

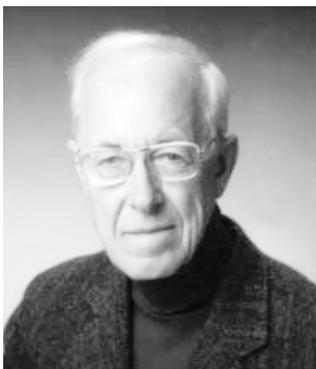
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# A f t e r m a t h

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## Calvin H. Wilcox

by Paul Fife



Calvin H. Wilcox, a reknowned mathematician and a member of our department since 1971, passed away on June 7, 2001.

His fields of expertise, in which he published numerous papers, were in the broad area of partial differ-

ential equations, with emphasis on those equations, such as the Helmholtz equation and systems of hyperbolic PDE's, which model linear wave propagation phenomena. This was merely an emphasis rather than a narrow focus. For example, one of his later papers was on the system of linear elastostatics, extending existing classical uniqueness theorems for that system to more realistic problems in domains with singularities.

Although Calvin was fundamentally concerned (as in this last example) with problems which are applicable to situations most likely to be encountered in the real world, he was not "applied" in the sense of only providing the nuts and bolts of solutions of these applied problems. Rather he was a builder of theories, and all of his research was mathematically rigorous.

His research led him naturally into abstract (mainly Hilbert space) formulations of classical problems and into aspects of functional analysis. Much of his work relied on spectral analysis of operators. This was especially true in his work concerning scattering theory and allied concepts such as diffraction theory, which he pursued with gusto in many contexts (Calvin's work in scattering theory also had important implications, e.g. in quantum theory).

In an important discovery, Wilcox exhibited a class of matrix partial differential operators  $\Lambda$ , such that the generalized Schrödinger equations

$i\partial u/\partial t = \Lambda u$  provide a unified model for the wave equations of classical physics, such as Maxwell's equations and the equations of acoustic and seismic waves, electric waves on transmission lines, and much more. In all cases, the degree of generality encompassed anisotropic inhomogeneous media. He, together with his student John Schulenberger, went on to develop a scattering theory for these problems. One novel feature of this theory is that the operator  $\Lambda$  is not necessarily elliptic. Among the important issues which they investigated for this class of operators is the limiting absorption principle, long a landmark of the theory of the Helmholtz equation.

A great deal of elliptic theory is based on the property of coercivity. Schulenberger and Wilcox were able to prove coerciveness inequalities, on subspaces, for a practically important class of systems of PDE's which are not necessarily elliptic, but rather have "constant deficit."

Calvin's studies and publications were a source of inspiration for many young colleagues.

He was given due world-wide recognition for his original results; for example, he was invited on a number of occasions to spend extensive periods of time at various universities in Europe and Japan. His professional activities also included, among other things, the organization of high level scientific conferences.

He wrote two research monographs on scattering theory and wave propagation and a major text, *Advanced Engineering Mathematics*, with Grant Gustafson.

Before moving to Utah, Calvin held positions at Caltech and the Universities of Wisconsin, Arizona (where he helped to build a strong mathematics department), and Denver. He also served as consultant to Lockheed, Argonne, and General Electric.

On extracurricular matters, Calvin was an intense advocate, both in spirit and in body, for

the outdoors, especially hiking and boating activities. In climbing and hiking trips in both the U.S. and Europe, he often left much younger companions far behind.

## A Note of Thanks

Frances Wilcox sent this note to the department following the passing of her husband:

“It has always been clear to me that when one joins the faculty of a university department – especially mathematics in this case – he finds a whole bunch of people ready to greet him with kindness, hospitality, friendship and understanding. Calvin and I have enjoyed this for thirty years. Now I understand that it is all there when one leaves, as well. Thank you all. Sincerely, Fran Wilcox.”

## Scholarship Established

Over thirty contributions have been made to the newly established Calvin H. Wilcox Memorial Endowed Scholarship Fund. These contributions, along with a generous gift from Frances Wilcox, will provide assistance to outstanding undergraduate mathematics majors.

## Summer Programs

by Jim Carlson

This summer the department ran several summer programs outside of its regular course offerings: ACCESS, the Summer Mathematics Program for High School Students, and a Research Experience for Undergraduates.

### ACCESS

ACCESS is an eight-week, half-day program for incoming freshman women interested in science and mathematics. This College of Science program was created ten years ago by then Dean Hugo Rossi, and its mathematics component is now led by Nick Korevaar. Nick led 21 bright and energetic students through two one-week sessions, the first devoted to cryptography, the second to scaling laws. The first week was built around Simon Singh's "The Code Book," moving historically from substitution ciphers to the number theory behind RSA internet security. Biology Professor Jon Seger gave an inspiring guest lecture on the genetic code, with applications to species' family trees. The second week included classical and fractional scaling. Fred Adler presented a controversial theory from mathematical biology which models the empiri-

cally observed fractional power law between animal mass and metabolism, and Ken Golden talked about the science of sea ice. Students completed group projects in which they implemented the RSA security system, created original fractals, and found an empirical power law relating human heights to weights. For more information see [www.science.utah.edu/access.html](http://www.science.utah.edu/access.html).

### Summer Program for High School Students

The Summer Mathematics Program for High School Students, held for three weeks beginning in mid-June, was started last summer by Jim Carlson and Hugo Rossi. This year 19 students from local schools participated (14 men, 5 women). In the early morning core course they learned about number theory – primes, congruences, Diophantine equations, and cryptography, which was done in conjunction with the ACCESS program. In the later morning seminar students were exposed to a variety of topics, from fractals and fixed point theorems to combinatorics, to knot theory, to mathematical models of fisheries based on difference equations and game theory. Hugo and Jim conducted the morning sessions, with five faculty and two graduate students, Darrell Poore and Bobby Hanson giving talks in the seminar. Angie Gardiner organized the overall program and provided publicity and logistical support. Darrell and Bobby did a great job of conducting the afternoon problem sessions. See [www.math.utah.edu/hsp](http://www.math.utah.edu/hsp).

### REU

Domningo Toledo and Jim Carlson conducted an eight-week REU (Research Experience for Undergraduates). Graduate students Bobby Hanson and Martin Deraux assisted, and did a superb job, both in the very free-wheeling discus-



sion sessions and through their presentation of advanced material, e.g., Riemann surfaces and hyperbolic geometry. Seven students, all local except for one from the University of Arizona, participated. It was an exciting intellectual experience for all involved. One week into Colin Adams' beautifully written "Knot Book," we

began considering new questions, among which was whether the notion of tricolorability, the simplest of the knot invariants, can be generalized in a significant way. This they found in a collaborative effort which has been written up as a joint paper. The paper shows how to compute the invariant using linear algebra over the integers and subsequent reduction modulo  $n$ .

There were many high points of the REU, but here are two. Matt Dalton showed that an  $(i,j,k)$  pretzel knot is  $n$ -colorable if and only if  $ij + ik + jk$  is equal to  $n$  up to sign. In fact Matt treated the case of a general pretzel knot. You can use his criterion to determine the "smallest" which cannot be distinguished from the unknot by colorability invariants. Note that  $i$ ,  $j$ , and  $k$  can be either positive or negative. Robert Palmer, a computer science major and Ryan Rettberg, an alumnus of the 2000 High School Summer Program both wrote java programs which allow the user to draw a knot, determine its "crossing matrix," and then determine whether it is  $n$ -colorable for some  $n$ . The students were truly impressive, and this short article does not do justice to their superb work. Participants were Rex Butler, Aaron Cohen, Matt Dalton, Lars Louder, Robert Palmer, Ryan Rettberg, and Allen Whitt (University of Arizona). Two additional students participated in individual REUs. Stephen Jensen worked with Stewart Ethier on video poker strategies and Tara Henriksen worked with Fred Adler on modeling Cystic Fibrosis patient health. For more information, see [www.math.utah.edu/reu](http://www.math.utah.edu/reu).

The summer REU program was made possible by the Department's VIGRE grant from the NSF. Next year's summer REU will be conducted by Davar Khoshnevisan.

After this summer experience, it is clear that we have enormous talent among our undergraduates. It is our job to discover this talent and to nourish it.

## Prelim Boot Camp

Matthew Rudd coordinated the Qualifying Examination Problem Sessions held this summer in preparation for Ph.D. preliminary exams. Students taking a particular exam met to discuss problems, and faculty members coordinating the exams were available for questions.

## Dept Retreat and Social

by Peter Trombi

The first annual departmental retreat was held at the Marriott Park Hotel on Tuesday, August 21. The afternoon session, which was attended by faculty and graduate students, began with a welcome from Jim Carlson. The participants were then asked to introduce themselves, indicate their areas of specialization, and identify special positions which they held. New faculty and instructors then gave short presentations on their research.

The chair then outlined the special needs and challenges which the department faces in the current academic year. This was followed by a presentation by Professor Klaus Schmitt who gave an overview of the the VIGRE grant and the new demands which it placed on the faculty and its students. The participants then divided into three breakout groups which discussed issues involving the undergraduate and graduate programs, and the VIGRE grant. After lively discussion the chairs of the breakout sessions reported the results of their session to the entire body. This was followed by a social hour and dinner which was attended by faculty, emeritus faculty, staff, graduate students, and their partners.

## Construction Update



Work on the LCB remodel and math center addition continues, and we can almost see the light at the end of the tunnel. The most recent construction completion date is November 24, with move-in hopefully taking place in December.

# Welcome

We are welcoming many new people to our department this year:

## Faculty

Paul Bressloff, Professor, received his Ph.D. in mathematical physics in 1988 from King's College, London University. His interests are in mathematical neuroscience and nonlinear dynamics.

Peter Trapa, Assistant Professor, received his Ph.D. in 1998 from MIT. His interests are in representation theory.

## Visitors

Boas Erez, Ph.D. 1987 University of Geneva, Switzerland, Algebraic Number Theory.

Marko Tadic, Ph.D. 1980 University of Zagreb, Croatia, Topology.

## Instructors

Alastair Craw (Wylie), Ph.D. 2001 University of Warwick, Algebraic Geometry.

Florian Enescu (Scott), Ph.D. 2001 University of Michigan, Commutative Algebra.

Javier Fernandez (Scott-VIGRE), Ph.D. 2001 University of Massachusetts, Algebraic Geometry, Hodge Theory.

David Hartenstine (Scott-VIGRE), Ph.D. 2001 Temple University, Partial Differential Equations.

Pedro Méndez (Wylie), Ph.D. 2001 Purdue University, Probability.

Thomas Pietraho (Scott-VIGRE), Ph.D. 2001 MIT, Representation Theory.

Jesse Ratzkin (Scott-VIGRE), Ph.D. 2001 University of Washington, Differential Geometry, Geometric Partial Differential Equations.

## Graduate Students

Our new graduate students are Bethany Bradfield, Charlie Casper, John Chinchin, Matthew Clay, Eric Cook, Michael Crosswhite, Zrinka Despotovic, Elizabeth Doman, Sarah Geneser, Shawn Harrison, Sunny Laws, An Le, Larsen Louder, Meagan McNulty, Kazuma Shimomoto, Ryan Stones, and Robert Thorn.

## Staff

Brenlyn Thiriot (MStat. 2000, University of Utah) is the VIGRE Grant Program Coordinator. She is also teaching statistics courses for the department.

Sarah Strong (B.A. Psychology 1998, Boston College) is our new Executive Secretary in the INSCC building.

## Odds and Ends

The following students will be participating in an REU during the academic year:

- Brian Budge working with Klaus Schmitt
- Rex Butler working with Henryk Hecht
- Aaron Cohen working with Paul Bressloff
- Matthew Dalton working with Mladen Bestvina
- Song Du working with Paul Fife
- Troy Finlayson working with Ken Golden
- Tara Henriksen working with Fred Adler
- David Lindsay working with Wieslawa Niziol
- Josh Stewart working with Jingyi Zhu

Piotr Kokoszka, former postdoc at the University of Utah and current assistant professor of mathematics and statistics at Utah State University, has received a New Faculty Research Grant award from USU.

## Calendar

**Sept. 18:** Jim White of Career Services will discuss career opportunities in preparation for the Career Fair, SSB 380, 12:55 p.m.

**Sept. 25:** Science and Engineering Career Fair, Union Ballroom 9:00 - 3:00.

**Oct. 3:** University of Utah Math Circle begins, AEB 350, 4:00 - 6:00 p.m.

**Oct. 4-5:** Fall Break, no classes.

**Wednesdays:** GRE Prep Seminar, JTB 110, 2:30 - 4:00 p.m.

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*[www.math.utah.edu/newsletter](http://www.math.utah.edu/newsletter)*

## Editorial staff:

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