1)

(According to Jeremy Kilpatrick, former editor of the *Journal for Research in Mathematics Education*, the constructivist view involves two principles: (a) knowledge is actively constructed, not passively received; and (b) coming to know is an adaptive process of organizing one's experiences and does not involve discovering an independent pre-existing world outside the mind of the knower. [See "Constructivism in Mathematics Education: a View of How People Learn" by A. Seldon and J. Seldon, *UME Trends*, March, 1990.] ) If students learn mathematics pragmatically, then the teaching strategy might involve introducing students to many applications in other fields.

Correspondingly, here are four views about the nature of mathematics: knowledge, techniques, thought, and applications. Again, each belief has

implications for teaching mathematics. If mathematics is merely a body of knowledge that must be passed on from generation to generation, then it must be taught in a manner that students can somehow ingest it. If mathematics is a set of techniques to solve problems, then students must be taught by solving a large number of problems that facilitate practice with these techniques. If mathematics is a set of ideas that have been created by individual and collective thought, then the teaching strategy may be to help students construct ideas on their own working individually or in groups. Finally, if the nature of mathematics is in applications and the essence of mathematics is to describe, explain, and predict phenomena, then the emphasis in teaching would be about applications in the sciences.

Dubinsky believes that most mathematics teaching is based upon the erroneous belief (perhaps implicit) that mathematics is learned spontaneously and inductively and that mathematics is some combination of knowledge and techniques. Most mathematics educators teach as if they believe students spontaneously learn by watching and listening and that mathematics is a collection of techniques that must be mastered. According to Dubinsky, this is wrong and is at least partly the reason for the problems of mathematics education in this country - high attrition rates, the low levels of mathematical understanding exhibited by students, and the turning away from mathematics by some of the best and brightest students.

Perhaps mathematics courses should be structured to reflect more what mathematicians actually do than is now the case. Creative, practicing mathematicians construct and reconstruct their own mental concepts after much cognitive conflict and in many cases do not work individually but in groups. Yet, in most cases, mathematics is taught as if it is a body of knowledge and techniques to be committed to memory by each student individually.

A Departmental seminar involving some faculty and graduate students has been initiated this Fall to address some of these questions. The answers are difficult but the questions can be thought provoking. Hopefully, right answers will generate more effective teaching and learning.



