



The Bulletin of the International Linear Algebra Society

Serving the International Linear Algebra Community
Edited by S. J. Leon and R. C. Thompson

Issue 5

JULY 1990



Group picture from the Directions in Matrix Theory Conference, Auburn, Alabama, March, 1990

DIRECTIONS IN MATRIX THEORY CONFERENCE HELD AT AUBURN

Report by Frank Uhlig

The conference was held at Auburn University during the period of March 20-23, 1990. It attracted about 130 participants from 22 countries. There were 33 invited speakers representing 11 countries and over 60 contributed talks.

The conference meetings were held at the year-old Auburn University Hotel and Conference Center during the university's quarter break. There were so many highlights, it seems like torture to be able to mention just a few. Since so many matrixians and near-matrixians had gathered in Auburn to assess the direction - past, present and future - of their field(s), this meeting was a very encouraging place for exchanges between the core of linear algebra and its applications as well as amongst the various applications. This interaction was wonderfully exposed in all of the invited talks. Some speakers even ventured to predict the future, which in part came naturally once the slow exponential growth (ca. 50% more every

five years) of the volume of research in linear algebra over the last 40 years was recognized - as it was from the opening remarks on. The future mathematical directions in our area were harder to fathom, but we heard very stimulating expositions on the symbiotic relationship of linear algebra with - among others - : combinatorics, control theory, algebra, computations, statistics and statistical matrix analysis, signal processing, parallel processing algorithms, complexity theory and on and on ...

Ky Fan was the banquet speaker. His after dinner mints were a treasure to hear and taste.

And yes, we used all of the available n dimensions to secure funding from the National Security Agency, for which we are very thankful.

Research papers and reports will make up a special issue of *LINEAR ALGEBRA AND ITS APPLICATIONS* for which David Carlson and Frank Uhlig will be the special editors. Please send in your manuscripts by August 1, 1990 in order to be part of these conference proceedings.

We thank all for this successful conference !!!

ILAS NEWS

ILAS ANNUAL REPORT

PRESIDENT-SECRETARY REPORT FOR THE PERIOD 1 Mar 1989 - 28 Feb 1990

Report by Hans Schneider and Danny Hershkowitz

NEW APPOINTMENTS:

1. **Tom Ando** has been appointed to serve as a member of the Board of Directors. This position will first stand for elections in 1992.
2. **Harm Bart** has been appointed to serve as a member of the Board of Directors. This position will first stand for elections in 1993.
3. **Steven J. Leon** has been appointed to the Board of Directors and to serve as co-editor of *IMAGE*. The Board of Directors position will first stand for elections in 1993.
4. **David H. Carlson** has been appointed to serve as a member of the Board of Directors. Simultaneously, he ceased to serve as a member of the Advisory Committee. This position will first stand for elections in 1992.
5. **Roberto Bevilaqua** has been appointed to the International Committee as the representative of ILAS in Italy.
6. ILAS has established an Education Committee, consisting of **David H. Carlson** (chair), **Steven J. Leon** and **Frank Uhlig**.
7. **Ann Cox**, Brigham Young University, has accepted the position of Production Editor for *IMAGE*.

NOMINATIONS COMMITTEE:

1. The president named **Richard A. Brualdi** to chair the nomination committee for the 1990 and 1991 elections. **Shmuel Friedland** was named by the executive board to be a member of that committee.
2. In Provo, **Richard A. Brualdi** presented the nomination committee (for the 1990 elections) consisting of **Richard A. Brualdi**, Chair, **Shmuel Friedland**, **Tom Laffey**, **Dias Da Silva** and **H. K. Au-Yeung**.

3. The decision of the nomination committee to nominate **Robert C. Thompson** for the position of vice president and **Daniel Hershkowitz** for the position of secretary was announced by Richard Brualdi at the Provo conference.

ELECTIONS:

An envelop to be circulated by ILAS in July will contain a ballot for the 1990 elections.

MEMBERSHIP:

1. It was decided that the July 1990 issue of *IMAGE* will be mailed to all people currently on our mailing list. Later, starting January 1991, *IMAGE* will be sent to members only. Members will be granted the whole year for membership renewal.
2. ILAS has decided to offer Institutional Membership for an annual fee of \$150. We hope several organizations will join us.

ILAS INFORMATION CENTER (IIC):

It is one of the goals of ILAS to co-ordinate linear algebra activities. A useful tool for co-ordination is a database, where everybody can get (and provide) information about forthcoming activities.

Accordingly, we are happy to announce the establishment of ILAS INFORMATION CENTER (IIC). The system provides information on international conferences in linear algebra, on other linear algebra activities, on linear algebra journals, and on ILAS-NET notices.

We invite organizations and individuals to contribute information to this database. We shall be glad to set up folders for organizations with regular activities in linear algebra.

If you wish to use IIC, please look at the INDEX of IIC, which describes the current contents of IIC and contains instructions for obtaining them. You can obtain the INDEX by sending the following message: *send index* (as subject or as a separate line) addressed to:

iic@water.uwaterloo.ca or to *iic@water.waterloo.edu*

The manager of IIC is:

Henry Wolkowicz
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If you have any questions and/or want to contribute information please contact Henry Wolkowicz.

ILAS-NET:

The ILAS electronic news service ILAS-NET, now consisting of 275 subscribers, has issued 73 messages so far, including contributed messages and ILAS news.

MEETINGS IN THE PERIOD OF THE REPORT:

1. ILAS meeting:
ILAS Inaugural Conference, Brigham Young University, Provo, Utah, August 12-15, 1989
2. ILAS sponsored meeting:
Directions in Matrix Theory, Auburn, Alabama, March 20-23, 1990

PLANNED MEETINGS:

1. Future planned ILAS meetings are:
University of Lisbon, summer 1992 (organizer: Dias da Silva)
University of West Florida - Pensacola, March 1993, (organizer: Jim Weaver)
University of Essex, Colchester, August 1993, (organizer: Stephen Barnett)
Erasmus University, Rotterdam, summer 1994, (organizer: Harm Bart)
2. Future ILAS sponsored meetings:
Sixth Haifa Matrix Theory Conference, June 11-14, 1990, Technion, Haifa, Israel
The Householder Symposium XI Meeting on Numerical Algebra, June 18-22, 1990, Tylosand, Halmstad, Sweden
Linear Algebra, Numerical Linear Algebra and Applications, May 3-5, 1991, Northern Illinois University, De Kalb, Illinois, U.S.A.
(Editors note: The two June 1990 meetings were successfully held. Reports on these meetings are included in this issue of IMAGE.)

ILAS Treasurer's Report March 12, 1989 - Feb. 28, 1990 Report by James R. Weaver

Balance on hand March 12, 1989				0.00
March 1989				
Income:	Dues	447.00		
	BYU Luncheon	75.00		
	Donations	185.00	707.00	
Expenses:	John R. Shores (CPA Conf.)	50.00		
	Service Charge (FL. Nat. Bank)	11.56	61.56	645.44
April 1989				
Income:	Dues	312.00		
	BYU Luncheon	105.00		
	Donations	88.00	505.00	
Expenses:	ACH Debit (Supplies)	29.99		
	Service Charge (FL. Nat. Bank)	4.95	34.94	407.06
May 1989				
Expenses:	Service Charge (FL. Nat. Bank)	3.49	3.49	(3.49)
June 1989				
Expenses:	Service Charge (FL. Nat. Bank)	1.80	1.80	(1.80)
July 1989				
Income:	Dues	180.00		
	BYU Luncheon	90.00	270.00	
Expenses:	Postage for (IMAGE # 3)	265.12		
	Printing for (IMAGE # 3)	300.80	565.92	(295.92)

August 1989				
Income:	Dues	644.00		
	BYU Luncheon	840.00		
	Donations	92.00		
	Inaugural Picture	336.00	1912.00	
Expenses:	BYU Luncheon	1125.00		
	Service Charge (Fl. Nat. Bank)	3.69		
	International Debit	7.00	1135.69	776.31
September 1989				
Income:	Dues	72.00	72.00	
Expenses:	Inaugural Picture	348.00		
	Entre Computer Center	29.75	377.75	(305.75)
October 1989				
Income:		00.00	00.00	
Expenses:		00.00	00.00	00.00
November 1989				
Income:	Dues	72.00		
	Refund on service charge	10.00	82.00	
Expenses:	Service Charges (FL. Nat. Bank)	10.00		
	John R. Shores (CPA Conf.)	50.00		
	Exchange Difference	2.98	62.98	19.02
December 1989				
Income:	Dues	36.00	36.00	
Expenses:	Service Charges (FL. Nat. Bank)	2.14	2.14	33.86
January 1990				
Income: Dues	216.00			
	Contributions	62.00	278.00	
Expenses:	Internal Revenue Service	150.00		
	Service Charge	5.00	155.00	(107.00)
February 1990				
Income:	Dues	216.00		
	Contributions	62.00	278.00	
Expenses:	IMAGE # 4	642.84		
	Service Charges (FL. Nat. Bank)	0.95	643.79	(365.79)
Account Balance				
	February 28, 1990			864.94

ILAS is tax exempt

Report by Jim Weaver

As of May 17, 1990, the International Linear Algebra Society, Inc. is exempt from Federal income tax (USA). This means that donors may deduct contributions to ILAS as provided in section 170 of the code. Bequests, legacies, devises, transfers, or gifts to ILAS or for ILAS's use are deductible for Federal estate and gift tax purposes if they meet the applicable provisions of Code sections 2055, 2106, and 2522. Dues may be deducted as a business expense if appropriate, but not as a contribution. The tax exempt status is retroactive since the application was made within 15 months of incorporation.

ILAS EDUCATION COMMITTEE

Report by Dave Carlson

In recent years, regional and national educational activities have begun to take place in linear algebra. Among these are short courses at national meetings, notably the one at the January 1989 Annual Meeting in Phoenix organized by Charlie Johnson; the 1989 Summer Course at Laramie led by Charlie and organized by Duane Porter; the Panel Discussion on teaching linear algebra at the January 1990 Annual Meeting in Louisville organized by Duane (to be continued at the 1991 Annual Meeting in San Francisco); and the Research Experience for Undergraduates being led this summer by Charlie at Williamsburg.

The ILAS Education Committee seeks to foster, coordinate, and help organize activities of this sort. These activities increase general knowledge of developments, pure, applied, and computational, in our field, bring enthusiasm and new ideas into the teaching of our subject, and encourage students and other faculty to consider linear algebra as an exciting place to work. We welcome suggestions for activities—particularly but not exclusively those you would be interested in working on yourself. Suggestions received already include two workshops, one on a specific topic, another directed at a specific region of the US. The ILAS Education Committee members are:

Dave Carlson, San Diego State University (carlson@sdsu.edu)

Steve Leon, Southeastern Massachusetts University (FILEON@SEMASSU.BITNET)

Frank Uhlig, Auburn University (FUHLIG@AUDUCVAX.BITNET)

Sixth Issue of *IMAGE* Planned for January 1991

IMAGE is edited by S. J. Leon and R. C. Thompson. The Production Editor is Ann Cox. News items for the sixth issue should be sent to:

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All news of interest to the Linear Algebra community is welcome including: news of conferences, journals and books, upcoming events, and activities of members. E-mail appears to be the fastest and most efficient way to submit news items.

Future issues of *IMAGE* will contain feature articles on linear algebra activities in other countries. These articles should be no more than three pages in length. We will also feature more book reviews. Reviewers who need review copies of books should contact S. J. Leon. If you're a member of ILAS then *IMAGE* is your publication. It needs your support. Please keep us informed about the linear algebra activities in your country.

IMPORTANT NOTE: If you are now on the mailing list for *IMAGE* and are not yet a member of ILAS, you must join in order to continue receiving *IMAGE*. The January 1991 issue will be sent to members only. To join fill out the reply form in this issue.

ILAS-NET

The International Linear Algebra Society also maintains an electronic news service *ILAS-NET* edited by Danny Hershkowitz. If you want to submit news items or to have your name added to the *ILAS-NET* distribution list, send a message to Danny at:

MAR23AA@TECHNION.BITNET

NEWS ITEMS

SPARSENET AND SPARSKIT

Report by Youcef Saad

There is now an e-mail group called *Sparsenet* which was started after the discussion on sparse matrix standards that took place in the recent meeting on iterative methods in Copper Mountain, Colorado. One of the main purposes of *Sparsenet* is to stimulate discussion on standards for sparse matrix computations and to facilitate the exchange ideas and software. To reach everybody in the mailing list send the message to: `sparsenet@riacs.edu`. If you would like to be added to the list send an e-mail message to Youcef Saad at the address: `saad@riacs.edu`.

Version 1 of SPARSKIT (a basic tool package for sparse computations) is now being made publically available (message sent through *Sparsenet* recently). To receive instructions on how to get the package send an e-mail request to Youcef Saad.

The Second SIAM Conference on LASSC

Report received from SIAM

The Second SIAM Conference on Linear Algebra in Signals, Systems and Control will be held November 5-8, 1990 at the Cathedral Hill Hotel, San Francisco, CA.

This will be a highly interdisciplinary conference, blending linear and numerical linear algebra with application ideas such as control and system theory and signal processing.

Twelve plenary presentations will be featured:

Least Squares and Restricted Least Square Problems: Methods and Applications, Ake Bjorck, Linkoping University, Sweden

Geometric and Lie Theoretic Methods for Inverse Eigenvalue Problems Arising in Control, Christopher I. Byrnes, Washington University

Computational Circuits for Upper Operators, Patrick Dewilde, Delft University of Technology, The Netherlands

On Hankel Operators, Bezoutians and Algebraic Stability Criteria, Paul Fuhrmann, Ben-Gurion University of the Negev, Israel

Linear Algebra in Sensor Array Signal Processing, Thomas Kailath, Stanford University

Recent Advances in Robust Control Theory, Pramod P. Khargonekar, University of Michigan

Decentralized Control and Computation, Dragoslav D. Siljak, Santa Clara University;

Sum Scaling and Max Scaling, Hans Schneider, University of Wisconsin, Madison.

It will also feature 11 contributed presentations, 42 minisymposia, a poster presentation and twelve 45-minute concurrent speakers. Among topics to be discussed are applications of core and computational linear algebra in the following areas:

Signal Processing; Large-Scale Systems; Algebraic and Geometric Methods in Control; Robust Control; Numerical Issues in Control; Large-Scale and Parallel Computations in Control; Mathematical Systems Theory; Identification and Estimation; Robotics.

This conference is sponsored by the SIAM Activity Group on Linear Algebra and co-sponsored by the SIAM Activity Group on Control and Systems Theory, and is co-chaired by David H. Carlson, San Diego State University and Biswa N. Datta, Northern Illinois University.

Conference program and registration material will be available mid- July 1990.

Contact SIAM now to ensure receiving your copy. Call 215 - 382-9800, or FAX your request: 215 - 386-7999, or e-mail to: siamconfs@wharton.upenn.edu

See you in SF!

PROGRAM FOR THE APPLIED LINEAR ALGEBRA YEAR AT IMA

Report by Richard A. Brualdi

Full program for the Applied Linear Algebra Year at the INSTITUTE FOR MATHEMATICS AND ITS APPLICATIONS (University of Minnesota) in 1991-1992

APPLIED LINEAR ALGEBRA September 1991 - June 1992 Program and Workshop Description

COORDINATORS: R.A. Brualdi, G. Cybenko, A. George, G. Golub, M.B. Luskin, P. Van Dooren

ADVISORY COMMITTEE: A. Bjorck, T. Kailath, V. Klee, J. McKenna, R. Ward

INTRODUCTION

The year is divided into three parts described below (corresponding to the fall, winter and spring quarters), although it is expected that there will be considerable fluidity between the various parts.

1. Discrete Matrix Analysis with emphasis on the mathematical analysis of sparse matrices and combinatorial structure;
2. Matrix Computations with special emphasis on iterative methods for solving systems of linear equations and computing the eigenvalues of sparse, possibly structured matrices;
3. Signal Processing, Systems and Control with emphasis on the matrix analysis and computations that arise in this area of application.

The formal announcement of the postdoctoral fellowship program (including application procedures) will be made in September, 1990.

PERIOD I: SEPTEMBER - DECEMBER

Long Term Confirmed Visitors for Sept-Dec 1991 are: Ake Bjorck, John Gilbert Richard Brualdi, Victor Klee, Shmuel Friedland, Joseph Liu, J. Alan George, and Mitchell Luskin
Tutorial (September 4-10, 1991):

Organizers: The Coordinators

Tutorial Lectures: Wednesday, September 4, to Tuesday September 10, 1991. These lectures will be given by the senior people in residence for the fall quarter: S. Friedland, V. Klee, J. Liu, J. Gilbert, A. Bjorck, A. George, R. Brualdi. It is expected that there will be three one-hour lectures each day with each speaker giving two lectures. These lectures will touch

on most of the issues for the first quarter and some of those for the second quarter.

SIAM CONFERENCE ON APPLIED LINEAR ALGEBRA (September 16-19, 1991)

This conference will be held at the Radisson University Hotel and the University of Minnesota

Workshop 1 (October 14-18, 1991): Sparse Matrix Computations: Graph Theory Issues and Algorithms

Organizers: Alan George, John Gilbert, Joseph Liu

Attempts to solve efficiently very large sparse systems of equations have spawned a multitude of important and interesting problems. Some of these problems are numerical, some are combinatorial, some can be phrased in terms of questions about graphs, and some are "core computer science" questions, involving the design and implementation of good (and sometimes provably optimal) data structures. The purpose of this workshop is to bring together people who work in sparse matrix computation with those who conduct research in applied graph theory and graph algorithms.

The intent of the workshop would be to foster active cross-fertilization. Those in sparse matrix computation would have the opportunity to describe some of the outstanding major graph theory questions that are prompted by sparse matrix computation. Equally, those in graph theory would have the opportunity to describe some problems that might be beneficially attacked through the use of modern sparse matrix algorithms and technology. Specific topics will include: chordal graphs, elimination trees, the minimum degree algorithm, graph separator theory and algorithms, finding independent sets, graph matching, simulated annealing, clique trees, graph traversals in sparse matrix computation.

Workshop 2 (November 11-15, 1991): Combinatorial and Graph-Theoretic Problems in Linear Algebra

Organizers: Richard Brualdi, Shmuel Friedland, Victor Klee

The purpose of this workshop is to bring together the diverse group of people who work on problems in linear algebra and matrix theory in which combinatorial or graph-theoretic analysis is a major component. Specific topics to be covered include: the use of graph theory and general combinatorial ideas in matrix analysis, eigenvalue estimates for graphs and finite Markov chains, qualitative properties of matrices with applications to chemistry and economics, spectra of nonnegative integral matrices with application to symbolic dynamical systems, matrices with some generic entries with application to systems analysis and controllability, the use of linear algebraic ideas in the graph isomorphism problem, and issues of computational complexity as they pertain to the problems above.

PERIOD II: JANUARY - MARCH

Long Term Confirmed Visitors for January - March, 1992 are: Adam Bojanczyk, Anne Greenbaum, G.W. Stewart, Richard Brualdi, N. J. Higham, James Demmel, Mitchell Luskin, Gene Golub, Robert J. Plemmons

Workshop 3 (January 13-17, 1992): Linear Algebra, Markov Chains, and Queuing Models

Organizers: John McKenna, Robert J. Plemmons and G. W. Stewart

Markov chains and queuing models are playing an increasing role in the understanding of complex systems such as computer, communication, and transportation systems. Three areas are important in the construction and numerical solution of these problems: linear algebra, Markov chains, and queuing network models. The object of this workshop is to bring together experts from these three areas to share their different points of view of the subject.

The first two days of the workshop will be devoted to technical surveys by experts,

two from each of the three areas. The last three days will be devoted to special topics. All speakers will be asked to furnish a tentative proceedings paper before the workshop. The survey papers will be distributed far enough in advance that the people speaking on special topics can use them in preparing their papers. There will be an opportunity for the participants to organize informal evening sessions.

Among the topics to be treated are:

1. Iterative methods for large Markov chains
2. Dealing with the exponential explosion of the state space in queuing networks
3. Transient behavior
4. Matrix geometric methods.

Workshop 4 (February 24 - March 1, 1992) Iterative Methods for Sparse and Structured Problems

Organizers: Gene Golub, Anne Greenbaum, and Mitchell Luskin

Large systems of matrix equations arise frequently in applications and they have the property that they are sparse and/or structured. Important applications await techniques for solving large nonsymmetric systems of linear equations and eigenvalue problems. The purpose of this workshop is to bring together researchers in numerical analysis and various application areas to discuss where such problems arise and possible methods of solution. Problems involving both convection and dissipation as well as statistical applications lead to nonsymmetric and indefinite linear systems and eigenvalue problems. We intend to explore recent developments in the nonsymmetric Lanczos-Loewy algorithm, domain decomposition and substructuring, conjugate gradient - like methods, preconditioners for nonsymmetric linear systems, and other new ideas in this area. Methods that are particularly efficient on modern computer architectures will be emphasized.

SPECIAL NOTE: The last two days of this workshop will be a celebration dedicated to Gene Golub on the occasion of his sixtieth birthday (Feb. 29, 1992). The program for this part of the workshop is being arranged by Jack Dongarra and Paul van Dooren.

PERIOD III: APRIL - JUNE Long Term Confirmed Visitors for April 1992 - June 1992 are: Adam Bojanczyk, Gene Golub, Paul Van Dooren, Jim Bunch, Mitchell Luskin, George Cybenko, Robert Plemmons, James Demmel, and G.W. Stewart

Workshop 5 (April 6-10, 1992): Linear Algebra for Signal Processing

Organizers: Adam Bojanczyk and George Cybenko

Signal processing is making increasingly sophisticated use of linear algebra on both theoretical and algorithmic fronts. The purpose of this workshop is to bring together signal processing engineers, computer engineers and applied linear algebraists for an exchange of problems, theories and techniques. Particular emphasis will be given to exposing broader contexts of the signal processing problems so that the impact of algorithms and hardware will be better understood. The workshop will explore five areas by having a sequence of talks devoted to the underlying signal processing problem, the algorithmic and analytic techniques and finally implementation issues for each area. The five areas are: (1) updating SVD and eigendecompositions; (2) adaptive filtering; (3) structured matrix problems; (4) wavelets and multirate signal processing; and (5) linear algebra architectures (parallel/vector and other high performance machines/designs).

Workshop 6 (June 1-5, 1992): Linear Algebra for Control Theory

Organizer: Paul Van Dooren

During the past decade the interaction between control theory and linear algebra has been

ever increasing, giving rise to new results in both areas. The purpose of this workshop is to further develop and nurture this cross-fertilization by bringing together control theorists and linear algebraists for an exchange of problems ideas and techniques. The cross-fertilization between control and linear algebra is reflected in the following 'theme sessions' to be held during the workshop: numerical linear algebra for control (organized by A. Bunse-Gerstner and V. Mehrmann), canonical forms and invariants (organized by D. Hinrichsen), ring-theoretic methods in linear control (organized by E. Sontag and B. Wyman), matrix theory in control (organized by L. Rodman) and H_∞ control (organized by A. Ran).

For each of these themes we plan to have 3-4 'formal' speakers focussing on the linear algebra problems that arise in the area. During the day ample time will be reserved for discussion and interaction between the participants. There will also be an opportunity to organize 'informal' evening sessions.

Inquiries etc. can be made to Richard A. Brualdi (brualdi@math.wisc.edu). Postal address is Mathematics Department, University of Wisconsin, Madison, WI 53706, USA.

Fourth SIAM Triennial Conference on APPLIED LINEAR ALGEBRA

Report by Richard A. Brualdi

The fourth conference will be held on September 16-19, 1991 in Minneapolis, Minnesota. The timing and location of the conference has been chosen to coincide with the beginning of the year on Applied Linear Algebra at the Institute for Mathematics and its Applications (IMA) at the University of Minnesota. The conference hotel, the Radisson University Inn, is adjacent to the campus and the IMA and some of the sessions of the conference will be held in the University's new Electrical and Computer Engineering building. The organizing committee consists of: R.A. Brualdi, D. Carlson, G. Cybenko, A. George, G. Golub, R. Horn, J. Lewis, M. Luskin, S. Morgera, G. Styan, and P. van Dooren.

The committee has selected a group of eight distinguished scientists to highlight the conference with plenary lectures. They are:

A.C. ANTOULAS (Rice University), Matrix functions with applications to systems theory: Interpolation problems.

A. BJORCK (Linkoping University), Matrix computations and sparsity issues.

M. FIEDLER (Czechoslovakia Academy of Sciences), Combinatorial aspects in matrix theory.

I. KAPLANSKY (Mathematical Sciences Research Institute-Berkeley), Basis free methods in linear algebra.

C. VAN LOAN (Cornell University), The design and analysis of block matrix algorithms.

G.W. STEWART (University of Maryland), Numerical methods for Markov chains.

A. WILSKY (MIT) Multiresolutional statistical signal processing.

M. WRIGHT (A.T. & T. Bell Laboratories), Linear algebra issues in interior methods.

The banquet will feature a talk by ALAN HOFFMAN of IBM.

Two minisymposia have been invited as "seeds" for suggestions from the linear algebra community for other minisymposia on topics of current interest. They are:

Direct Sparse Methods, organized by J. Liu (York University)

Abstract Algebra and its Application to Statistical Signal Processing, organized by S. Morgera (McGill University).

Suggestions for minisymposia and general inquiries should be directed to: Richard A. Brualdi (brualdi@math.wisc.edu). Postal address is Mathematics Department, University of Wisconsin, Madison, WI 53706.

NEWS ITEMS FROM SWEDEN

The Householder XI Symposium on Numerical Algebra

Report by Hans Schneider

The eleventh Householder (Gatlinburg) symposium on numerical algebra took place in Tylosand, Sweden, from 18 to 22 June 1990. Its chief organiser was Ake Bjorck of the University of Linköping, Sweden. The meeting was held in a comfortable hotel in a beach resort in very pleasant physical surroundings. Talks were presented both in formal daytime sessions and in informal evening sessions, as is traditional for Householder meetings. The talks ranged from the essentially computational to the theoretical linear algebra, with most talks involving both theory and computation. The general level of talks was extremely high.

On the Friday of the meeting, the chairman of the Householder prize committee, G.W. (Pete) Stewart, announced the two winners of the Householder prize for the best thesis in numerical algebra submitted in the previous three years. These are:

Edelman, Alan

Title: *Eigenvalues and Condition Numbers of Random Matrices*

Advisor: Nick Trefethen

Institution: MIT

Ong, Maria Elizabeth Go

Title: *Hierarchical Basis Preconditioners for Second Order Elliptic Problems in Three Dimensions*

Advisor: Loyce Adams

Institution: Applied Math. Dept., University of Washington

There are some changes in the composition of the Householder organizing committee. Hans Schneider has resigned and Chandler Davis is a new member.

Householder XII is planned for California in 1993. Its organizers are Tony Chan and Gene Golub.

NEWS ITEMS FROM INDIA

Visit to the Indian Statistical Institute

Report by R. E. Hartwig

From Jan. 13 thru Feb. 12 I visited the Indian Statistical Institute (ISI) in Delhi at the invitation of Prof. S. K. Mitra. Besides being a good stopover place on the long way down under, there are numerous other reasons why the ISI is a very good place to visit for a person interested in matrix theory.

The ISI in Delhi is a unique research institute, with its own walled-in campus in South Delhi. A quiet oasis in an otherwise turbulent world. Besides Statistics, research is also done in such related fields as, mathematical physics, economics, operations research, and mathematics. In particular, matrix theory is eminently represented by Drs. Mitra, Bhatia and Bapat, with additional interest coming from Drs. K. R. Parthasarathy (probability and quantum mechanics) and K. B. Sinha (math. phys.).

In addition to research, there is also a small number of graduate students taking courses towards masters and Ph.D. degrees. Visitors are always welcome and the facilities are quite unique (by western standards). Indeed, the guesthouse is right next to the department and

is actually more like a small hotel with meals being served three times a day; vegetarian or otherwise. Accommodation is nominal and there is a small charge for food. If possible even an office may be supplied. In order to enhance contacts and exchange information, there is morning and afternoon tea, should the weekly matrix seminar not suffice.

The ISI is located in South Delhi, about 5 miles from the airport and 12 miles from downtown. It is easy to get around using either bus, motor-rickshaw or taxi. One very nice feature is that the weekend can be used to make sightseeing trips to such highlights as the Taj Mahal, Khajuraho or Benares.

I enjoyed the friendly hospitality encountered, and the chance to meet visitors from all over the world, such as Franco Fagnola from Italy or Todor Proychev from Bulgaria. Some of the recent matrix visitors have included T. Ando, C. Davis, L. Eisner, M. Fiedler, J. Holbrook, V. Ptak and J. J. Seidel, with G. Styán several years back. All in all a good place to remember.

Generalized Inverse Day held at ISI

Report by R. B. Bapat

The Indian Statistical Institute, Delhi Centre organized a Generalized Inverse Day on February 9, 1990. There were about forty-five participants coming mainly from the ISI, Indian Agricultural Statistics Research Institute, University of Delhi and its affiliated colleges.

The program was comprised of nine half-hour talks. The talks were typically of a survey nature covering the area of interest of the speaker. There were talks which emphasized applications of generalized in cryptography, Markov chains, the linear complementarity problem and partial orders from matrices.

NEWS ITEMS FROM ISRAEL

The Sixth Haifa Matrix Theory Conference

Report by Daniel Hershkowitz

The Sixth Haifa Matrix Theory Conference was held on June 11-14, 1990, at the Technion - Israel Institute of Technology, Haifa, Israel. It was the sixth in a series of conferences in Linear Algebra which take place every year in Haifa. The program consisted of fifty seven half hour talks, both in plenary and in parallel sessions, covering a wide range of topics in theoretical and applied linear algebra. The participants came from Australia, Austria, Belgium, Canada, Hungary, Israel, Italy, Spain, Taiwan, United States, and West Germany.

The social activities included a reception, a banquet (followed by a lecture of Professor Pal Rozsa from Hungary on Hungarian mathematicians), and an Israeli folklore performance. There was also a long half day excursion to the Galilee and the Golan Heights.

The organizing committee of the conference consisted of A. Berman and D. Hershkowitz as co-chairmen, and of M. Goldberg, L. Lerer, R. Loewy and A. Zaks. The conference was sponsored by the Israel Mathematical Union and the International Linear Algebra Society (ILAS). Conference proceedings will appear as a special issue of *Linear Algebra and its Applications*.

NEWS ITEMS FROM PORTUGAL

Reported by G. N. de Oliveira

1. Graciano de Oliveira is now in Macau and his new address is: East Asia University, Faculty of Science and Technology, P.O.Box 3001, Macau. He expects to return to Portugal in October 1991.
2. F. Conceição Silva was awarded the 1988 Gulbenkian Prize for Science and Technology, for his research work in Linear Algebra. He shared the prize with J. C. Dias and M. Figueira for their joint work on partial differential equations.
3. Two thesis were recently completed under the supervision of J. A. Dias da Silva.
 - I. M^a. da Purificação Coelho — *Linear groups defined by tensor equalities*
 - II. Amélia Fonseca — *On the multilinearity partition*

CALENDAR OF COMING CONFERENCES

August 20–25, 1990 Janos Bolyai Mathematical Society, 5th Conference on Numerical Methods, Technical University for Heavy Industry Miskolc, Hungary (Miskolc is about 180 km northeast of Budapest)

Focus of Conference: Survey recent results in Numerical Algebra and in Numerical Solution of Differential Equations.

Information: Katalin Balla, Janos Bolyai Mathematical Society, H 1368 Budapest, Pf. 240, Hungary

September 9–22, 1990, NATO Advanced Study Institutes Course — Computer Algorithms for Solving Linear Algebraic Equations: The State of the Art, Centro Congressi Il Ciocco, Tuscany, Italy

Application deadline: May 15, 1990. Attendance by invitation only.

Information: Emilio Spedicato, Dipartimento di Matematica, Università, Piazza Rosate, 24100 Bergamo, Italy

September 28–29, 1990, Linear Algebra and its Applications, Miami University, Oxford Ohio
Information: J. H. Skillings, Miami University, Dept. of Math. and Stat., Bachelor Hall, Oxford, OH 45056

November 5–7, 1990, SIAM Conference on Linear Algebra in Signals, Systems and Control, San Francisco, CA. A short course is planned for Nov. 4.

Focus: The interrelationship between theoretical and computational linear algebra with application areas such as signal processing and control and systems theory.

Information: Contact David Carlson, Dept. Math., CSU San Diego, CA 92182 or Biswa N. Datta, Dept. Math., Northern Illinois Univ., DeKalb, IL 60115 (See article in this issue of *IMAGE*)

January 16–19, 1991, AMS Annual Meeting, San Francisco, CA

April 2–4, 1991, IMACS International Symposium on Iterative Methods in Linear Algebra, Brussels Free Universities, Belgium

Information: R. Beauwens, IMACS International Symposium, Université Libre de Bruxelles, C.P.165. 50, Av. F.D. Roosevelt, 1050 Brussels, Belgium; (beauwens@bbrnsf11.bitnet)

April 21–27, 1991, Numerical Linear Algebra, Oberwolfach, W. Germany
Focus: The iterative solution of nonsymmetric linear systems

April 25–28, 1991, Linear Algebra, Numerical Linear Algebra and Applications, Northern Illinois University, Sponsored by ILAS
Information: See article in *IMAGE* # 4

July 8–12, 1991, International Conference on Industrial and Applied Mathematics, Washington, D.C.
Information: ICIAM 91 Conference Manager, c/o SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688 (e-mail: iciam@wharton.upenn.edu)

Summer 1991, International Conference on Linear Algebra and Applications, Fudan University, Shanghai, China
Information: B. Datta, Dept of Math., Northern Illinois Univ., DeKalb, IL 60115, (niuvax!datta@mcs.anl.gov)

1991–92 Applied Linear Algebra Year, IMA, University of Minnesota
Emphasis: Fall Quarter: Discrete Matrix Analysis, Winter Quarter: Matrix computations, Spring Quarter: Signal Processing, Systems and Control
Information: R.A. Brualdi, Dept. of Math., Univ. of Wisconsin, Madison, WI 53706, e-mail: brualdi@vanvleck.math.wisc.edu (See article in this issue of *IMAGE*)

September 14–19, 1991, SIAM Conference on Applied Linear Algebra, Minneapolis, Minnesota
Information: R.A. Brualdi, Dept. of Math., Univ. of Wisconsin, Madison, WI 53706, e-mail: brualdi@vanvleck.math.wisc.edu (See article in this issue of *IMAGE*)

Summer 1992, ILAS Conference, Lisbon University, Portugal
Information: See future issues of *IMAGE*

March 1993, ILAS Conference, University of West Florida, Pensacola, Florida
Information: See future issues of *IMAGE*

August 1993, ILAS Conference, University of Essex, Colchester, England
Information: See future issues of *IMAGE*

December 13–17, 1993 International Cornelius Lanczos Centenary Conference, North Carolina State University, Raleigh, North Carolina
Information: Robert J. Plemmons, North Carolina State University, Raleigh, North Carolina 27695–8205

Summer 1994, ILAS Conference, Erasmus University, Rotterdam
Information: See future issues of *IMAGE*

JOURNAL NEWS

SIAM JOURNAL ON MATRIX ANALYSIS AND APPLICATIONS (SIMAX)

New editorial board members of **SIMAX** are: **Richard Brualdi**, University of Wisconsin; **Anne Greenbaum**, Courant Institute; **Jaroslav Kautsky**, Flinders University; **Kermit Sigmon**, University of Florida; **Charles Van Loan**, Cornell University; **G. Alistair Watson**, University of Dundee.

LINEAR ALGEBRA AND ITS APPLICATIONS (LAA)

LAA has a new associate editor: **Georg Heinig**, Karl-Marx Universitaet, Leipzig, GDR

Special Issues

Title: Interior Point Methods for Linear Programming
Special Editors: D. Gay, M. Kojima, R. Tapia
Full Announcement: LAA vol. 110, November 1988
Submission Deadline: August 1989

Title: Matrix Canonical Forms
Special Editors: R.A. Horn, R.J. Laffey, R.L. Merris
Full Announcement: LAA vol. 113, February 1989
Submission Deadline: November 1989

Title: Iterations in Linear Algebra and in Applications
Special Editors: Owe Axelsson, John de Pillis, Michael Neumann,
Wilhelm Niethammer, Robert J. Plemmons
Full Announcement: LAA Vol. 116, April 1989
Submission Deadline: March 1990

Title: Algebraic Linear Algebra
Special Editors: R.M. Guralnick, W.H. Gustafson, L.S. Levy
Full Announcement: LAA Vol. 119, July 1989
Submission Deadline: August 1990

Title: Proceedings of Auburn 1990 Conference
Special Editors: Frank Uhlig, David Carlson
Full Announcement: See *IMAGE* #3
Submission Deadline: August 1, 1990

Title: Proceedings of the First Conference of the International
Linear Algebra Society
Special Editors: W. Barrett, D. Hershkowitz, and D. Robinson
Full Announcement: See article in *IMAGE* #4
Submission deadline: January 31, 1990

Title: Proceedings of the Sixth Haifa Conference on Matrix Theory
Special Editors: A. Berman, M. Goldberg, D. Hershkowitz
Submission deadline: October 1, 1990

LINEAR AND MULTILINEAR ALGEBRA (LAMA)

Henryk Minc, Professor of Mathematics at the University of California at Santa Barbara for many years, retired June 1990. To commemorate his years of service to linear algebra, *Linear and Multilinear Algebra* is planning to publish one or more issues of papers dedicated to Professor Minc. Manuscripts should be submitted to R. C. Thompson, Math., University of California, Santa Barbara CA 93106, USA. In press is a special issue of papers emanating from the workshop on Invariant Factors that was organized by J. A. Dias da Silva in Lisbon,

September 1988. Also in press is a special issue on Algebraic Graph Theory, organized by Russell Merris, California State University, Hayward.

Special issue of *BIT*

Report by Germund Dahlquist

The Scandinavian journal *BIT* has recently published a special issue on *Preconditioned Conjugate Gradient Methods* with Owe Axelsson as guest editor. It contains 18 contributions from the whole world and covers about 375 pages. It has also appeared in book form and is available at \$42.00 (42 U.S. dollars) from:

BIT, Box 113, DK-1004 Copenhagen, Denmark

NEWS ON BOOKS

Recent Publications

Barnett, Stephen, *Matrices: Methods and Applications*, Oxford University Press, 1990.

Cox, M. G. and Hammarling, S., editors, *Reliable Numerical Computation*, Oxford University Press, 1990. This volume was published to honor the late Jim Wilkinson. The articles included reflect the research interests of Wilkinson.

Gover, M. J. C. and Barnett, S., editors, *Applications of Matrix Theory*, Oxford University Press, 1989.

Johnson, Charles R., editor, *Matrix Theory and Applications*, AMS, 1990. This volume contains the lecture notes prepared for the AMS Short Course on Matrix Theory and Applications, held in Phoenix in January, 1989.

Nash, John C., *Compact Numerical Methods for Computers: Linear Algebra and Function Minimization*, 2nd. ed., Adam Hilger, 1990.

Stewart, G.W. and Sun Ji-guang, *Matrix Perturbation Theory*, Academic Press, 1990.

MEMBERSHIP IN ILAS – Reply Form

The annual membership fee for ILAS is \$12. To join ILAS or renew your membership, please fill out this form and send it along with the membership fee (or a letter requesting waiver of the membership fee) to:

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