

IMAGE

The Bulletin of the International Linear Algebra Society (formerly the International Matrix Group)

Serving The International Linear Algebra Community

Issue 2

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Free to ILAS members

News

Inaugural Meeting: International Linear Algebra Society (ILAS) August 12-15, 1989

Brigham Young University, Provo, Utah USA

Report by H. Schneider and C.R. Johnson

The purpose of this first general meeting of ILAS (formerly IMG) is to provide an opportunity for researchers everywhere with an interest in matrix theory to get together. The term "matrix theory" is broadly interpreted to include those parts of the many subjects that have stimulated research about matrices over the years.

In an effort to maximize the number of participants, the cost is being kept to a minimum. Centrally located Salt Lake City International Airport is nearby and is serviced by most major US carriers. A limited number of on-campus housing slots will be available at a very low cost, along with an inexpensive meal plan of good quality. Nearby motels offer very affordable alternative housing. There will be no registration fee as such, although a nominal and optional donation to the Society and for daily refreshments will be solicited.

Within easy driving distance from Provo lie a large fraction of the many spectacular attractions of the Rocky Mountain West. In addition to Yellowstone, the Grand Canyon, Bryce Canyon and Zion Parks there are a host of lesser known but also enjoyable parks. A tour on either side of the meeting would be rewarding.

A special concentration at the meeting on nonnegative matrices and related topics is to be modestly funded by the US NSA. Additional subsidy is being graciously provided by Brigham Young University and the time, effort and research funds of the organizers. We hope that you can help make this meeting a success with your attendance. Please contact Wayne Barrett by electronic mail or in writing about your interest in attending. We hope you will do this soon, as it will be helpful for planning the program.

A special issue of Linear Algebra and Its Applications will be devoted to this meeting. This issue will contain only papers that meet the publication standards of the journal and that are approved by the normal refereeing procedure. Special editors of this issue are Wayne Barrett, Danny Hershkowitz and Don Robinson.

The organizers are:

C.R. Johnson, Chair, Dept. of Math., College of William and Mary, Williamsburg,
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Rocky Mountain Mathematical Consortium 1989
Summer Workshop: "Matrix Theory for Applications"
July 17 -August 4, 1989, University of Wyoming, Laramie, Wyoming
 Report by C.R. Johnson

Each summer the Rocky Mountain Mathematical Consortium sponsors a three week series of lectures aimed at advanced graduate students and junior faculty nationwide. The 30 eighty-minute lectures (two per morning) and afternoon discussions are presented by one or more speakers on a single subject. There are usually 25-40 participants, persons who hope to add the subject to their expertise or develop a research program in the area. This year the Consortium hopes to expand the program to a broader range of faculty, via an NSF program that guides pedagogical innovations.

This summer the subject will be "Matrix Theory for Applications" and the talks will be given by Charles R. Johnson, together with Wayne Barrett, Roger Horn and Douglas Shier, assisted by Michael Lundquist and Peter Nysten. A program of support for interested graduate students is already in place and support for faculty is pending. For further information, contact A. Duane Porter, Dept. of Mathematics, University of Wyoming, Laramie WY 82071 USA. Charles R. Johnson could also be contacted about specific issues related to content (address in previous article).

Any individual seeking to augment or develop a research program in the subject may attend. It should be a worthwhile workshop in an enjoyable part of the US.

Introductory Survey Lectures on Matrix Theory and Applications:
AMS Short Course, January 10-11, 1989, Phoenix, Arizona

The American Mathematical Society is presenting this two day short course in conjunction with its 95th annual meeting. The program is being organized by Charles R. Johnson and emphasizes concepts from matrix analysis that are important in areas of modern applied mathematics. Six 75 minute lectures are to be presented:

Richard A. Brualdi, Univ. of Wisconsin, *Combinatorial Matrix Theory*
 C.R. Johnson, College of William and Mary, *Matrix Completion Problems: A Survey*
 Persi Diaconis, Harvard Univ., *Eigen Analyses of Matrices with Symmetry*

Properties

Arunava Mukherjea, Univ. of South Florida, *The Role of Nonnegative Idempotent Matrices in Certain Problems in Probability*

Roger A. Horn, Johns Hopkins Univ., *The Hadamard Product*
 I. Gohberg, Tel Aviv Univ., *Interpolation Problems for Rational Matrix Functions*
 Ingram Olkin, Stanford Univ., *Interplay Between Matrix Theory and Multivariate Statistics*

New Name for International Matrix Group:
International Linear Algebra Society (ILAS)

Report by H. Schneider

IMG will soon be incorporated as a society under its new name ILAS (the International Linear Algebra Society). The purposes of the organization remain the same (see the first issue of IMAGE, January 1988).

The Executive Board is: Hans Schneider, President; Danny Hershkowitz, Secretary; R.C. Thompson, Vice Chairman.

The Advisory Committee is: R. A. Brualdi, D. H. Carlson and C. R. Johnson.

The International Committee is:

Belgium	P. Van Dooren	Japan	T. Ando
Canada	P. Lancaster	Malaysia	M.H. Lim
Czechoslovakia	M. Fiedler ✓	Netherlands	H. Bart
Finland	J.K. Merikoski	P.R. China	J.C. Chen
Germany	L. Elsner ✓	P.R. China	J.G. Sun
Great Britain	S. Barnett	Portugal	G.N. de Oliveira ✓
Greece	J. Maroulas	Sweden	A. Bjorck
Hungary	P. Rosza	Spain	V. Hernandez ✓
India	R. Bhatia	US	G. Golub
Ireland	T. Laffey	At Large	B. Datta
Israel	A. Berman		

Feature Article

The Development of Linear Algebra in Portugal

by G.N. de Oliveira, University of Coimbra

I was honoured when I received a letter from Professor R.C. Thompson inviting me to write the story of the development of Linear Algebra in Portugal. Of course I cannot enter into too many details and thus will describe the points that seem more interesting from my point of view.

Due mainly to political reasons many Portuguese mathematicians had to leave the University, and even the country, in the thirties and forties. When I was a student between 1957 and 1961 there were, as a consequence, very few active mathematicians and the environment for research was far from ideal. When I graduated I felt very interested in research but did not know how to start. I thought I should go to the library and read as many books as possible. One of my teachers, Professor Luis de Albuquerque, played a decisive role in bringing me to Linear Algebra. He had written a monograph on nonnegative matrices which, at the end, described a problem of Suleimanova (find a necessary and sufficient condition for n numbers to be the eigenvalues of an $n \times n$ stochastic matrix). One day I was talking to Professor Albuquerque and asked him why had he not solved the problem. He said it was very difficult and added "why don't you try it?" I tried and as far as I can remember this was my first research problem in Linear Algebra.

In 1962 I was summoned for military service, which I finished by the end of 1966. During this time I did not forget the problem and in 1969 received my doctorate with a thesis on stochastic and doubly stochastic matrices which included several partial results on Suleimanova's problem.

I am often credited with founding the Portuguese school of Linear Algebra. It is true that I made some efforts to get younger people interested in this subject but I feel that the real founder was in fact Professor L. de Albuquerque inasmuch as without him there would have been no school of Linear Algebra in Portugal. When Albuquerque was starting his career, the conditions for research in Mathematics were even worse than when I was a student. Partly because of this situation, Professor Albuquerque started to do research in History, mainly concerned with the Portuguese navigators. When I first met him, I was a freshman at Coimbra, and although he was teaching Mathematics, his main research interest was already in History. Nevertheless I still consider that he was my real thesis advisor.

Another Portuguese mathematician that influenced me was Professor J.J. Dionísio. He is a few years younger than Albuquerque and had moved to Lisbon a couple of years

before I entered the University. His influence on me was indirect, through my reading his papers, many of which were published in Portuguese and in Portuguese journals. In fact I only met Professor Dionísio for the first time in 1970.

After obtaining my doctorate I felt very isolated and dreamt of building a Linear Algebra school instead of confining myself to my own research work. I viewed this as a contribution to the mathematical activity of the country.

By the end of the sixties I had gathered a group of younger people and we organized regular Seminars (three times per week as I was quite enthusiastic). At the end of 1969 I had to leave Coimbra unwillingly and was only able to return a few years later, after the democratization of the country. Once back in Coimbra I reorganized the Linear Algebra Seminars. As a result the group of people working in this area expanded greatly in the late seventies.

For a time I had some difficulties. There has always been much foreign cultural and scientific influence in Portugal, especially from France. Initially it was not easy to attract research students, since there was a widespread feeling that a doctorate obtained abroad carried more prestige than one gained locally. I think that only when the work of my younger collaborators surpassed mine was this difficulty overcome.

How did the interest in Linear Algebra spread from Coimbra? In 1980 after receiving his doctorate in Coimbra, José Vitória of Coimbra got in touch with Juan Miguel Gracia of the Colegio Universitario de Alava in the Basque Country. This was the starting point of a fruitful cooperation in Linear Algebra between the two Iberian countries. It should be pointed out that the cooperation in Mathematics between Portugal and Spain has not been what it ought to be; before 1972 the mathematicians of the two countries were practically unknown to each other and this situation has only been remedied with the Portuguese-Spanish meetings. In particular in Linear Algebra these meetings gave rise to the Iberian Linear Algebra Conferences, the fourth of which was organized last September in Valencia. Due to the action of Juan Miguel Gracia in the Basque Country and Vicente Hernandez in Valencia the cooperation between Portuguese and Spanish linear algebraists has grown very much in recent years. An outcome of this cooperation is Zaballa's outstanding work. He proved recently a result which contains as a Corollary the Sá-Thompson interlacing inequalities.

Thus I am very hopeful about the future.

I have only described the human story (or perhaps my own story) and have not described mathematical work. I think it would not be easy for me to do that in a critical way. However it goes without saying that words like eigenvalue, inverse problems, invariant polynomials, interlacing, star products, normal matrices, and Schur functions mean much for many of us.

Since I believe in mankind, I believe in human struggles, efforts and activities. The human activities include writing papers but are no means restricted to this.

Ed. Note: What follows are the abstracts of the doctoral theses of Professor de Oliveira's first three mathematical "grandchildren," of whom he is justifiably proud.

Sums of matrices with prescribed invariant factors, by Fernando C. Silva.
Supervisor: J.A. Dias da Silva, University of Lisbon. May 20, 1987.

In this thesis, written in Portuguese, several problems of the following form are studied:

Under what conditions do there exist matrices A and B over a field F (resp., a principal ideal domain R) such that $A+B$ has certain properties?

Among the problems concerned with matrices over F , necessary and sufficient conditions are given so that:

- a) $A+B$ has prescribed eigenvalues;
- b) The number of invariant polynomials of $A+B$ is less than or equal to a previously fixed integer;

c) $A-B$ has prescribed rank, when F is algebraically closed.

Among the problems concerned with matrices over R , necessary and sufficient conditions are given so that:

d) The number of invariant factors of $A+B$ that are divisors (resp., multiples) of $\delta \in R$ is greater than or equal to a fixed integer (except for a few cases);

e) $A+B$ has prescribed rank.

These results are also presented in the following papers:

1. Fernando .C. Silva, On the number of invariant polynomials of the matrix $XAX^{-1} + B$, LAA 79 (1986), 1-21.
2. --, On the invariant factors of the matrix $XAY + B$, LAA 96 (1987), 1-16.
3. --, Spectrally complete pairs of matrices, LAA, to appear.
4. --, The eigenvalues of the sum of matrices with prescribed invariant polynomials, LAMA, to appear.
5. --, The eigenvalues of the sum of matrices with prescribed invariant polynomials II, preprint.
6. --, The rank of the difference of matrices with prescribed similarity classes, preprint.

Chains with partial prescription of their coordinates and matrix imbeddings, J.C. David Vieira.

Supervisor: E. Marquis de Sá, University of Aveiro. November 9, 1987.

Let K be an arbitrary field. The main problem considered in this thesis is the following: Find necessary and sufficient conditions for the existence of square matrices A and B over K such that (i) some of the invariant factors of A and B are given in advance; (ii) A is a principal submatrix of B .

We completely solve this problem when K is algebraically closed.

In the first part of this work, we introduce the concept of a polynomial chain, that is, a sequence of polynomials forming a divisibility chain. Some results are proved for pairs of polynomial chains satisfying additional divisibility conditions (the so-called interlacing relations) and subject to rank and degree constraints.

In the second part of the thesis we use a well-known imbedding theorem of M. de Sá and R.C. Thompson to yield a matricial interpretation of the previously obtained results involving polynomial chains. As particular cases of our main result we obtain three theorems about partial prescription of invariant factors of matrices and submatrices proved by M. de Sá in his Ph.D. thesis (Univ. Coimbra, 1979).

The Singular Values/Invariant Factors Analogy, José Felipe Queiró.

Supervisor: Eduardo Marques de Sá, June 18, 1988.

The subject of this work is the formal analogy which exists between singular values of real or complex matrices and invariant factors of matrices over certain types of rings. Main points are:

In Chapter 1 approximation numbers in an abstract setting are considered. They are defined for elements of semigroups where a "norm" with values in a partially ordered set is given. Some of the features of the singular values/invariant factors analogy (e.g., the interlacing theorem) appear with great simplicity in this context. Several models are studied in which the semigroup is just an additive group of matrices.

In Chapter 2, a study is made of A. Pietsch's axiomatic theory of s -numbers for the case of operators acting between finite-dimensional normed linear spaces.

In Chapter 3 a thorough analysis of the reciprocal of the interlacing theorem, both for s -numbers and invariant factors, is carried out. A partial unification is proposed. It is worth mentioning Section 3.6, where the converse of interlacing (previously seen to be false in general) is proved for s -numbers in a special situation. The proof consists of a somewhat delicate homotopy argument.

In Chapter 4, some further analogies are gathered. Section 4.1 presents an axiomatic characterization of the invariant factor sequence for matrices over elementary divisor domains; this parallels Pietsch's work on s -numbers of operators in Hilbert space. The main results of section 4.4 describe the exact range of the k^{th} invariant factor of a product of two square matrices (over a principal ideal domain) with prescribed invariant factors.

Throughout attention is called to the fact that many results about invariant factors usually presented for matrices over principal ideal domains in fact hold for elementary divisor domains (occasionally without change in the proofs). Krull's "localization" technique then allows most of them to be extended to the even larger class of greatest common divisor domains.

News

Special Year on Applied Linear Algebra at IMA

Report by Richard A. Brualdi

The Board of Governors of the Institute for Mathematics and Its Applications (IMA) has approved a program in Applied Linear Algebra for 1991-92. The organizers are R.A. Brualdi, George Cybenko, Alan George, Gene Golub and Paul van Dooren. The plans are to focus the program on three major themes. The general emphases and workshops planned as of this time are:

Fall Quarter: Discrete Matrix Analysis, with emphasis on the mathematical analysis of sparse matrices and combinatorial structure. Workshops on (1) Sparse Matrices and (2) Combinatorial and Qualitative Matrix Analysis.

Winter Quarter: Matrix Computations, with special emphasis on iterative methods for solving systems of linear equations and computing the eigenvalues of sparse, possibly structured matrices. Workshops on (1) Iterative Methods for Dense Problems and (2) Markov Chains, Networking and Queuing.

Spring Quarter: Signal Processing, Systems and Control, with emphasis on the matrix analysis and computations that arise in this area of application. Workshops on (1) Signal Processing Applications of Linear Algebra and (2) Systems and Control Applications of Linear Algebra.

It is expected that there will be considerable fluidity between various parts of the program. Specialized seminars on topics in both core and applied linear algebra will be held throughout the year. There will also be opportunities for minisymposia on other special topics of interest. To a considerable extent the activity at any time during the year will be influenced by the interests of the people in residence (typically 30-35 at nonworkshop periods).

It is expected there will be twelve postdoctoral fellowships awarded for the year. There will be a very limited amount of money for senior people who will spend one or more quarters at the IMA. Preference will be given to persons with sabbatical leaves, fellowships or other stipends. There will also be support for the expenses of those invited to be in residence for one month or less, in particular for workshop participants. For more information, contact R.A. Brualdi, Dept. of Math., Univ. of Wisconsin, Madison, WI 53706 USA (brualdi@vanvleck.math.wisc.edu).

Journal News

Linear Algebra and Its Applications (LAA), Report by H. Schneider and R. Brualdi

The following joined the LAA Editorial Board during 1988: Peter Lancaster, previously Associate Editor, is now Advisory Editor; new Associate Editors are R. Bhatia, D. Hershkowitz, R.A. Horn and L. Rodman.

The following five special issues of LAA will appear during 1989:

In honor of Alan Hoffman (Volumes 114-115, March 1989),
 Proceedings of the Valencia Conference on Linear Algebra and Applications,
 Proceedings of the Fourth Haifa Conference on Linear Algebra,
 Linear Systems and Control,
 Linear Algebra and Statistics.

Contributions are invited for future additional special issues. Full announcements about all but the last of the following have already been published on IMG-NET. Details about the last will shortly be circulated on the network.

Title: Linear Algebra in Image Reconstruction from Projections
 Special Editors: Y. Censor, T. Elfving, G.T. Herman
 Full announcement: LAA vol. 99, February 1988
 Submission deadline: January 1989

Title: Matrix Valued Functions
 Special Editors: J.A. Ball, L. Rodman, P. Van Dooren
 Full announcement: LAA vol. 106, August 1988
 Submission deadline: July 1989

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: ILAS (IMG) Inaugural Meeting, Provo, Utah, August 1989
 Special Editors: W. Barrett, D. Hershkowitz, D. Robinson
 Full announcement: With conference material
 Submission deadline: November 1989

Title: Iteration Methods in Linear Algebra and in Applications
 Special Editors: O. Axelsson, J. de Pillis, M. Neumann, W. Niethammer,
 R.J. Plemmons
 Full announcement: LAA Vol. 116, April 1989
 Submission deadline: March 1990

Linear and Multilinear Algebra (LAMA), Report by R.C. Thompson

Linear and Multilinear Algebra operates on the flow system, that is, issues are published as manuscripts to fill them are accepted. Currently this comprises eight issues per year. Four issues of about 90 pages each make up one volume, and Volume 25, No. 3 is now filling. Volume 25, No. 2 was dispatched to the (London, England) typesetter December 10, 1988. The most recent published issue is Volume 23, No. 4, and it generally takes about six or seven months between receipt of an issue by the typesetter and its

publication. The only other time delays between submission and publication are for the referee (very variable), and for administrative overhead (not much).

Recent appointments to the editorial board are: Richard Brualdi, Alan Laub, and Rajendra Bhatia.

Russell Merris is organizing a special issue on the theme of *Algebraic graph theory*. Contributions to this issue may be submitted either directly to him (address: Prof. R. Merris, Mathematics Department, California State University, Hayward, CA 94542, USA) or to the principal office of *Linear and Multilinear Algebra* (address: Linear and Multilinear Algebra, Mathematics Department, University of California, Santa Barbara, CA 93106, USA.)

Linear and Multilinear Algebra regularly publishes research problems. Good contributions to this department are invited, and should be submitted to the principal chief editor, R. C. Thompson, at the Santa Barbara address in the last paragraph.

A cumulative index of all papers published to date has been under construction for some time. It is nearly ready, and has been substantially (but not completely) checked for accuracy. It will be published when fully checked. A limited number of copies in "pretty good but not final" form will soon be available, on request. Requests should be sent to R.C. Thompson at the address above.

Siam Journal on Matrix Analysis and Applications (SIMAX), Report by B.N. Datta

Three issues have now appeared. The journal publishes research articles on the applications of matrix analysis to areas such as Markov Chains, networks, signal processing, systems and control theory, mathematical programming, economic and biological modeling and statistics and operations research.

Papers should be sent either to the SIAM office in Philadelphia or to an editor. The editors are: Gene H. Golub, Managing Editor, Robert Plemmons, Asst. Managing Editor, Richard Brent, James Bunch, Francois Chatelin, George Cybenko, Pierre-Jacques Courtois, Biswa N. Datta, David Fox, Yves V. Genin, John R. Gilbert, William Gragg, F. Alberto Grunbaum, Martin H. Gutknecht, Sven Hammerling, Roger Horn, Charles R. Johnson, Thomas Kailath, Sam Karlin, Linda Kaufman, Peter Lancaster, Jean Meingnet, Russell Merris, Carl Meyer, Nancy Nichols, Ingram Olkin, Chris Paige, Johng-shi Pang, Uriel Rothblum, Axel Ruhe, Gilbert Strang, Paul M. van Dooren, and Hans Weinberger.

News on books

Perturbation Bounds for Matrix Eigenvalues, Rajendra Bhatia, Pitman Research Notes in Mathematics 162, Longman (London) and John Wiley (New York), 1987.

Review by R.C. Thompson: The chapter titles of this concisely written research level text are: Preliminaries, Singular Values and Norms, Special Variation of Hermitian Matrices, Spectral Variation of Normal Matrices, The General Spectral Variation Problem, and Arbitrary Perturbations of Constrained Matrices. There is a quite up to date bibliography of slightly under 100 items.

In its relatively few pages this book covers in some depth a significant topic in current linear algebra, and without much overlap with other books. Some proofs are included, others are just sketched or not given. The author's own research has contributed significantly to spectral variation theory, and his expertise is everywhere visible in his

book. It is a highly recommended acquisition even though its conciseness makes the reader wish the author had fleshed in more detail.

Linear Algebra in Signals, Systems and Control, SIAM, 1988. Edited by Biswa N. Datta, Charles R. Johnson, M.A. Kaashoek, Robert Plemmons and Eduardo Sontag.

Summary by B.N. Datta: This is the proceedings of the SIAM Conference on Linear Algebra in Signals, Systems and Control, held in Boston, MA in August 1986. The meeting was highly interdisciplinary in nature. Engineers and mathematicians came together to exchange ideas, methods and research findings. The proceedings contain papers on topics in core and numerical linear algebra, linear and nonlinear control and systems theory, and algorithms for signals, systems and control problems.

Personal Honors

Kailath named Hitachi Professor of Engineering

Thomas Kailath, Professor of Electrical Engineering at Stanford University, has been named the first Hitachi America Professor of Engineering at Stanford. This professorship is the first engineering endowment at Stanford from a Japanese company, Hitachi America, Ltd.

Schneider named James Joseph Sylvester Professor of Mathematics

Hans Schneider, a member of the Mathematics Department at the University of Wisconsin, Madison, since 1959, was named to the J.J. Sylvester Professorship in May 1988 in recognition of his distinguished record in research, leadership and service to mathematics.

Comings and Goings

Volker Mehrmann has the following address from July 1988 through March 1989: IBM Wiss. Zentrum, Heidelberg, Tiergartenstr. 15, Postfach 103068, D-6900 Heidelberg, F.R.G. (Tel. 06221-404-0)

Danny Hershkowitz has been visiting at the Univ. of Wisconsin and expects to return to Israel on February 13, 1989.

Meetings held

Southern California Linear Algebra Meeting November 19, 1988

Report by R.C. Thompson and Wasin So

An annual regional linear algebra meeting was established in southern California in 1986. The third such conference was held at the University of California at Santa Barbara on November 19, 1988, organized by R.C. Thompson. Speakers were J. Bunch, "Strong and weak stability of algorithms for matrix computations," R. Grone, "Extremal Hermitian matrices," R. Guralnick, "The variety of pairs of matrices with rank one commutator," C.R. Johnson, "The Robertson-Taussky inequality revisited," C.K. Li, "Distance to the convex

hull of a unitary orbit with respect to unitary similarity invariant norms," M. Lundquist, "Completion problems, zero patterns, determinants," R. Loewy, "Inertia preservers," R. Mathias, "The equivalence of two partial orders on a convex set of positive semidefinite matrices," R. Merris, "An edge version of the matrix tree theorem," S. Pierce, "Simultaneous congruence of Hermitian matrices," W. So, "The exponential function," O. Taussky-Todd, "Determinants of integral matrices," and N. Tsing, "Linear preservers of unitarily invariant norms." Over thirty persons attended.

Invariant Factor Workshop in Portugal

Report by R. C. Thompson

A workshop on invariant factors was held in Lisbon, Portugal, for 2.5 days early in October 1988. Organized by Jose Diaz da Silva, with financing raised by him, and intended to be a small meeting, the workshop was attended by about 30 people. Principal addresses were given by S. Friedland and R. C. Thompson, with additional talks by C. R. Johnson, E. Marques de Sá, G. N. de Oliveira, I. Zaballo, F. C. Silva, J. Duarte, O. Azenhaus, and others. Some of the papers resulting from this conference will be published in *Linear and Multilinear Algebra*.

Operator Theory Conference Celebrated 60th Birthday of I. Gohberg

Report by R. C. Thompson

Israel Gohberg, very well known for many contributions to operator theory and finite dimensional linear algebra, including a large number of beautifully written books coauthored with many mathematicians, was honoured by a well attended five day conference at the University of Calgary, August, 1988. The long list of speakers and the wide variety of their topics do not permit a concise summary here: the papers will be published in a conference proceedings volume being prepared. Worth commenting on, however, are the acknowledgments to the stimulus afforded by contact with I. Gohberg present in almost every talk.

Bradford (England) Applied Linear Algebra Conference

Report by R. C. Thompson

This conference was held in mid July, 1988, with an attendance exceeding 50. It was very well organized (by S. Barnett and M. Gover), successful, and the papers resulting from it will appear in a conference proceedings volume currently being prepared. C. R. Johnson, M. Powell, and A. George were among the principal speakers. Although the theme was applied linear algebra, it was apparent to this writer that little difference exists between an applied linear algebra conference and a nonapplied one. Presumably applied ones are more easily financed. This meeting was well worth attending, and let us hope there will be a second Bradford applied linear algebra conference.

"Linear Algebra, Digital Signal Processing and Parallel Algorithms,"

NATO Advanced Study Institute, Leuven, Belgium, August 1-12, 1988

Report by P. Van Dooren and G. Golub

There were over 90 participants, including the 15 invited speakers, from 16 countries. A significant number of those attending were from industry. The invited speakers included M. Bellanger (TRT, France), B. Bitmead (ANU, Australia), A. Bjorck (Linköping, Sweden), R. Brent (ANU, Australia), Y. Genin (PRLB, Belgium), S. Hammarling (NAG, England), I. Ipsen (Yale, USA), T. Kailath (Stanford, USA), F. Luk (Cornell, USA), J. McWhirter (RSRE, England), G. Meurant (CEL, France), D. Sorensen (Argonne, USA), J. Vandewalle (KUL, Belgium) and the codirectors G. Golub (Stanford, USA) and P. Van Dooren (PRLB, Belgium).

The goal of this meeting was to synthesize the three topics in the title as there is currently a great deal of activity in each of these areas. There were many interactions at the meeting, not only between participants that were familiar with all three but also between people working in different areas. The following major themes emerged at the conference:

- 1) Singular value and eigenvalue decompositions, including applications.
- 2) Toeplitz matrices, including special algorithms and architectures.
- 3) Recursive least squares in linear algebra, digital signal processing and control.
- 4) Updating and downdating techniques in linear algebra and signal processing.
- 5) Error analysis and stability of algorithms and sensitivity analysis of special recursive least squares problems.
- 6) Special architectures, including supercomputers and distributed processor arrays, for linear algebra and signal processing.

It became apparent during the meeting that there is a strong interconnection between several of these major themes, and this led to lively discussions. Several of the contributed talks focused on specific applications, in particular radar technology, medical applications and robotics.

The Proceedings will include the invited presentations, some of the contributed talks and all of the abstracts. They will be published by Springer-Verlag in the NATO ASI Series and should appear in early 1989.

Ed. Note: Due to the length of this newsletter, we have omitted reports on several excellent matrix theory and linear algebra meetings held earlier in 1988. However, we will include the following photograph taken at the Fifth Haifa Matrix Conference.

Participants at
5th Haifa
Matrix Conference,
January 1988.
In the foreground:
Harald Wimmer,
Ludwig Elsner,
Thomas Laffey,
Binyamin Schwarz,
David London, and
R.C. Thompson.
Photograph courtesy
of A. Berman.



Calendar of Coming Conferences

January 10-11, 1989, AMS Short Course on Matrix Theory and Applications, Phoenix, Arizona.

March 20-22, 1989, SIAM Conference on Domain Decomposition Methods, Houston, Texas.

April 3-5, 1989, 3rd SIAM Conference on Optimization, Boston, Massachusetts.

May 17-19, 1989, SIAM Conference on Control in the 90's, San Francisco, California.

May 22-24, 1989, SIAM Conference on Sparse Matrices, Gleneden Beach, Oregon.

July 16-21, 1989, SIAM 1989 Annual Meeting, San Diego, California

For information on any SIAM conference, contact: SIAM, 117 South 17th Street, 14th Floor, Philadelphia, PA, 19103-5052, USA (Tel: 215-564-2929).

June 19-23, 1989, International Symposium on the Mathematical Theory of Networks and Systems (MTNS '89), Vrije University, P.O. Box 7161, 1007 MC Amsterdam, The Netherlands. Program committee includes Biswa N. Datta and P. Van Dooren. Several special sessions on the interactions between linear algebra and numerical linear algebra and control, systems and signal processing are planned, which will be of real interest to the linear algebra community.

July 17-August 4, 1989, Rocky Mountain Mathematics Consortium Summer Lecture Series, Univ. of Wyoming, Laramie, Wyoming. See article above.

August 12-15, 1989, ILAS Inaugural Meeting, Provo, Utah. See article above.

Fall 1989, Fourth Annual Southern California Linear Algebra Meeting. More details in July 1989 issue of *Image*.

November 5-7, 1990, SIAM Conference on Linear Algebra in Signals, Systems and Control, San Francisco, California. A short course is planned for Nov. 4. Co-Chairs are David Carlson (Dept. Math., CSU San Diego, CA 92182 USA) and Biswa N. Datta, (Dept. Math., Northern Illinois Univ., DeKalb, IL 60115 USA). The focus will be on the interrelationship between theoretical and computational linear algebra with application areas such as signal processing and control and systems theory. Inputs are welcome, to either chairman.

Announcements

International Conference Planned in China Report by B.N. Datta

In Summer 1991, an International Conference on Linear Algebra and Applications is being planned to be held at Fudan University, Shanghai, China. Applied and numerical linear algebra will be included. Biswa N. Datta and Jiang Erxiong are Co-Chairs and the conference will probably follow or precede the MTNS '91 Conference. Since things need to

be planned long in advance in China, it will be very helpful to the organizers to have an idea of the approximate number of potential attendees from countries outside China. Even if you are not sure but think you might be interested in participating, please drop a note to B. Datta to this effect at Dept. of Mathematical Sciences, Northern Illinois Univ., DeKalb, IL 60115 USA (niuvax!datta@mcs.anl.gov or na.bdatta@-net.stanford.edu).

Third Issue of Image Planned for Early July 1989

News items should be sent to Dr. Steven Leon, to arrive by June 1, 1989. His addresses are: Dept. of Math., Southeastern Massachusetts University, North Dartmouth, MA 02747 USA; f1LEON@semassu.bitnet. He will be Co-Editor of *Image*, starting with that issue.

The present issue has been co-edited by J.M. Day and R.C. Thompson.

IMG-NET, Electronic News Service

ILAS operates IMG-NET, an electronic news service which transmits announcements of ILAS activities and other notices of interest to linear algebraists. The e-mail address of IMG-NET is: MAR23aa@technion.bitnet. If you wish to contribute an announcement to IMG-NET or be on the list to receive its news, please contact Danny Hershkowitz at that e-mail address.

Letter to the Editor

21 January, 1988

Dear Editor:

IMAGE's first, tentative steps are absolutely successful. Its presence will contribute to covering many gaps in the spreading of information in the international and especially the European scientific communities of those interested in Linear Algebra. For this reason its representative body must include people from other European countries. Your proposal about the need of a significant IMG meeting is very constructive; I believe it should take place every 2 or 3 years. Furthermore I propose that during the meeting we award a prize to the best doctoral dissertation that appeared since the last meeting. This would provide a good encouragement to young researchers.

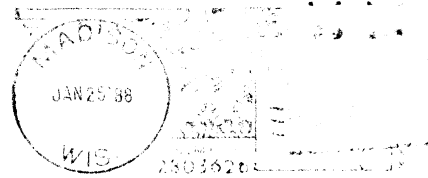
The Bulletin must include information/reviews about new books on Linear Algebra and Linear Analysis in general, as well as their applications.

Yours truly,

J. Maroulas, Athens, Greece

IMAGE

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