

IEEE Information Theory Society Newsletter



Vol. 52, No. 4, December 2002

Editor: Lance C. Pérez

ISSN 1059-2362

2002 IEEE International Symposium on Information Theory

Palais de Beaulieu, Lausanne, Switzerland, 1-5 July 2002.

By Daniela Tuninetti

This year, the 2002 Symposium of our society was held in Lausanne, Switzerland, on the shores of the beautiful Lake Geneva at the foot of the Alps in the Palais de Beaulieu during the first week of July.

There were 730 participants, 234 of which were students, and about 500 technical papers were presented. Every justified request for financial support could be granted, totaling roughly \$110,000. Most of the financial support went to students presenting papers. For the first time in ISIT history, high-speed wireless LAN access was provided to the participants. Furthermore, the organizers developed user-friendly and open-source software for on-line registration, paper submission, and paper review. Another 'first' for ISIT was the on-line availability of the one-page abstracts.

A traditional welcome cocktail on Sunday evening opened the symposium at the Palais de Beaulieu. The technical program started on Monday morning. For five days, except on Wednesday afternoon, seven parallel tracks were scheduled with two morning sessions and two afternoon sessions, each consisting of four 20 minutes talks. Talks covered the whole spectrum of communications from Coding Theory, Source Compression, Iterative Decoding, Network Information Theory to Signal Processing, Multi-user Detection, Estimation and Cryptography. Two parallel sessions on recent results



IT Society President Tom Fuja addresses the conference.

were organized on Tuesday evening. As the tradition of the symposium has it, every day's sessions were preceded by a plenary talk:

- on Monday, on "Quantum Mechanics, Chaos, and the Primes" by Sir Michael V. Berry, professor at Bristol University (UK);
- on Tuesday, on "Saving Bandwidth in the Wideband Regime" by Prof. Sergio Verdu from Princeton University (USA);
- on Wednesday, on "Advances in Convex Optimization: Theory, Algorithms, and Applications" by Prof. Stephen P. Boyd from Stanford University (USA);
- and on Friday, Prof. Shafi Goldwasser from MIT (USA) talked about "The Marriage of Cryptography and Complexity Theory".

This year's Awards of the Information Theory Society were presented on Tuesday during a lunch ceremony. The president of the IT society, Prof. Thomas E. Fuja, announced the newly-elected IEEE Fellows from our Society: Prof. Oliver Collins, Prof. Evangelos S. Eleftheriou, Prof. Paddy Farrel, Prof. Vijay Kumar and Prof. Shojiro Sakata.

continued on page 3



From the Editor

Lance C. Pérez

This issue of the *IEEE Information Theory Society Newsletter* contains several interesting workshop reports including the 2002 International Symposium on Information Theory which took place in Lausanne, Switzerland.

I am pleased to announce the digital newsletter project is nearing completion and members will soon be able to access the Society's newsletter collection from the same site that hosts the Transactions. The March 2003 Newsletter will have all the details.

Please help make the Newsletter as interesting and informative as possible by offering suggestions and contributing news. The deadlines for the 2003 issues of the newsletter are as follows:

Issue	Deadline
March 2003	January 15, 2003
June 2003	April 15, 2003
September 2003	July 15, 2003
December 2003	October 15, 2003

Electronic submission, especially in ascii and Word formats, is encouraged.

I may be reached at the following address:

Lance C. Pérez
 Department of Electrical Engineering
 209N Walter Scott Engineering Center
 University of Nebraska-Lincoln
 Lincoln, NE 68588-0511
 Phone: (402)472-6258
 Fax: (402)472-4732
 Email: lperez@unl.edu



Lance C. Pérez

Sincerely,

Lance C. Pérez

In the September 2002 issue of the Information Theory Newsletter the article announcing the new ComSoc/ITSoc Joint paper award on page 4 contained two errors.

The first author of the paper "Iterative (Turbo) Soft Interference Cancellation and Decoding for Coded CDMA" should be Xiaodong Wei instead of Xiaodong Wang. Also, the paper appeared in the IEEE Transactions on Communications.

IEEE

Information Theory Society Newsletter

IEEE Information Theory Society Newsletter (USPS 360-350) is published quarterly by the Information Theory Society of the Institute of Electrical and Electronics Engineers, Inc.

Headquarters: 3 Park Avenue, 17th Floor, New York, NY 10016-5997.

Cost is \$1.00 per member per year (included in Society fee) for each member of the Information Theory Society. Printed in the U.S.A. Periodicals postage paid at New York, NY and at additional mailing offices.

Postmaster: Send address changes to IEEE Information Theory Society Newsletter, IEEE, 445 Hoes Lane, Piscataway, NJ 08854.

© 2002 IEEE. Information contained in this newsletter may be copied without permission provided that the copies are not made or distributed for direct commercial advantage, and the title of the publication and its date appear.

Table of Contents

2002 IEEE International Symposium on Information Theory	cover page
From the Editor	2
Historian's Column	5
Call for Nominations	6
Coming in 2003: The IEEE Member Digital Library	6
60th Birthday Celebration for Daniel J. Costello	7
Workshop Report: 2002 Information Theory Workshop	7
Workshop Report: Two Successful 2002 events organized by the IEEE German IT Chapter	9
Golomb's Puzzle Column™: Early Bird Numbers	10
IEEE Information Theory Society Annual Meeting	10
New Books	14
Golomb's Puzzle Column™: On a Problem of Richard Epstein - Solutions	16
Call For Papers	18
Dimacs.	19
2nd Call for Papers for WiOpt'03	20
Call for Papers	21
Conference Calendar	23

2002 IEEE International Symposium on Information Theory

Continued from page 1



IEEE President Raymond D. Findlay presents the Leon Kirchmayer Prize Paper Award to Muriel Medard.



Symposium Co-Chairs Bixio Rimoldi and James L. Massey with Rudiger Urbanke.

Prof. Paul Siegel, editor in chief for IEEE Transactions on Information Theory, then handed out the appreciation certificates for the outgoing associate editors Prof. Patrick Sole, Prof. Neal Koblitz, Prof. Gabor Lugosi, Prof. Marcelo Weinberger, Prof. Peter Shor, Prof. Andrew Klapper and Prof. Jonathon Ashley and for the outgoing publications editor Prof. Erik Agrell.

Prof. Thomas E. Fuja then gave Prof. Bixio Rimoldi and Prof. James Massey a certificate of appreciation for serving as co-chairs of ISIT '02. The two co-chairs thanked everyone involved in the organization of the symposium for their efforts and enthusiasm.

Prof. David Tse and Prof. Stephen Hanly were presented the 2000 Joint Communication Society / Information Theory Society Paper Award, Prof. Emre Telatar was given the 2001 Information Society Paper Award and Prof. Toby Berger the 2002 Shannon Award.

The IEEE President, Dr. Raymond D. Findlay, presented the IEEE Graduate Teaching Award to Prof. Vijay Bhargava and the IEEE Leon K. Kirchmayer Prize Paper Award to Prof. Muriel Medard.



IEEE President Raymond D. Findlay presents the IEEE Graduate Teaching Award to Vijay Bhargava.



IT Society President Tom Fuja presents the 2002 Shannon Award to Professor Toby Berger of Cornell University.



Attendees of the 2002 ISIT enjoy the historical village of Gruyere with the mountain le Moleson in the background.

This year's best paper award has been shared by M.G. Luby, M. Mitzenmacher, M.A. Shokrollahi and D.A. Spielman and by T.J. Richardson and R.L. Urbanke.

On Wednesday afternoon, no technical session was held. Instead, a wide range of excursions in the surroundings of Lausanne had been organized, namely a visit to the historical town of Gruyere with its medieval village, a visit to the 12th century castle of Chillon, a trip to Gstaad on the GoldenPass Panoramic Train, and hiking in the mountains at Les Diablerets and an ascension to Rochers-de-Naye.

This year's Shannon Lecture was given by Prof. Toby Berger from Cornell University (USA) on Thursday morning, entitled 'Living Information Theory'. He introduced the audience to the way neurons communicate and to the studies undertaken in the quest to understand the way nature ensures efficient communication. He ended his presentation on the tones of his harmonica.

The cocktail banquet dinner was held on the premises of the Olympic Museum. It was not a traditional sit-down

banquet. Instead, there were five "islands of food" corresponding to the five continents. The banquet format provided a lot of opportunities for interaction. After dinner, the recipient of the 2003 Shannon Award was announced: Prof. Lloyd R. Welch. Prof. Welch will give his Shannon Lecture at the 2003 ISIT in Yokohama. Nusha Wyner, wife of the late Aaron Wyner, received a bronze plaque commemorating the June 2002 special issue of IEEE Transactions on Information Theory dedicated to her husband. At the conclusion of the banquet, Prof. Hideki Imai welcomed everyone to participate in the next ISIT that will be held in Yokohama, Japan, in summer 2003.

The symposium came to an end on Friday afternoon. Several of the attendants expressed their compliments to the organizers for a successful, enjoyable and well organized conference.

Photos are available at the conference web site <http://isit02.epfl.ch/>. Any participant who has photos to share may send them to isit02local@epfl.ch to be posted on the conference web site.



Symposium attendees at one of the "islands of food" at the 2002 banquet.

Historian's Column

A. Ephremides

First the good news: most of the people who have worked and/or are working on Information Theory are alive and well. It is truly unusual that for over fifty years almost all of our colleagues are thriving and enjoying good health. Perhaps the field itself has a beneficial effect on people's health and well-being.

But, of course, we have had some losses. Almost to the day that this is written, exactly five years ago our Society experienced the sad passing of Aaron Wyner. This somber anniversary made me think about counting our losses. The most recent losses have included the Founder, himself. In February of 2001 Claude E. Shannon died after a devastating and long battle with Alzheimer's disease. As was fitting, his death received wide notice and marked a major milestone in our field's history. And then, more recently, in December of 2001, the unexpected death of Peter Elias added to the grief that last year brought upon the world. Claude and Peter were senior luminaries of Information Theory and their recent deaths are still fresh in our memories.

By contrast, Aaron Wyner left us already five years ago and very prematurely. He was also a major luminary. He won the Shannon Award and the literature is replete with his contributions. Aaron was a bit different than most Information Theory researchers. He was a solid devotee to the fundamentals of our field and was the Shannon Theorist, par excellence, after Shannon himself. What marked Aaron's work the most was his knack of exploring avenues that helped extend Shannon Theory to new directions. He was among the first to explore multi-user Information Theory. He considered, early on (as early as the seventies), the wiretap channel. And, as recently as 1995 at the Whistler ISIT, in the recent results session, he presented an information-theoretic view of the cellular communications paradigm.

But what was perhaps his most characteristic hallmark was his enthusiasm for, and devotion to, our field and our Society. He was a true partisan and believer in Information Theory. He served, of course, our Society in all capacities. For many years he was a key member of the Board of Governors. I had the honor of serving with him on the Board and recall vividly the energy and enthusiasm he was injecting to its transactions. He served as President, he was Editor-in-Chief of our journal, he was Chair of ISIT's and workshops (he was crucial in organizing the 1973 ISIT and the 1984 IWIT in Israel), and he was the mover and shaker in revamping our constitution and by-laws in the mid-seventies. He was also a staunch and tough negotiator with the Soviets in that turbulent era and led the organization of the US-USSR workshop

in New York that followed the memorable Moscow workshop during that decade.

Aaron had also a keen sense of humor and a quick wit. It was never dull to be around him. Even in disagreements he was a spirited but honorable adversary who would define his turf with good arguments and zest. He was truly a perennially "young" person. It is too bad that fate chose that he leave the scene so early. Five years later his presence continues to be felt in the life of our Society.



A. Ephremides

But there have been others, perhaps not as well known but no less worthy, whose passage has left a void. I am sure I won't be able to name all of them but there are at least four prominent colleagues who have passed away while in their scientific prime. Gus Solomon left us in January of 1996 and his friend and collaborator, Bob McEliece, noted his passing with a fine obituary. Gus was perhaps not "centered" in our Society but his life and contributions spanned many creative activities. Then, there was Ed Posner, another exceptional individual for whom it fell upon Bob McEliece's shoulders again to write an obituary, as he was also a close friend and associate. He died in a tragic accident in June of

1993 while bicycling near his home. Ed was a leader in shaping information theoretic thinking into the field of Neural Networks. He had an unusual and "biting" sense of humor that was often "delivered" with sarcasm and a sneer that were his hallmarks but which disguised his gentle and affable nature.

In April of 1995, we also lost Stamatis Cambanis. He was very special to me since we were close friends and classmates back in Greece and at Princeton. He was more in the field of Probability and Mathematical Statistics than in Information Theory. But, he did not miss a single ISIT and published regularly in our Transactions. He served as Associate Editor for Stochastic Processes and was widely respected in his field. Stamatis had also a gem of a personality. Not only did he have a "golden" heart, but he had also a good-natured smile on his face and only the kindest words to say about anyone. His character and integrity were unparalleled. His painful passing left the most vivid and cherished memory to all who were lucky enough to have known him. It is quite rare to meet someone like him.

And then there was Haluk Derin, who died earlier this year. Haluk was also more of a Stochastic Processes and Detection/Estimation specialist. He and I were officemates at Princeton and had the same advisor, John B. Thomas. Haluk was a native of Turkey and he and I used to have many "heated" but friendly discussions about Cyprus and about the differences and disputes between our mother countries. He was also a man

of fine character and friendly demeanor. His luck ran sour as soon as he graduated. He took up a position in a University back in Turkey in the early seventies and had a bad car accident that left his wife paralyzed. A few years later he returned to the United States where he rebuilt his life and career at the University of Massachusetts in Amherst. I was very surprised and saddened to hear of his death.

But such is the fate of all. Sooner or later many of our famous and less famous contemporaries will be leaving us with memories and with their contributions. As a group we have had remarkable longevity and health and we are lucky to continue having the pleasure of enjoying each other's company as we all traverse the short path of life while we try to leave a small legacy through our contributions to our field.

Call For Nominations

IEEE Fellow

The grade of Fellow is the highest membership grade in the IEEE. The Information Theory Society has many distinguished members who are potential candidates for this honor. Of those members who are evaluated by the IT Society, a good percentage are usually elected.

Fellow elections reflect honor not only on the individuals elected but also on the Society as a whole, and the Board of Governors advocates an aggressive search for nominations. The Society also has an interest in identifying candidates from historically underrepresented subfields, regions, and institutions.

The basic qualification for election to Fellow is "unusual distinction in the profession." A list of the 2002 class of IEEE Fellows can be found through the IEEE Website at <http://www.ieee.org/about/awards/fellows/new-fellows.htm>.

Preparation of the nomination form is important. Any person may serve as nominator (except IEEE staff or volunteers

involved in the Fellow selection process). The basic responsibility of the nominator is to prepare a complete and accurate four-page nomination form that clearly identifies the unique contributions of the candidate. The other principal task of the nominator is to obtain the agreement of five to eight IEEE Fellows who are qualified to judge the candidate's work to serve as references.

Detailed instructions and forms may be found in the IEEE Fellow Nomination Kit, which may be obtained from the IEEE homepage at <http://www.ieee.org/about/awards/fellows/request.htm>. A hardcopy may be requested by sending email to fellow-kit@ieee.org.

The deadline for the nomination form and all reference letters is March 15, 2003. Your Society asks you to: Think about identifying a qualified candidate; ask for a Fellow nomination kit; Get started early!

COMING IN 2003: THE IEEE MEMBER DIGITAL LIBRARY

Coming in 2003, the new IEEE Member Digital Library will allow IEEE members to access individual online articles from IEEE-published journals, magazines and conference proceedings with one convenient subscription. Subscribers will pay a monthly fee to access up to 25 articles and papers a month from the current year and the last five years worth of publications. Access will be through the IEEE *Xplore*[®] online delivery platform.

"This new offering will greatly enhance the scientific and education goals of the IEEE," said Dr. Raymond D. Findlay, IEEE President. "In addition, IEEE publishes the most highly cited information in EE and Computer Science, and online access to a wider range of information will greatly enhance our members' careers."

The IEEE Member Digital Library provides IEEE members with direct online access to the articles and papers in IEEE

journals and conference proceedings without requiring subscriptions to the individual publications.

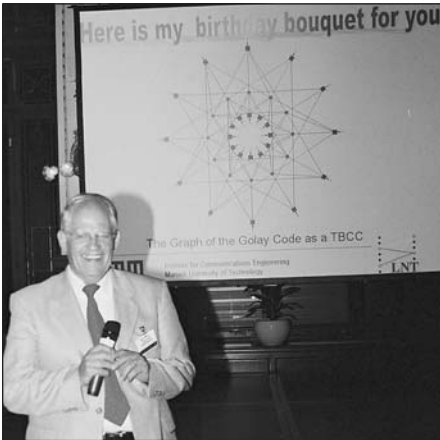
"IEEE members tell us that the number one reason they join is to gain access to technical data," said Findlay. "The IEEE Member Digital Library will prove to be a marked addition to the information IEEE members already gain from individual journal subscriptions and technical society memberships."

IEEE members renewing or joining for the 2003 year will be eligible to subscribe to the IEEE Member Digital Library. Anyone subscribing by 31 December 2002 will receive their first month of the IEEE Member Digital Library for free. The service will be available in January 2003.

For more information on the IEEE Member Digital Library or the first-month free offer, visit www.ieee.org/ieeemdl

60th Birthday Celebration for Daniel J. Costello

by Tom Fuja and Roger Petersen



Joachim Hagenauer presents a birthday bouquet to Daniel J. Costello, Jr.



Daniel J. and Lucretia Costello outside the Beau Rivage Palace.



Daniel J. Costello, Jr. at his 60th birthday celebration.

Daniel J. Costello, Jr. was the honored guest at a surprise party held to celebrate his sixtieth birthday at the Beau Rivage Palace in Lausanne, Switzerland on July 1, 2002.

Costello, the co-author of *Error Control Codes: Fundamentals and Applications* and a former president of the Information Theory Society, was joined by 76 friends and colleagues, who were in Lausanne to attend the 2002 International Symposium on Information Theory. Costello's former student Pierre Chevillat (now of IBM Zurich) served as master of ceremonies, and brief words of welcome were provided by Roger Peterson (another Costello student, now of Motorola) as well as Tom Fuja and Yih-Fang Huang of Notre Dame.

The principal speaker of the evening was Prof. Joachim Hagenauer of the Technical University of Munich. Prof. Hagenauer regaled the audience with an often-humorous

overview of Costello's life and career. In one instance, he showed the audience a picture of a young Dan Costello featuring very prominent ears with the comment, "See - even then, Dan understood the importance of antenna diversity."

The evening was co-sponsored by Motorola and the University of Notre Dame.

Roger Petersen of Motorola, presents a gift to Daniel J. Costello, Jr.



WORKSHOP REPORT:

2002 Information Theory Workshop

October 20-25
Bangalore, India

By Tom Fuja

The 2002 IEEE Information Theory Workshop was held October 20-25 at the Hotel Windsor Sheraton and Towers in Bangalore, India. This was the first meeting sponsored by the IEEE Information Theory Society in India, and it attracted 173 participants – more than 100 of whom came from India.

The technical program featured two plenary talks, numerous invited sessions, and two sessions made up of contributed papers. On Tuesday morning, Prof. Thomas Kailath of Stanford University gave a plenary lecture on "Effective Maximum Likelihood Detection with Polynomial Expected Complexity." Prof. G. David Forney of MIT delivered the

Thursday morning plenary, "Codes and Systems on Graphs." There were almost 40 invited papers arranged into sessions on Shannon Theory, Communication Networks, Channel Coding and Modulation, Space-Time Coding and Processing, Cryptography, Information Theory and Statistics, and Source Coding. The 17 contributed papers were selected from more than 50 that were submitted.

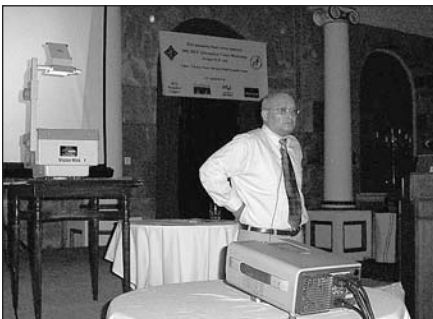
In addition, on Tuesday night there were two parallel Recent Results sessions that gave all interested researchers a 10-minute opportunity to describe their recent efforts.



G. David Forney presenting his plenary talk entitled “Codes and Systems on Graphs”.

As is tradition, a Wednesday afternoon excursion was arranged to give all interested participants a sampling of the local culture. Three busses took about 80 workshop attendees to the Janapatloka Folklore College where they toured museum exhibits and heard a traditional percussion troupe perform. The highlight of the evening was a theatrical performance of a selection from the Indian epic, “Mahabharata,” featuring extravagant costumes and masks and dramatic dialog as well as singing and dancing.

The Thursday evening banquet provided a splendid selection of Indian food. After the dishes were taken away, the evening took a musical turn as local arrangements co-chair Vijay Bhargava encouraged one attendee after another to come forward (either solo or as part of an ensemble) and sing a song in his/her native tongue. Musical selections in English, Italian, Spanish, French, Russian, Danish, Mandarin, Cantonese, Greek, and several languages of India then ensued. Perhaps the high point of the evening occurred when Brittany Hajek Scheid (9-year old daughter of Bruce Hajek) sang four verses of “Are You Sleeping?” in four different languages.



Thomas Kailath presenting his plenary talk at the 2002 Information Theory Workshop.



Vijay Bhargava, Hesham El-gamal, Tom Fuja, R.K. Bansal and Vinod Sharma during the Wednesday tour of the KPJ Prabhu Artisans Training, Production & Marketing Centre.

The workshop’s technical program can be found at the ITW ‘02 website, <http://ece.iisc.ernet.in/ieee-itw2002/>.

The Workshop’s general co-chairs were Anurag Kumar and Tom Fuja, and the technical co-chairs were B. Sundar Rajan and Prakash Narayan. In charge of local arrangements were Vinod Sharma and Vijay Bhargava. Marc Fossorier served as the ITW treasurer, and Munish Goyal served as the webmaster. In addition, numerous volunteers from the Indian Institute of Science in Bangalore put in considerable effort to insure a successful workshop.



David Forney, Tom Kailath, Sarah Kailath and Vijay Bhargava during the tour of the Kaveri Pottery Science, Manufacture & Marketing Centre.

WORKSHOP REPORT:

Two successful 2002 events organized by the IEEE German IT Chapter

by Han Vinck

The German Chapter on Information theory organized two scientific workshops. The first workshop was held in July at the beautiful location of the Castle Maurach on Lake Constance in honor of Professor Bernhard Dorsch's retirement. The meeting was organized by Martin Bossert (Ulm). A 1-star Michelin cook was responsible for the catering. Former students and old friends discussed the impact of Bernhard Dorsch on the early development of Information Theory in Germany and his contribution to "Soft-Decision" decoding in 16 presentations. Tailbiting codes were presented by Joachim Hagenauer to solve the problem "What is better – block or convolutional codes?" At the workshop the chapter members elected Dejan Lasic from the University of Karlsruhe as their new chairman. The participants were very pleased by having Jim Massey as the banquet speaker.



Martin Dorsch

The second workshop "Topics in Information Theory" was organized in cooperation with the University of Essen, September 12-13. The 2-day workshop provided 11 lectures to

about 20 participants. Highlights of the workshops were the presentations by Steven McLaughlin (Georgia Tech, Atlanta) on M-ary Optical Data Storage and Marc Fossorier (Hawaii) on Soft Decision Decoding. Further talks were given by: Chai Mitrpant (Essen) on "The Multi-User Wire-Tap Channel", Trung van Tran (Essen) on "Tracability Codes", Dejan Lasic (Karlsruhe) on "Optimal Codes for the AWGN Channel", Han Vinck (Essen) on the 2-Access Switching Channel", Erik Haas (DLR, Oberpfaffenhofen) on "OFDM Implementation Aspects", Marzio Mura (FTW, Vienna) on "Iterative Decoding of Analog Product Codes", Gottfried Lechner (FTW, Vienna) on "Iterative Decoding", Peter Sweeney (Surrey, UK) on "Information-hiding" and Jossy Sahir (FTW, Vienna) on "Matrimonial Alternatives for Source and Channel Coding". In addition to the

technical program, the local organizers provided a very informal atmosphere with many intensive discussions, drinks and food. A visit to a local chemical industry concluded the workshop. Proceedings (42 pages) can be obtained from Mrs. Rieth at: rieth@exp-math.uni-essen.de.



The "Professors" present at the Dorsch-Workshop organized by the IEEE German Chapter.

GOLOMB'S PUZZLE COLUMN™

EARLY BIRD NUMBERS

Consider the sequence (*) consisting of the consecutive positive integers, written in decimal notation, with no intervening spaces or punctuation:

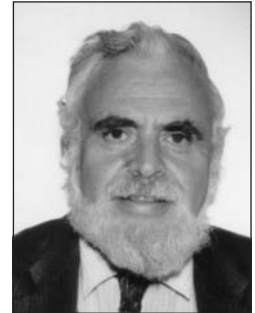
(*) 12345678910111213141516171819202122232425...

It is easy to show that if this sequence is preceded by a decimal point, the resulting real number is irrational and is "normal, to the base ten" (i.e. every sequence of k consecutive digits occurs in this sequence, asymptotically, with a frequency of 10^{-k}). It has also been shown that this real number is transcendental.

Martin Gardner has defined a positive integer to be an *early bird number* (e.b. no., for short), if it can be found in the sequence (*) earlier than its guaranteed place in the counting sequence. Thus, **12** is an e.b. no., since the sequence (*) begins with 12. So too is **718**, since we find it in (*) in the overlap of 17 and 18: (17)(18). On the other hand, the numbers from 1 to 11, inclusive, are *not* e.b. nos., nor are any two-digit numbers ending in "0". Here are some questions.

1. There are 90 two-digit integers from 10 through 99. Exactly half of these (i.e. 45) are e.b. nos. Can you describe which ones these are?
2. Suppose that n is a k -digit positive integer ($k > 1$) such that there is a cyclic permutation n' of the digits of n , where n' begins in a digit other than 0 and ends in a digit other than 9, and $n' < n$. Prove that n must be an e.b. no.

Solomon W. Golomb



3. Is the previous statement still true if n' , the cyclic permutation of n with $n' < n$, is allowed to end with the digit 9? (Prove or disprove.)
4. a. Show that every integer from 91 to 99 (inclusive) is an e.b. no.
b. Show that every integer from 901 to 999 is an e.b. no.
c. Prove or disprove: "Every integer from $9 \cdot 10^d + 1$ to $10^{d+1} - 1$ (inclusive) is an e.b. no., for all $d \geq 1$." (If true, give a proof. If false, exhibit counter-examples.)
5. Martin Gardner observed that "31415" (the first five digits of π) is an "early" e.b. no., occurring in the sequence (*) at (13)(14)(15). By the theorem in Problem 2, we can also get 31415 as an e.b. no. using either $n' = 14153$ or $n' = 15314$. (That is, n appears in the overlap of the consecutive integers (14153)(14154) and of (15314)(15315).)
Find a 5-digit integer that has six different representations as an e.b. number.
6. Asymptotically, what percentage of all positive integers are e.b. numbers?

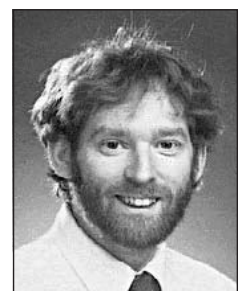
IEEE Information Theory Society Annual Meeting

Hotel Alpha-Palmiers, Lausanne, Switzerland, Sunday June 30, 2002

Attendees: Erik Agrell, John Anderson, Vijay Bhargava, Daniel Costello, Tom Cover, Michelle Effros, Anthony Ephremides, Raymond Findlay, David Forney, Marc Fossorier, Thomas E. Fuja, Alex Grant, Aaron Gulliver, Joachim Hagenauer, Michael Honig, Hideki Imai, Philippe Jacques, Torleiv Kløve, Ryuji Kohno, Steven W. McLaughlin, Urbashi Mitra, Mehul Motani, Levent Onural, Lance C. Pérez, Paul H. Siegel, Wojciech Szpankowski, Alexander Vardy, Han Vinck, Raymond Yeung

1. The meeting was called to order at 1:50 PM by Society President Tom Fuja. Those present were welcomed and introduced themselves. IEEE President Raymond Findlay and Region 8 Director Levent Onural were welcomed to the meeting. The Agenda was approved as distributed.

Aaron Gulliver



Aaron Gulliver

2. The minutes of the previous meeting held in Princeton, NY on March 22, 2002, were approved as distributed.
3. Society President Tom Fuja began with a report on the ongoing financial crisis. In particular, the 'Findlay model' was discussed. This model determines how corporate infrastructure expenses will be allocated to IEEE organizational units.

In response to pressure by the organizational units to reduce costs and balance the budget, the IEEE Board of Directors has raised dues \$9. Due primarily to staff

reductions, infrastructure savings of \$4.7 million have been obtained for 2002, with an additional \$6 million for 2003. In addition, an Infrastructure Oversight Committee and an Operations Review Committee have been formed. While these initiatives have resulted in some cost savings, the new financial structure still leaves the society with considerable budget deficits for 2002 and 2003.

He stated that as a society we need more ways to generate revenue. Most of our revenue comes from the electronic library (IEL) and the all-societies periodical package (ASPP). However, returns to the society for these products are diminishing, primarily because of the IEEE charges against this revenue.

Conferences generate a large amount of revenue for some societies, particularly the Communications Society. The subject of budgeting ISITs and Workshops to generate a surplus for the society was discussed. The major problem noted is that conference registration fees are already considered high, and would have to be raised to generate a significant surplus. In addition, this would limit the surplus monies that have traditionally been used for subsidies for students and people from disadvantaged countries.

President Fuja suggested that since dues increases tend to lower membership numbers, small increases in dues should be instituted rather than the large increase made recently. The information technology electronic library (ITEL) was discussed. The Information Theory Society was not consulted about including the Transactions on Information Theory in this package. The possibility of joining at a later date will be explored.

To reduce expenses, a reduced rate membership with electronic-only access to the transactions was discussed. This option was suggested by the Ad-hoc Committee on Finances. Currently it costs approximately \$70 to service each member, much of this is shipping of the transactions. Instead, a yearly CD with the 12 issues could be supplied. A motion to authorize Treasurer Fossorier to investigate and implement an alternative all-electronic membership for 2003 with a CD at the end of the year was passed unanimously. This will be done in consultation with Tom Fuja, Urbashi Mitra and Han Vinck. A membership survey will be conducted to establish the extent of member interest in such an option.

The future of the society was considered. In particular, what would happen to the society if the reserves are reduced to zero. It is doubtful that the society would be terminated as it is not in the best interests (financial or otherwise) of IEEE. President Findlay stated that he would be appalled if a society were to be put in 'bankruptcy', he would rather see societies voluntarily amalgamate. It was noted that the society was doing fine until the recent infrastructure charges. An opinion was expressed that radical changes are needed at IEEE corporate rather than an increase in society revenues and cost cutting. A major problem is that the societies were left out of

the discussion of how to implement infrastructure charges. President Findlay apologized for this, and stated that the societies are valuable, it is the breadth of interests that makes the IEEE what it is. Scenarios were discussed about how the society could secede. An Ad-hoc Committee on Secession consisting of Tom Fuja, Michelle Effros, David Forney, Steven McLaughlin, Han Vinck, plus additional members to be added later, was formed to consider the issues surrounding the society leaving IEEE.

A reduction of editorial expenses and award honorariums was also discussed.

In summary, the corporate cuts have helped, but the society must try to diversify its income streams. President Fuja's report in PDF format can be found at: <http://www.itsoc.org/June-report.pdf>.

4. Marc Fossorier presented the Treasurer's Report. He distributed an overview of the current financial status of the society. The society no longer has control over the allocation of funds to long term investments, this is now decided by IEEE. Current assets stand at just under \$ 1 million. After the infrastructure charges for this year and next, the society will be left with approximately \$400,000. A chart showing the major society expenses and revenues was presented.

He suggested that the proceedings ordered by IEEE through the Book Broker program be distributed free at Symposia and Workshops, and perhaps these events could absorb the shipping costs. This would have to be negotiated with the event organizers. Currently, these proceedings are purchased by the Society for the Symposium or Workshop and later, a percentage of the sales by IEEE is paid back to the Society. The motivation for this change is to avoid a possible loss with the current process, especially in the case of a co-sponsored event.

5. The Transactions Report was given by Editor-in-Chief Paul Siegel. The transaction has no backlog, and they are being mailed on time. He noted that the Dinner for the Associate Editors would be held Tuesday evening at the Chateau d'Ouchy, and thanked Bixio Rimoldi and Rudiger Urbanke for their help in organizing this event.

It was announced that the winners of the 2002 IEEE Communications Society and Information Theory Society Joint Paper Award are Michael L. Honig and Weimin Xiao for their article, "Performance of Reduced-Rank Linear Interference Suppression," which appeared in IEEE Transactions on Information Theory, Vol. 47, No. 5, July 2001.

The June 2002 Special Issue entitled "Shannon Theory: Perspective, Trends and Applications," was delivered on schedule. He thanked the Guest Editors for a great job. The Call for Papers for the 2003 Special Issue has appeared and the Call for the 2004 Special Issue will appear soon.

Two new appointments to the Editorial Board were presented to the Board for approval:

- (a) Source Coding: Serap Savari to replace Marcelo Weinberger, effective September 1, 2002.
- (b) Complexity and Cryptography: Thomas Johansson to replace Neal Koblitz effective September 1, 2002.

The appointments were approved unanimously. In addition, he noted that new Associate Editors would be required during 2002 for:

- (a) Nonparametric Estimation, Classification and Neural Networks to replace Gabor Lugosi
- (b) Quantum Information Theory to replace Peter Shor
- (c) Sequences to replace Andrew Klapper

The 2002 page budget is 3150, with a maximum of 5 % over, the target is 3308. Since there will be a loss of \$10-20 K if this amount is exceeded, a modest backlog may be incurred to ensure no loss in revenue. There was some discussion about author incentives to reduce paper lengths. It was decided not to institute page charges.

In terms of editorial expenses, the budgeted amount to the end of May was \$21K but actual costs were only \$13.3 K. The bulk of these costs are for the Editorial Assistant, Katherine Perry.

Distribution alternatives for the Transactions were explored. A remailer could reduce costs and delivery times in Regions 8-10. However the cost reduction is only when the weight is below 18-20 ounces, and there could be some loss in control of delivery by a contractor. The board approved a motion to use a remailer at all times to reduce delivery times. The estimated cost of this move is \$2900.

To reduce costs, the IEEE now sends PDF page proofs via email. They are also considering trimming pages by 1/4 inch more and using lower weight paper.

- 6. Lance Pérez presented the Newsletter Editor's Report. He asked that announcements and call for papers be sent to him as early as possible for timely inclusion. Parity Computing is creating a newsletter electronic library. It is hoped this will be active by August. He asked those present to look for the missing issues listed in the March issue of the Newsletter so that the library can be complete.
- 7. Aaron Gulliver presented the report on the IT Society website. The new website is being developed by IEEE Entity Creation Services. The design has been finalized and should be deployed by the next board meeting. Two rounds of design were done and feedback was solicited each time. The goal is to simplify the site and make it more attractive and user friendly. The website statistics for the year 2002 (to date) were presented. There were no significant changes since the Princeton meeting report. This year, daily volume peaked at 3000 file transfers and 290 Mbytes of data. Of the 102 countries that have accessed the website, the top five are the US, Japan, Germany, France and the UK, in that order. The June Newsletter was recently posted, and so it is currently the most popular

item. Conference information and newsletters continue to be the most commonly visited pages.

- 8. Tom Fuja presented a proposal to change the honorarium for the Paper Award. The change to the Bylaws for the Paper Award was distributed to the board members prior to the Annual Meeting, as per the Society Constitution. The rationale is the current financial stringency and to provide an honorarium similar to that of other societies. The current amount of \$10 K is the same as IEEE Medal award winners.

The wording of the proposed change to Article VIII. Paper Award, Section 1. is as follows:

... and an honorarium of \$1,000 for a paper with a single author, or an honorarium of \$2,000 equally split among multiple authors.

The change was approved unanimously.

No changes were proposed for the Shannon Award.

- 9. The Awards Committee Report was given by Han Vinck. He announced that Peter Elias has won the Hamming Medal. He also mentioned the joint paper award by Honig and Xiao.

From those papers nominated for the 2003 paper award, three were chosen for consideration by the board as per Bylaw Article VIII, Section 2. The rationale for their selection was previously distributed to the board members. After voting, the joint winners of the award were announced by President Fuja:

"Low-Density Parity-Check Codes Under Message-Passing Decoding", T.J. Richardson and R.L. Urbanke, IEEE Transactions on Information Theory, vol. 47, no. 2, pp. 599-618, February 2001,

and

"Improved Low-Density Parity-Check Codes Using Irregular Graphs", M.G. Luby, M. Mitzenmacher, M.A. Shokrollahi and D.A. Spielman, IEEE Transactions on Information Theory, vol. 47, no. 2, pp. 585-598, February 2001.

Hideki Imai announced to the board that the first Best Chapter Award will be presented at the Chapters lunch on Monday afternoon.

- 10. The establishment of a Distinguished Service Award was discussed. Han Vinck circulated a proposal for the award. The name and frequency of the award were discussed, as well as the selection criteria. The board unanimously approved a motion to establish a Distinguished Service Award. The Bylaws committee will draft an appropriate bylaws amendment for consideration at the next board meeting.
- 11. The establishment of a multi-year presidency has been suggested by IEEE. At present, election to 2nd Vice-President entails a commitment of 5 years service as a society officer. The key is to have more experienced officers at the

- TAB meetings. A designated TAB representative was suggested, as well as having the 1st Vice-President attend the meetings along with the President. This issue was tabled until the next board meeting, at which time the Society President will present a detailed proposal.
12. The frequency of the Symposia was discussed next. Yearly events provide regularity with respect to other events, but have a short time from the end of one of the submission deadline of the next. It was suggested that this problem could be alleviated by having a later deadline which could be accommodated by streamlining the review process. To allow for southern hemisphere venues, a variable date from April to July could be allowed. There were differing opinions on the success of the yearly frequency. Some viewed the regular dates as a benefit, while others found it to be a problem. No consensus was reached, so an Ad-Hoc Committee on Frequency of ISITs was formed consisting of Alexander Vardy, Tony Ephremides, John Anderson and Tom Cover. The committee will investigate these issues in detail and present their recommendation at the next board meeting.
 13. Steven McLaughlin presented the Report on Symposia and Workshops.
 - 13.1. Tom Fuja reported on ISIT 2001. A small surplus of \$4385 is anticipated pending the final audit, which will be completed soon.
 - 13.2. Alex Grant reported that there is no new information regarding the 2001 Information Theory Workshop which was held in Cairns, Australia. There is one remaining payment outstanding.
 - 13.3. Bixio Rimoldi reported on ISIT 2002. Over 700 papers were submitted and 500 were accepted for presentation. Attendance is expected to be 720-730. Ten terminals have been provided for computer access. The online submission and registration software which was developed for ISIT 2002 worked well and can be used for future events.
 - 13.4. Tom Fuja presented the report on the 2002 Information Theory Workshop to be held in Bangalore, India. Twenty out of fifty submitted papers have been selected to be presented in addition to the invited papers. The current political climate in India was discussed. The current problems are subsiding, therefore it appears the travel advisory will be lifted and there will be no impediments to those outside India participating. Should the event be cancelled, the participants from India will be asked to continue on with the event.
 - 13.5. Ryuji Kohno reported on the progress of ISIT 2003, to be held in Yokohama, Japan. A detailed budget was presented and discussed. The budget was approved unanimously.
 - 13.6. Joseph Boutros presented the report on the 2003 Information Theory Workshop to be held in Paris, France. A detailed budget was presented and discussed. The budget was approved unanimously.
 - 13.7. Dan Costello presented the report on the 2004 Information Theory Symposium to be held in Chicago, IL. The dates will be June 27 to July 7. The theme is Exploring New Connections.
 - 13.8. For future meetings, Alex Grant presented a proposal to hold ISIT 2005 in Adelaide, Australia. The organising committee, tentative dates and a budget summary were presented. The board voted unanimously to approve this proposal.
Raymond Yeung presented a detailed proposal for an Information Theory Workshop to be held in Hong Kong July 6-10, 2003 (just after ISIT 2003 in Yokohama). The proposal was approved unanimously along with a \$5000 loan.
 - 13.9 A request for technical co-sponsorship of the International Symposium on Turbo Codes and Related topics was considered and approved. The symposium will be held September 1-5, 2003, in Brest, France.
 - 13.10 A request for cooperation for the IEEE CAS Workshop on Emerging WLAN Networking Technologies was considered and approved.
 - 14.1 Nominations for Society Officers for 2002 were made. The candidates for President, 1st VP and 2nd VP were approved. The Society President will conduct the voting in July.
 - 14.2 A list of 12 candidates from the Nominations Committee for new Board Members was presented. In addition, Erik Agrell was nominated by the Board. The 13 candidates were approved unanimously.
 15. Under other business, Han Vinck suggested a new journal called Information Theory Letters with a style similar to Communications Letters. There was some discussion as to how well Communications Letters is doing. The Editor-in-Chief, Desmond Taylor, will be consulted regarding this issue. Levent Onural, Region 8 Director, made a presentation to the board. He talked about chapters, the distinguished lecturers program, and the new logo. He voiced his concerns regarding IEEE participation from low income countries and the number of election ballots received too late to vote.
 16. The next board meeting will take place during the Information Theory Workshop in Bangalore, India. Tom Fuja thanked the organizers of ISIT 2002 for making arrangements for the Annual Meeting. The meeting was adjourned at 6:15 PM.

New Books

by Raymond Yeung

Multi-Antenna Digital Radio Transmission

By Massimiliano Martone. Artech House, 2001, 418 pp., £75, ISBN 1-58053-318-3.

Contents:

Broadband Wireless Access; Theoretical Limits of the Spatio-Temporal Wireless Channel; Digital Radio Design Principles; Space-Time Modems Based on Traditional Principles; Spatio-Temporal Processing Using High-Order Statistics; An Experimental Digital Radio for MIMO; Advanced Solutions for High Mobility; Spatio-Temporal Radios for CDMA.

Handbook of Markov Decision Processes: Methods and Applications

Edited by Eugene A. Feinberg and Adam Shwartz. Kluwer, 2001, 576 pp., US\$175, ISBN 0-7923-7459-2.

Contents:

1. Introduction. Part I: Finite State and Action Models. 2. Finite State and Action MDPs. 3. Bias Optimality. 4. Singular Perturbations of Markov Chains and Decision Processes. Part II: Infinite State Models. 5. Average Reward Optimization Theory for Denumerable State Spaces. 6. Total Reward Criteria. 7. Mixed Criteria. 8. Blackwell Optimality. 9. The Poisson Equation for Countable Markov Chains: Probabilistic Methods and Interpretations. 10. Stability, Performance Evaluation, and Optimization. 11. Convex Analytic Methods in Markov Decision Processes. 12. The Linear Programming Approach. 13. Invariant Gambling Problems and Markov Decision Processes. Part III: Applications. 14. Neuro-Dynamic Programming: Overview and Recent Trends. 15. Markov Decision Processes in Finance and Dynamic Options. 16. Applications of Markov Decision Processes in Communication Networks. 17. Water Reservoir Applications of Markov Decision Processes.

Compression and Coding Algorithms

By Alistair Moffat and Andrew Turpin. Kluwer, 2002, 288 pp., US\$110, ISBN 0-7923-7668-4.

Contents:

1. Data Compression Systems. 2. Fundamental Limits. 3. Static Codes. 4. Minimum-Redundancy Coding. 5. Arithmetic Coding. 6. Adaptive Coding. 7. Additional Constraints. 8. Compression Systems. 9. What Next?

Codes, Graphs, and Systems

Edited by Richard E. Blahut and Ralf Koetter. Kluwer, 2002, 480 pp., US\$95, ISBN 0-7923-7686-2.

Contents:

Part I: Convolutional Codes, Turbo Codes, and Other Words of Wisdom. The Mutations of Convolutional Coding (Around the Trellis). Heavy Tails, Phase Transitions, and the Nature of

Cutoff. Concatenated Codes with Convolutional Inner Codes. Equivalence of Systematic and Nonsystematic Convolutional Encoders. Systematic Bits are Better and No Buts About It. Part II: Detection and Equalization. Sequence Detection: Backward and Forward in Time. Least Squares and Kalman Filtering on Forney Graphs. Iterative Algorithms for Maximum Likelihood Sequence Detection. Part III: Modems. V. 92: The Final Chapter in the Never-ending Story of Dial-up Modems. Modems to Mars. Existence of Good Codes with Low Peak-to-Average Power Ratios. Part IV: Physics and Information Theory. On Synchronization and ISI for Jammed Timing Channels. Decoding Only the Strongest CDMA Users. Power Limited Channels: Coding, Multi-access, and Spread Spectrum. Recursive Construction of Multi-Channel Transmission Lines. On the Capacity of Multimode Optical Fibers. Huffman Shaping. Part V: Lattices and Geometry. Lattices and Cryptography. A Simple Construction for the Barnes-Wall Lattices. Part VI: Behaviors and Codes on Graphs. Minimal Bases of Rational Vector Spaces and their Importance in Algebraic Systems Theory. Finite Geometry Low Density Parity-Check Codes. The Tetrahedral Golay Code. On the Representation of Codes in Forney Graphs.

Information, Coding and Mathematics

Edited by Mario Blaum, Patrick G. Farrell, and Henk C. A. van Tilborg. Kluwer, 2002, 392 pp., US\$125, ISBN 1-4020-7079-9.

Contents:

1. A Computational Theory of Surprise. 2. Dynamic Key Distribution Using MDS Codes. 3. Worst-Case Mutual Information Trajectories in Concatenated Codes with Asymptotic Interleavers. 4. Results to get Maximal Quasihermitian Curves. New possibilities for AG Codes. 5. On Asymmetric Error Detection with Feedback. 6. Cryptanalysis of Block Ciphers and Weigh Divisibility of Some Binary Codes. 7. Sloppy Alice attacks! Adaptive chosen ciphertext attacks on the McEliece Public-Key Cryptosystem. 8. Reducible Rank Codes and Applications to Cryptography. 9. On a Boolean Maximization Problem. 10. On the Security of the McEliece Public-Key Cryptosystem. 11. Performance of MIMO Space Time-Coding with Discrete Modulations on Flat Fading Channels. 12. Coding for Slow-Frequency-Hop Transmission: Variations on a Theme of McEliece. 13. On Graph Constructions for LDPC Codes by Quasi-Cyclic Extension. 14. On the Channel Memory-Diversity Tradeoff in Communication Systems. 15. Duality, Dirty Paper Coding, and Capacity for Multiuser Wireless Channels. 16. Stability Analysis of the Turbo Decoding Algorithm Using Max-Log-MAP. 17. Recursive List Decoding for Reed-Muller Codes and their Subcodes. 18. Adaptive Soft-Decision Decoding In Two Dimensions. 19. On the Theory of Linear Trellises. 20. Coding

Over Graphs. 21. On Approaching the Capacity of Finite-State Intersymbol Interference Channels.

Constrained Coding and Soft Iterative Decoding

By John L. Fan. Kluwer, 2001, 280 pp., US\$110, ISBN 0-7923-7455-X.

Contents:

1. Introduction. 2. Message-Passing Algorithm. 3. Forward-Backward Algorithm. 4. Application to Magnetic Storage. 5. Constrained Coding for Hard Decoders. 6. Constrained Coding for Soft Decoders. 7. Array Codes as LDPC Codes. 8. Other Topics.

Iterative Detection: Adaptivity, Complexity Reduction, and Applications

By Keith Chugg, Achilleas Anastasopoulos, and Xiaopeng Chen. Kluwer, 2000, 392 pp., US\$125, ISBN 0-7923-7277-8.

Contents:

1. Overview of Non-Iterative Detection. 2. Principles of Iterative Detection. 3. Iterative Detection for Complexity Reduction. 4. Adaptive Iterative Detection. 5. Applications in Two Dimensional Systems. 6. Implementation Issues: A Turbo Decoder Design Case Study.

The Art of Error Correcting Coding

By Robert H. Morelos-Zaragoza. Wiley, 2002, 238 pp., US\$95, ISBN 0-471-49581-6.

Contents:

Introduction; Hamming, Golay and Reed-Muller codes; Binary cyclic codes and BCH codes; Non-binary BCH codes; Reed-Solomon codes; Binary convolutional codes; Modifying and combining codes; Soft-decision decoding; Iteratively decodable codes; Combining codes and digital modulation; Appendix A: Weigh distributions of extended BCH codes.

Multuser Detection in CDMA Mobile Terminals

By Piero Castoldi. Artech House, 2002, 246 pp., £70, ISBN 1-58053-330-2.

Contents:

Introduction and CDMA Models; Single-User Detection; Linear Multuser Detection; Structured vs. Unstructured Linear Detection and Interference Mitigation; Adaptive Linear Multuser Detection; Performance of Linear Multuser Detection; Non-Linear Multuser Detection; Synchroniza-

tion Techniques; Third Generation Mobile Radio System; The ASI-CNIT Communication System.

Probabilistic Logic in a Coherent Setting

By Giulianella Coletti and Romano Scozzafava. Kluwer, 2002, 296 pp., US\$106, ISBN 1-4020-0970-4.

Multi-Carrier Technologies for Wireless Communication

By Carl R. Nassar, Bala Natarajan, Zhiqiang Wu, David A. Wiegandt, S. Alireza Zekavat, and Steve Shattil. Kluwer, 2001, 216 pp., US\$125, ISBN 0-7923-7618-8.

Constellation Shaping, Nonlinear Precoding, and Trellis Coding for Voiceband Telep

By Steven A. Tretter. Kluwer, 2002, 288 pp., US\$125, ISBN 1-4020-7006-3.

Error Coding for Engineers

Edited by A. Houghton. Kluwer, 2001, 256 pp., US\$130, ISBN 0-7923-7522-X.

Coding and Modulation for Digital Television

By Gordon Drury, Garik Markarian, and Keith Pickavance. Kluwer, 2000, 264 pp., US\$95, ISBN 0-7923-7969-1.

Multipath Phenomena in Cellular Networks

By Nathan Blaunstein and Jøgen Bach Andersen. Artech House, 2002, 316 pp., £68, ISBN 1-58053-185-7.

Design of Digital Video Coding Systems

By Jie Chen and UT-VA Koc. Marcel Dekker, 2001, 488 pp., US\$165 (US\$59.75 for five copies or more), ISBN 0-8247-0656-0.

Compressed Video over Networks

Edited by Ming-Ting Sun and Amy R. Reibman. Marcel Dekker, 2000, 576 pp., US\$175 (US\$79.75 for five copies or more), ISBN 0-8247-9423-0.

Data and Telecommunications Dictionary, 2nd Ed.

By Julie K. Petersen. CRC Press, 2002, 1, 088 pp., US\$69.95, ISBN 0-8493-9591-7.

The Telecommunications Illustrated Dictionary, 2nd Ed.

By Julie K. Petersen. CRC Press, 2002, 1,074 pp., US\$69.95, ISBN 0-8493-1173-X.

GOLOMB'S PUZZLE COLUMN™

On a Problem of Richard Epstein — Solutions

The numbers $n = \{5, 6, 25, 76, 376, 625\}$ have the property that n^2 ends in n , in standard decimal notation. The following questions were asked:

1. Are there other values of $n > 1$ with this property?
2. What is the general procedure for finding additional examples?
3. Is the “complete list” finite or infinite?

Here are short answers:

1. Yes, there are more values of n .
2. For $n > 1$,
 - a) no examples end in 0 or 1,
 - b) all examples end in 5 or 6,
 - c) if n is a t -digit example, $t > 1$, every shortening of n by removing digits from the left end of n is also an example.
3. The “complete list” is infinite, with infinitely many examples ending in 5, and infinitely many ending in 6.

Here are the first eighteen examples, separated into those ending in 5 and those ending in 6.

n	n^2
5	25
25	625
625	390,625
90,625	8,212,890,625
890,625	793,212,890,625
2,890,625	8,355,712,890,625
12,890,625	166,168,212,890,625
212,890,625	45,322,418,212,890,625
8,212,890,625	67,451,572,418,212,890,625

n	n^2
6	36
76	5,776
376	141,376
9,376	87,909,376
109,376	11,963,109,376
7,109,376	50,543,227,109,376
87,109,376	7,588,043,387,109,376
787,109,376	619,541,169,787,109,376
1,787,109,376	3,193,759,921,787,109,376

Note three cases (all ending in 5) where an n^2 in the table reappears later as a value of n , namely: 25; 625; and 8,212,890,625. (Is this list finite or infinite?)

The following theorems apply in base $b \geq 2$, where “10” represents b written in base b . The set E_b consists of those integers $n > 1$ for which n^2 “ends in” n , when both n and n^2 are written in base b .

Theorem 1. No member of E_b ends in 0. (That is, no $n > 1$ in E_b is a multiple of b .)

Proof. Suppose n , when written in base b , ends in exactly $t \geq 1$ zeroes. Then n^2 ends in $2t > t$ zeroes, and does not end in n .

Theorem 2. (the Main Theorem). Suppose $n \in E_b$, where n has $t \geq 2$ digits when written in base b . Then every “shortening” of n , by removing digits from the left of n , leaving between 1 and $t - 1$ digits, is again in E_b .

Proof. Suppose $n \in E_b$ and n has $t > 1$ digits in base b notation. This says: $n^2 \equiv n \pmod{10^t}$, or $n^2 - n \equiv 0 \pmod{10^t}$. But then also $n^2 - n \equiv 0 \pmod{10^{t-1}}$, which says that n' , which is n with its left-most digit removed, is also in E_b ; and this process can be iterated to obtain the assertion of the Theorem.

Theorem 3. For base $b \geq 2$, no element $n > 1$ of E_b has its “units digit” equal to 1.

Proof. Suppose $n = c \cdot 10^t + 1$, where $0 < c < b$, and $t \geq 1$, is the “base b ” representation of n (where $b = 10$ in base b). Then $n^2 - n = (c^2 \cdot 10^{2t} + 2c \cdot 10^t + 1) - (c \cdot 10^t + 1) = c^2 \cdot 10^{2t} + c \cdot 10^t \pmod{10^{t+1}}$, since n has $t + 1$ digits in base b . But since $0 < c < b$, this says $n^2 - n \equiv c \cdot 10^t \not\equiv 0 \pmod{10^{t+1}}$, so that $n \notin E^b$.

When $b = 10$, the elements of E_b must end in either 5 or 6, since these are the only “single digit” elements of E_{10} . Members of E_{10} ending in 5 are formed by starting with $n_1 = 5$, and obtaining n_{j+1} from n_j by taking one more digit to the left of n_j in the base-10 representation of n_j^2 . (If this next digit is 0, go one additional digit to the left.) This is the method of generating the subsequence $\{5, 25, 625, 90625, 890625, 2890625, \dots\}$ of E_{10} .

The elements of E_{10} ending in 6 are formed in a similar way, starting with $m_1 = 6$, but instead of adjoining the new left-most digit r to m_j from the base-10 representation of m_j^2 to get m_{j+1} , adjoin $10 - r$ instead. This method leads to the subsequence $\{6, 76, 376, 9376, 109376, 7109376, \dots\}$ of E_{10} . (If the next digit to the left is 0, we go one additional digit to the left, as with the previous subsequence.)

Each of these subsequences will continue to have new members by the recursive constructions just described.

The remaining three questions concerned E_b for other values of b . Note that the three Theorems above work for every base $b > 1$.

4. “For prime $b \geq 2$, E_b is empty”.

Proof. Suppose $1 < n < b$, so that n is a single-digit number in base b , with $n > 1$, and suppose $n^2 \equiv n \pmod{b}$. But this

says that the prime b divides $n^2 - n = n(n - 1)$ where neither n nor $n - 1$ is a multiple of b , a contradiction. Then, in view of the Main Theorem (Theorem 2), since E_b has no one-digit members, E_b is empty. By Theorems 1 and 3, the units digits 0 and 1 generate no multi-digit examples.)

5. "When $b = 2p$, where $p > 2$ is prime, E_b contains p and $p + 1$."

Proof.

a. $p^2 - p = p(p - 1) \equiv 0 \pmod{b}$, because $p - 1$ is even and $b = 2p$.

b. $(p + 1)^2 - (p + 1) = p^2 - p = p(p - 1) \equiv 0 \pmod{b}$, because $p + 1$ is even and $b = 2p$.

Since the quadratic $x^2 - x \equiv 0 \pmod{p}$ has at most two roots in the field $GF(p)$, and $x = 0$ and $x = 1$ are both roots, it is easy to show that $x^2 - x \equiv 0 \pmod{2p}$ has precisely the four roots $\{0, 1, p, p + 1\}$ in the ring of integers modulo $2p$.

6. The complete solution for E_b , where $b = 2p$ and $p > 2$ is prime, precisely parallels the special case $p = 5$, $b = 10$ considered earlier. One infinite subsequence of E_b consists of numbers with units digit p , and the other infinite subsequence of E_b consists of numbers with units digit $p + 1$. It is even the case that

$$p^2 - p \equiv (2p) \binom{p-1}{2} \equiv 0 \pmod{b},$$

$$p^4 - p^2 \equiv (2p)^2 \binom{p+1}{2} \binom{p-1}{2} \equiv 0 \pmod{b^2}$$

$$p^8 - p^4 \equiv (2p)^4 \binom{p^2+1}{2} \binom{p^2-1}{2} \equiv 0 \pmod{b^4},$$

so that p , p^2 , and p^4 all belong to $E_b = E_{2p}$.

CALL FOR PAPERS

Problems on Sequences: Information Theory & Computer Science Interface

2004 Special Issue of IEEE TRANSACTIONS ON INFORMATION THEORY

The IEEE TRANSACTIONS ON INFORMATION THEORY will publish a Special Issue on “*Problems on Sequences: Information Theory and Computer Science Interface*”.

Recent years have seen a proliferation of research in “Problems on Sequences” which has benefited from the interplay between information theory and computer science – each of these two fields has had an impact upon the other in providing design paradigms and in providing ways of obtaining performance bounds. Because of the continued expansion of this research interest, it is an opportune time for a special issue to be devoted to this area.

Below are examples of topics illustrating some of the ways in which information theory (IT) and computer science (CS) impact each other.

- Analysis of algorithms applied to analyze algorithms for data compression, prediction, pseudorandom number generation, and classification.
- Computational or descriptive complexity applied to examine the complexity/performance tradeoff in lossless/lossy data compression.
- CS data structures (grammars, trees, and graphs) applied to design codes for sequences.
- Exact and approximate pattern matching techniques applied to context modeling/coding.
- Entropy, mutual information and information distance concepts applied to problems of computational biology.
- IT concepts applied to provide bounds in computational learning theory.
- Applications of IT to computational linguistics.
- Applications of IT to information retrieval (especially data mining).

The litmus test regarding the suitability of a paper submitted to the special issue will be whether it addresses a problem on sequences in a manner in which IT and CS interface in an essential way. It is expected that the paper submissions to the special issue will predominately concern the compression/prediction/modeling subarea of IT and the theory of algorithms subarea of CS. The list of topics above reflects that expectation, but should not be considered to be all-inclusive: there could be paper submissions meeting the litmus test which address other subareas of IT and CS, or which address new problems at the interface.

Prospective authors are invited to submit their papers electronically as postscript files to any of the following guest editors. All submissions should follow the guidelines of the IT Transactions as to format, and will undergo a rigorous review. The deadline for submission is **March 15, 2003**.

John Kieffer
Dept. of Electrical&Comp. Engr.
University of Minnesota
Minneapolis, MN 55455
U.S.A.
kieffer@ece.umn.edu

Wojciech Szpankowski
Dept. of Computer Science
Purdue University
W. Lafayette, IN 47907
U.S.A.
spa@cs.purdue.edu

En-hui Yang
Dept. of Electrical&Comp. Engr.
University of Waterloo
Waterloo, Ontario N2L 3G1
CANADA
E.Yang@ece.uwaterloo.ca

DIMACS

*Center for Discrete Mathematics & Theoretical Computer Science
Founded as a National Science Foundation Science and Technology Center*



DIMACS Special Focus on Computational Information Theory and Coding

Workshop on Complexity and Inference

June 2 - 6, 2003

DIMACS Center, Rutgers University, Piscataway, NJ

Organizers: Mark Hansen Paul Vitányi Bin Yu
Bell Laboratories CWI & U of Amsterdam UC Berkeley

URL: <http://stat.bell-labs.com/complexity>

Description: The notion of algorithmic complexity was suggested independently by Kolmogorov, Chaitin, and Solomonoff in the 1960's. Both Kolmogorov and Chaitin introduced the concept as a way to formalize notions of entropy and randomness, building on results from theoretical computer science dealing with partial recursive functions. Independently, Solomonoff defined algorithmic complexity in the pursuit of universal priors for statistical inference. In recent years, Rissanen expanded the applicability of these ideas, employing well-established concepts from information theory to frame his principle of Minimum Description Length (MDL) for statistical inference and model selection.

Each of these lines of research has developed methods for describing data (through coding and compression, or by analogy with some formal computing device); and each of these lines has employed some concept of an efficient representation to guide statistical inference. In this workshop, we will explore both the foundational aspects of complexity-based inference as well as applications of these ideas to challenging modeling problems. Participants will be drawn from the fields of statistics, information and coding theory, machine learning, and complexity theory. Application areas include biology, information technologies, physics and psychology. The following specific topics will be covered by the workshop:

- Kolmogorov complexity and inference
- Lossy compression and complexity theory
- Individual sequence/on-line prediction and predictive complexity
- Complexity and cognitive science
- MDL (MML) theory and applications
- Complexity and Bayesian methods
- Compression methods for clustering
- Machine learning and computational complexity
- Applications

Contributed Presentations: While leading researchers in each of these areas are being invited to participate in the workshop, submissions of contributed papers of original works in these areas are now being solicited. Papers will be reviewed on the basis of an extended abstract (not exceeding 3 pages) to allow for a reasonable review. The deadline for submission is **February 1, 2003**, with notification of decisions by **March 1, 2003**. Authors are required to submit electronic versions of their abstracts in PDF form to complexity@research.bell-labs.com.

Financial Support: A limited amount of funding is available for partial support of people wishing to attend. Students, recent Ph.D.'s, women and minorities are particularly encouraged to apply. To apply for funding, send a letter explaining your interest in the workshop together with a vita or bibliography and a budget for travel/living expenses. If you are a student, also solicit a letter from a faculty adviser.

DIMACS Center, CoRE Bldg. • Rutgers, The State University of New Jersey
96 Frelinghuysen Road • Piscataway, NJ 08854-8018 • USA
TEL: 732-445-5928 • FAX: 732-445-5932 • EMAIL: center@dimacs.rutgers.edu
URL: <http://dimacs.rutgers.edu/>

DIMACS is a partnership of Rutgers University, Princeton University, AT&T Labs - Research, Bell Laboratories, the NEC Research Institute and Telcordia Technologies
Affiliate members: Avaya Labs, IBM Watson Research Center and Microsoft Research

2nd CALL FOR PAPERS for WiOpt'03

Modeling and Optimization in Mobile and Ad Hoc and Wireless Networks

March 3 - 5, 2003, Sophia-Antipolis, France

Workshop Website:

<http://www-sop.inria.fr/mistral/personnel/K.Avrachenkov/WiOpt/main.html>

This workshop is intended to bring together leading researchers from both academia and industry to present both foundations and practical methods and tools for modeling and optimisation of mobile and ad-hoc networks. The workshop will bring together researchers studying optimisation issues of mobile networks from both the network performance and the mobile networking perspectives:

- Mobile Network Optimisation: Applications and Algorithms
- Performance characterisation and optimisation of mobile/wireless networks and systems
- Protocols design (MAC, Routing) for optimal mobile network utilisation
- Tools for network optimisation
- Energy efficiency in mobile networks
- Security and co-operation models for mobile networks
- Pricing and incentives in mobile and ad-hoc networks.

Presentations will be selected based on an extended abstract of three pages that should be sent via email to altman@sophia.inria.fr. Authors of accepted presentations will have the opportunity to publish either the extended abstract or the full paper in a proceedings volume. Full papers will further be considered for publication in a special issue of some high-level journal in the area (we are actually in contact with MONET).

Plenary Speakers:

P.R.Kumar (UIUC) V.Anantharam (UC Berkeley)

IMPORTANT DATES:

Submission of extended abstract: Dec. 1, 2002.
 Notification of acceptance: Jan. 10, 2003.
 Camera ready copy: Jan. 20, 2003.
 Early Registration: Jan. 31, 2003.

General chairman:

Jon Crowcroft

Program committee of the conference:

Eitan Altman and Anthony Ephremides (Co-Chairmen)

Francois Baccelli, Tamer Basar, Andrew Campbell, Imrich Chlamtac, A. Chockalingam, Marco Conti, Jerome Galtier, Stephen. V. Hanly, Jean-Pierre Hubaux, Philippe Jacquet, Anurag Kumar, Ravi Mazumdar, Philippe Nain, R. Srikant, Ness Shroff, Violet Syrotiuk, Leandros Tassioulas, Thierry Turetli, Jeff Wieselthier, Wing S. Wong, Yoshikuni Onozato.

Publicity Co-Chair:

Silvia Giordano - EPFL & Sven Ostring - University of Cambridge

Local Arrangement and Registration Chair:

Konstantin Avrachenkov - INRIA

Treasurer:

Monique Simonetti from INRIA.

Sponsors:

The workshop is co-sponsored by

- IEEE Information Society
- Univ. of Cambridge,
- INRIA Sophia-Antipolis
- France Telecom

In-cooperation (pending) with ACM Organized by INRIA Sophia-Antipolis

Due to the sponsorship from the above organisations, the registration fees for the workshop is 150 Euros, and this includes:

- Proceedings
- All lunches and coffee breaks
- Workshop banquet
- Daily transportation between hotel and INRIA

Also, travel grants are available for students presenting their research work and for participants from low-income countries.



Preliminary Call for Papers

2003 IEEE Information Theory Workshop Hong Kong, July 6 - 10, 2003



General Co-Chairs

Victor K. Wei
kwwei@ie.cuhk.edu.hk

Raymond W. Yeung
whyeung@ie.cuhk.edu.hk

Technical Co-Chairs

Wai Ho Mow
w.mow@ieee.org

Li Ping
eeliping@cityu.edu.hk

Local Arrangements

Tat Ming Lok
tmlok@ie.cuhk.edu.hk

Cunsheng Ding
cding@cs.ust.hk

Treasurer

C. W. Kok
eekok@ust.hk

Publicity

Mordecai Golin
golin@cs.ust.hk

Publication

Morris M. Z. Wang
enmzwang@polyu.edu.hk

International Liaison

Zhen Zhang
zzhang@milly.usc.edu

Workshop Announcement

The 2003 IEEE Information Theory Workshop will be held at the New World Renaissance Hotel, Hong Kong, China, from July 6 (Sunday) through July 10 (Thursday), 2003. Detailed information including submission guidelines, contact links, technical program, registration, travel, accommodation, getting around, and social events will be available at the workshop web site: <http://itwhk03.cs.ust.hk/>

Program Information

The workshop has a three and half-day technical program featuring plenary talks, as well as invited and contributed paper presentations. These sessions will be organized around the topics below:

- Shannon theory and statistics
- Modulation and coding
- Communication systems and networking
- Sequences and cryptography
- Source coding, data compression and signal processing
- Quantum information theory
- Wireless systems, multiuser detection and space-time processing

Paper Submission and Important Dates

Papers presenting new results in the above areas are hereby solicited. Only electronic submissions sent to submit-itw@ee.ust.hk in PDF or PS formats are accepted. Each submission must be at most 2 pages in length conforming to the double-column IEEE conference proceedings format. Further details as well as Latex templates will be posted at the workshop web site.

Submission deadline: **March 15, 2003**

Notification of acceptance: **April 15, 2003**

Camera-ready deadline: **May 15, 2003**

Submissions that cannot be accommodated in contributed paper sessions may be considered for poster sessions. All papers accepted for presentation will be published in the Workshop Proceedings.

Further Inquiries

Please send your questions to: info-itw@ie.cuhk.edu.hk

General Co-Chairs:

Dan Costello
Bruce Hajek

Program Committee:

Frank R. Kschischang (co-chair)
David N. C. Tse (co-chair)
Venkat Anantharam
Erdal Arıkan
Alexander Barg
Ian F. Blake
Joseph Boutros
Giuseppe Caire
Thomas M. Cover
Imre Csizsár
Michelle Effros
Meir Feder
G. David Forney, Jr.
Joachim Hagenauer
Tom Höholdt
Michael L. Honig
Johannes B. Huber
Brian L. Hughes
Rolf Johannesson
Ralf Koetter
Gerhard Kramer
Sanjeev R. Kulkarni
P. Vijay Kumar
P. R. Kumar
Simon N. Litsyn
Brian H. Marcus
Ueli M. Maurer
Muriel Médard
Neri Merhav
Prakash Narayan
Joseph A. O'Sullivan
H. Vincent Poor
Balaji Prabhakar
Kannan Ramchandran
Thomas J. Richardson
Bixio Rimoldi
Ron M. Roth
Serap A. Savari
Shlomo Shamai (Shitz)
M. Amin Shokrollahi
Emina Soljanin
Stephan ten Brink
Mitchell D. Trott
Alexander Vardy
Venugopal V. Veeravalli
Sergio Verdú
Pramod Viswanath
Gregory W. Wornell
En-hui Yang
Bin Yu
Ram Zamir

International Liaisons:

Johannes B. Huber
Raymond Yeung

Finance:

Dilip Sarwate

Local Arrangements:

Mike Honig
Randall Barry

Publications:

Mike Fitz
Oscar Takeshita

Publicity:

Ralf Koetter
Andrew C. Singer

Tutorials:

Venu Veeravalli

Registration:

TBD

Spouses Program:

Barbara Blahut
Lucretia Costello
Elizabeth Scheid
Eileen Tanner



FIRST CALL FOR PAPERS

The 2004 IEEE International Symposium on Information Theory will be held at the Chicago Downtown Marriott in Chicago, Illinois, from Sunday, June 27, through Friday, July 2, 2004. The theme of ISIT 2004, "Exploring New Connections," represents a focus on fostering new connections among people, technical areas and ideas, both within the traditional boundaries of Information Theory, and beyond in related fields.

Previously unpublished contributions to the following areas will be solicited:

Coded modulation	Coding theory and practice
Communication complexity	Communication systems
Cryptology and data security	Data compression
Data networks	Detection and estimation
Information theory and statistics	Multiuser detection
Multiuser information theory	Pattern recognition and learning
Quantum information processing	Shannon theory
Signal processing	Source coding

The conference site is the Chicago Downtown Marriott Hotel, located on the "Magnificent Mile" of Michigan Avenue, near the Chicago river and lake front.

Papers will be reviewed on the basis of an extended abstract (not exceeding six pages) of sufficient detail to permit reasonable evaluation. The deadline for submission is **December 1, 2003**, with notification of decisions by March 15, 2004. The deadline will be strictly enforced. In view of the large number of submissions expected, multiple submissions by the same author will receive especially stringent scrutiny. All accepted papers will be allowed twenty minutes for presentation, and one-page abstracts will be printed in the conference proceedings. Authors are strongly encouraged to submit electronic versions of their summaries in the form of Portable Document Format (PDF) files. Detailed information on paper submission, the technical program, special events, tutorial sessions, accommodations, travel arrangements, excursions and applications for travel grants will be posted on the Symposium web site:

<http://www.isit2004.org>

Inquiries on general matters related to the Symposium should be addressed to chair@isit2004.org.

Conference Calendar

DATE	CONFERENCE	LOCATION	CONTACT/INFORMATION	DUE DATE
March 12-14, 2003	37th Annual Conference on Information Sciences and Systems (CISS '03)	The Johns Hopkins University, Baltimore, Maryland	2003 CISS Barbara Sullivan, Conference Coordinator The Johns Hopkins University 3400 N. Charles Street Baltimore, MD 21218 Phone: 410-516-7033 Fax: 410-516-5566 Email: ciss@jhu.edu http://www.ece.jhu.edu/ciss/index.html	January 3, 2003
March 31- April 4, 2003	2003 IEEE Information Theory Workshop	Louis Liard Room of La Sorbonne Paris, France	See CFP in this issue. http://www.comelec.enst.fr/itw2003/index.html	October 30,
May 18 – 21, 2003	2003 Canadian Workshop on Information Theory	Waterloo, Ontario Canada	http://www.multicom.uwaterloo.ca/cwit2003	January 7, 2003
June 29 - July 4, 2003	2003 IEEE International Symposium on Information Theory (ISIT)	Pacifico Yokohama, Yokohama, Japan	Prof. Ryuji Kohno Yokohama National University Graduate School of Engineering Division of Physics, Electrical and Computer Engineering 79-5 Tokiwadai, Hodogaya-ku Yokohama, 240-8501 JAPAN +81-45-339-4116 +81-45-338-1157 (fax) isit2003@kohnolab.dnj.ynu.ac.jp http://www.isit2003.org	Nov. 1, 2002
July 6-10, 2003	2003 IEEE Information Theory Workshop	New World Renaissance Hotel Hong Kong, China	Victor Keh-wei Wei & Raymond Wai-ho Yeung The Chinese University of Hong Kong { @ie.cuhk.edu.hk">whyung,kwwei }@ie.cuhk.edu.hk http://itwhk03.cs.ust.hk	Mar. 15, 2003
August 27-29, 2003	13th IFAC Symposium on System Identification	Rotterdam, The Netherlands	Prof. Paul Van den Hof Delft University of Technology The Netherlands p.m.j.vandenhof@tnw.tudelft.nl www.sysid2003.nl	Nov. 20, 2002
September 1-5, 2003	3rd International Symposium on Turbo Codes and Related Topics	Brest, France	http://www-turbo.enst-bretagne.fr/	March 31, 2003
September 24-25, 2003	InOWo'03 - 8th International OFDM Workshop	Hamburg, Germany	Prof. Hermann Rohling Department of Telecommunications TU Hamburg-Harburg, Eißendorfer Str. 40 D-21073 Hamburg, Germany Tel: +49 (0)40 42878 3228 Fax: +49 (0)40 42878 2881 email: rohling@tu-harburg.de http://ofdm.tu-harburg.de	TBA

Conference Calendar

DATE	CONFERENCE	LOCATION	CONTACT/INFORMATION	DUE DATE
December 1-5, 2003	GLOBECOM 2003	San Francisco Marriott San Francisco, CA	Ms. Patricia Dyett IEEE Communications Society 305 E. 47th St., 9th Floor New York, NY 10017 +1 212 705 8999 (Fax) +1 212 705 8943 GLO2003C@comsoc.org	February 15, 2003
June 20 - 24, 2004	2004 ICC	Paris, France	http://www.icc2004.org	TBA
June 27 - July 2, 2004	2004 IEEE International Symposium on Information Theory (ISIT)	Chicago, Illinois, USA	See CFP in this issue http://www.isit2004.org	Dec. 1, 2003
July 19-24, 2004	2004 Stochastic Networks Conference	Centre de Recherches Mathematiques Universite de Montreal Montreal, Canada	http://www.stanford.edu/group/stochnetconf/	
TBA	2005 IEEE International Symposium on Information Theory (ISIT)	Adelaide, AUSTRALIA		TBA

IEEE Information Theory
Society Newsletter

445 Hoes Lane, P.O. Box 1331
Piscataway, NJ 08855-1331 USA