

$$\begin{bmatrix} I & L \\ A & S \end{bmatrix} \quad \cdot \xrightarrow{I} \cdot \xrightarrow{M} \cdot \xrightarrow{A} \cdot \xrightarrow{G} \cdot \xrightarrow{E} \cdot \quad \begin{bmatrix} I & L \\ A & S \end{bmatrix}$$

The Bulletin of the International Linear Algebra Society

Serving the International Linear Algebra Community
 Edited by Steven J. Leon

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JULY 1993



Group Picture from ILAS Conference in Pensacola

Third ILAS Conference held in Pensacola

Report by James Weaver

The Third conference of The International Linear Algebra Society, entitled "Pure and Applied Linear Algebra: The New Generation" was held at The University of West Florida and The Pensacola Grand Hotel in Pensacola, Florida from March 17 through March 20, 1993. The University of West Florida's help and generous support were key factors in this highly successful conference. The total number of participants was 180, distributed as follows:

Belgium: 1; Canada: 10; Czech Republic: 2; England: 1; France: 1; Germany: 3; Hong Kong: 1; India: 1; Ireland: 1; Israel: 2; Japan: 1; Jordan: 1; Korea: 2; The Netherlands: 1; New Guinea: 1; Portugal: 6; Spain: 6; West Indies: 1; U.S.A.: 137; and the Ukraine: 1.

The types of talks presented can be summarized as follows. There were 11 one-hour New Generation Speakers (which included the Olga Taussky Todd/John Todd Lecturer), 1 Hans Schneider Prize Winner, 18 half hour Invited speakers, 4 Minisymposiums, and 63 twelve-minute Contributed Lectures.

Some highlights of the conference included the eleven "New Generation" presentations given by: R. B. Bapat; Bart DeMoor, Bob Guralnick, Daniel Hershkowitz, Chi-Kwong Li, Roy Mathias, Volder Mehrmann, Dianne P. O'Leary, Andre Ran, Helene Shapiro, and Ion Zaballa. The "Invited" presentations by T. Ando, A. C. Antoulas, Joseph A. Ball, Wayne Barrett, J. A. Dias da Silva, Miroslav Fiedler, Ed Johnson, Thomas Kailath, Peter Lancaster, Thomas Pate, Steve Pierce, Nam-Kiu Tsing, Frank Uhlig, and Richard Varga were excellent talks and the support of these individuals was greatly appreciated by the conference organizers. There was a panel discussion with Paul Halmos on his book "I Want To Be A Mathematician: An Automathography" as well as on mathematics and mathematics education. Richard Brualdi gave a brief review of the Year on Applied Linear Algebra at the IMA at the University of Minnesota. Steve Leon brought everybody up to date on the ATLAST project, which is being jointly sponsored by the National Science Foundation and the ILAS. Reports on undergraduate education and graduate education in linear algebra were given by Charles Johnson (undergraduate), David Lay (undergraduate) and Frank Uhlig (graduate). The ILAS held its annual business meeting on March 19, 1993.

The conference banquet was held on March 18, 1993 and the meal was an international buffet. Jerry Maygarden (the Mayor of Pensacola) opened the banquet with an official welcome to the ILAS from the City of Pensacola by presenting a plaque to the ILAS President Hans Schneider. Thomas Laffey presented the Hans Schneider prize to Miroslav Fiedler, Shmuel Friedland, and Israel Gohberg. Richard Varga recognized Helene Shapiro as the first Olga Taussky Todd/John Todd Lecturer. The banquet address by Paul Halmos, entitled "Has Linear Algebra Changed Since 1940?", was enjoyed by all in attendance.

Elsevier Science Publishing Company, John Wiley and Sons Publishing Company, The University of West Florida Student Chapter of the MAA, and the UWF Chapter of Pi Mu Epsilon hosted a Hospitality Room for all the conference participants on the evenings of March 16, 17 and 19, 1993.

The Book Display included books from Elsevier, John Wiley and Sons, Gordon and Breach, Marcel Decker, SIAM, Wadsworth Inc., and Worldbook Childcraft International.

The proceedings of the conference will be published in a special issue of the journal *Linear Algebra and Its Applications*. The special editors of this issue are Dianne P. O'Leary, Leiba Rodman and Helene Shapiro.

In closing, as the Chair of the Program and Local Arrangements Committees, I would like to thank the members of these committees for their hard work in helping to bring about such a successful conference.

Program Committee & Investigators

Richard Brualdi
Pamela Coxson
Paul Van Dooren
Leiba Rodman
Hans Schneider
Jeffrey L. Stuart
Robert Thompson

Local Arrangements Committee

Norman Givens
Rohan Hemasinha
Kuiyuan Li
Cynthia McGinnis
Jeffrey L. Stuart
Jossy Uvah

ILAS NEWS

ILAS Nominations for 1994

Report by Jose Dias da Silva, Chair, ILAS Nominating Committee

I am happy to report that the Nominating Committee of ILAS (Ludwig Elsner, Moshe Goldberg, Chi-Kwong Li, Jose Dias da Silva, and Robert Thompson) has completed its selection of nominees for the

ILAS elections scheduled for the Fall of 1993 with the term of office beginning March 1, 1994. Each of the nominees listed below has agreed to be a candidate for the designated office.

1. President (one to be elected): Hans Schneider
2. Treasurer (one to be elected): James R. Weaver
3. Board of Directors (two to be elected):
 - Richard Brualdi
 - Thomas Kailath
 - Thomas Laffey
 - Richard Varga

According to the bylaws of the ILAS, additional nominations for any of the offices above may be made by any three members of the Society with the prior approval of the nominee. Such nominations should be sent to Jose Dias da Silva by either regular or electronic mail before September 15, 1993

ILAS President-Secretary Annual Report

Report by Hans Schneider and Danny Hershkowitz

1. The following have been elected for the term 1 March 1993 to 28 February 1995:

| | |
|--------------------|-------------------------------|
| Vice-President: | Graciano Oliveira |
| Secretary: | Daniel Hershkowitz |
| Board of Directors | Harm Bart and Paul van Dooren |

2. On the recommendation of the ILAS Linear Algebra Prize Committee, the ILAS Executive Board has awarded the first Hans Schneider Prize in Linear Algebra jointly to MIROSLAV FIEDLER (Czech Academy of Sciences, Prague), SHMUEL FRIEDLAND (U. Illinois, Chicago) and ISRAEL GOHBERG (U. Tel-Aviv). The prizes will be awarded at the Pensacola meeting in March 1993. The prize talks will be delivered at three consecutive meetings as follows: Fiedler - Pensacola (March 1993), Gohberg - Rotterdam (August 1994), and Friedland - Atlanta (August 1995). The prize committee consisted of Tom Laffey (Chair), Gene Golub, Alan Hofman, Hans Schneider (ex officio) and Robert Thompson.
3. ILAS has formed an Institutional Membership Committee, consisting of LeRoy Beasley (Chair) and Carolyn Eschenbach.
4. Jeff Stuart has been appointed to assistant treasurer.
5. The Nomination Committee, chaired by Jose Da Silva, was assigned the task of selecting the nominees for this summer's elections (terms to start March 1, 1994). There will be elections for the positions of president, treasurer, and two other positions on the board of directors.
6. ILAS-NET: As of March 15, 1993, we have circulated 273 ILAS-NET announcements. ILAS-NET currently has 498 subscribers.
7. Since May 27, 1992, ILAS INFORMATION CENTER (IIC) has had 615 information requests (not counting FTP operations).
8. Future ILAS meetings are:
 - (a) Rotterdam, August 15-19, 1994
Organizer: Harm Bart

- (b) Atlanta, August 16-19, 1995
Organizers: Frank Hall and Paul Van Dooren
 - (c) Chemnitz, summer 1996 (tentative)
Organizer: Volker Mehrmann
 - (d) Madison 1998, (tentative) Organizer: Richard Brualdi
9. Future ILAS sponsored meetings will be the Workshop on "Nonnegative Matrices, Applications and Generalizations", Haifa, May 31 - June 4, 1993, and the Eighth Haifa Matrix Theory Conference, Haifa, June 7-10, 1993.

The Olga Taussky - John Todd Lecture Program

Report by Richard Varga

In honor of their combined contributions and dedication to the field of linear algebra, the International Linear Algebra Society (ILAS) has announced the *Olga Taussky-John Todd Lecture Program*, where a talented younger person in linear algebra will be selected, every 3 or 4 years, to deliver an hour address on his or her research, at a specific linear algebra meeting endorsed by the ILAS. Friends, students, and colleagues of Olga and Jack have already made generous contributions to a new fund, to be used to cover the travel expenses of selected speakers for this Program. We take this opportunity to thank all those who have contributed to this Lecture Program.

The first speaker, chosen for this Olga Taussky-John Todd Lecture program, was

Dr. Helene Shapiro (Swarthmore College),

who spoke at the *Pure and Applied Linear Algebra Conference - The New Generation*, in Pensacola, Florida, March 17-20, 1993. (Dr. Shapiro is also a Ph.D. student of Olga Taussky's from Caltech.)

Although Olga Taussky and John Todd are internationally known for their many deep and penetrating results in linear algebra and numerical analysis, it seems proper to briefly recap here their splendid careers. We begin with Olga's career.

Olga Taussky was born August 30, 1906 in Olomouc (a city in Bohemia), and she later moved to Linz, Austria. She received her Ph.D. degree in mathematics in 1930 from the University of Vienna (under the direction of Professor Furtwängler). She spent the year 1931-1932 at the University of Göttingen, and the years 1932-1934 at the University of Vienna. From 1934-1940, she was a fellow at Girton College, Cambridge, and an assistant lecturer at University of London, 1937-1943. (It was in this period that she met and married John Todd in 1938). During the war years, she worked as a mathematician at the Ministry of Aircraft Production (1943-1946), and there, she applied Gerschgorin estimates of eigenvalues of matrices to actual flutter calculations! Then, she and John Todd came to America and took positions at the U.S. National Bureau of Standards (1947-1957), and later, they accepted positions in 1957 at the California Institute of Technology, where they have remained ever since. (Olga was initially a Research Associate 1957-71 at Caltech, and she has been a Professor of Mathematics since 1971.)

Olga has written over 200 research papers, and has had 14 Ph.D. students. Her many honors include an honorary doctorate from the University of Southern California (1988), the Ford Prize of the Mathematical Association of America (1971) (for her paper "Sums of squares"), the Gold Cross of Honor from the Austrian Government (1978), and corresponding memberships in the Austrian Academy of Sciences and the Bavarian Academy of Sciences.

Olga's mathematical research has been in the areas of algebraic number theory, integral matrices, and matrices in algebra and analysis. Being most familiar with her work in matrix theory, I can state that many of her research contributions in this area have been for me of path-finding quality. And, as a path needs a source of light, isn't it appropriate that she wrote "How I became a torchbearer for matrix theory," in the *Mathematical Monthly* 95(1988), 801-812? She is the *Grand Dame* of matrix theory, and many, myself included, can trace their abiding interest in this area to her infectious enthusiasm for matrix theory!

John Todd was born May 16, 1911 in Carnacally, Ireland. His B.S. degree was from Queen's University in Belfast, Northern Ireland, in 1931. Later, he was a research student at St. John's College, Cambridge, 1931-1933, and then a lecturer from 1933-1937 at Queens' University, and from 1937-1949 at King's College in London. Then, from 1947-1957, Jack was at the U.S. National Bureau of Standards, initially at the Institute for Numerical Analysis at UCLA, (1947-1948), and then in Washington, D.C., first as Chief of the Computation Laboratory (1949-1954), and then as Chief, Numerical Analysis (1954-1957). (This is where I first met Jack and Olga in 1954.)

Jack is best known for his many books and research papers in numerical analysis, and for his contributions to the editorial board of *Numerische Mathematik*, *Journal of Approximation Theory and Aequationes Mathematicae*. He has written over 100 research papers, has had six Ph.D. students, and has written five books, including the widely-read "Basic Numerical Analysis," volumes I and II. Can I also concisely sum up his research contributions, personally? Jack will always be for me a young-at-heart pioneer in numerical analysis, with an inexhaustible knowledge of the literature, supplemented by an Irish twinkle in his blue eyes!

Hans Schneider Prize Winners

Report by Danny Hershkowitz

The first Hans Schneider Prize has been awarded jointly to Shmuel Friedland, University of Illinois, Chicago, Israel Gohberg, Tel Aviv University, and Miroslav Fiedler, Czech Academy of Sciences.

Shmuel Friedland was born in the USSR province of Uzbekistan and educated in Israel. The award is in recognition of his fundamental contributions to analysis, algebra, and geometry. "A number of the deepest and most elegant results in linear algebra are due to him, and he has enriched the subject through the introduction of power analytic and algebraic tools," the prize committee said. Among the specific accomplishments for which he was cited are finding an effective solution to the simultaneous similarity problem for matrices, advances in combinatorial matrix theory, and a powerful method of attack on the graph isomorphism problem.

Israel Gohberg was born in 1928 and began his mathematical studies in Frunze (Kirgizia), and then in Kishinev (Moldava). Later, he became a close friend and collaborator of M.G. Krein in Odessa (Ukraine) and began a justly famous partnership that lasted for 24 years. In 1964 he obtained a doctoral degree at Moscow State University, and in 1970 he was elected a corresponding member of the Moldavian Academy. Since 1974 he has been a Professor at Tel Aviv University, Israel, and has been the incumbent of the Nathan and Lily Silver Chair since 1981. He has been a Foreign Member of the Royal Netherlands Academy of Arts and Science since 1985 and was awarded the Rothschild Prize in Mathematics in 1986. He has supervised more than 40 doctoral candidates.

Israel Gohberg has over 300 publications. He published seven books while in the Soviet Union, five of which have been translated into English, French or German. His books with Krein on *Linear non-self-adjoint operators* (translation by the AMS in 1969) and *Volterra operators in Hilbert space* (AMS 1970) have had profound impact on functional analysis and linear algebra. He has published seven more books in English since 1974. His book on *Minimal Factorizations of Matrices and Operator Functions* (1979) with Bart and Kaashoek is the seminal work on the subject and has led to great advances in the area in which many authors, not least Gohberg himself, have made significant contributions. The classification of pencils of matrices under equivalence achieved by Kronecker in the last century is still difficult today and the problem of extending it to general matrix polynomials is daunting. Gohberg and his many collaborators have made tremendous progress on this. His three important books with Lancaster and Rodman *Matrix Polynomials* (1982), *Matrices and Indefinite Inner Product Spaces* (1983) and *Invariant Subspaces of Matrices with Applications* present accounts of more linear algebraic aspects of this work. His 1990 book with Ball and Rodman *Interpolation of Rational Matrix Functions* breaks significant new ground in this area. His contributions have covered most aspects of linear algebra. He has obtained important results on such diverse areas as completion problems, structured matrices, spectral theory, factorization and realization of matrix functions, canonical forms, perturbation theory, matrix functions and interpolation, complexity, and systems theory. Because of the strength and interest of his results,

he has greatly influenced the direction of the development of linear algebra.

Miroslav Fiedler was born in Prague in 1926. His future greatness was foreshadowed early on by his brilliance at problem-solving. Already while in secondary school he won a mathematical competition run by the *Razhledy matematicko přírodovědecké*. He graduated in Mathematics and Physics from Charles University in 1950. His thesis treated questions on algebraic curves. As a research student he worked at the Central Mathematical Institute, now part of the Czechoslovak Academy of Sciences and this has been his base ever since. He did his (senior) doctorate under the supervision of Cech on the theory of simplices. Gradually, he broadened his interests from geometry into matrix theory, numerical analysis, mathematics of economics, graph theory. He was appointed full professor at Charles University in 1964. The significance of his work has been recognized internationally through associate editorships of LAA, LAMA, Numerische Mathematik. He has accepted invitations to visit several prestigious universities. He has been Editor-in-Chief of the Czechoslovak Mathematical Journal. In Czechoslovakia, his influence on the whole mathematical spectrum has been profound. He has given lectures in several of its cities to encourage mathematical research and given his own early display of brilliance in Mathematics, he has actively helped in the training program for the very successful Czech involvement in the annual international mathematical olympiads.

Fiedler's first significant research was in the theory of simplices. In the light of his later fundamental contribution to algebraic graph theory it is interesting to note that he was one of the innovators of their combinatorial study and obtained several results characterizing graphs in terms of their interpretability as graphs of simplices.

Because of the role of positive definite matrices in the theory of simplices, he began his examination on the influence of the diagonal entries of a matrix on its spectrum. Again a foretaste of major contributions to the problem of localization of the spectrum of general matrices - that is, determining the smallest complex domain containing all the eigenvalues.

He extended the theory of M-matrices and successfully applied it to get information on $\rho(A)$ (his first encounter with this goes back to 1958 when with Sedláček, he reproved and generalized the classical theorem of Kirchhoff). He identified the importance of its second largest eigenvalue. His work in this area has greatly influenced the direction of research in the field and the Laplacian matrix continues to provide surprises.

He has made significant contributions to mathematical economics and numerical linear algebra. He has made a fundamental study of tridiagonal matrices and Hankel matrices, and several other areas of linear algebra. He has also been interested in the application of his results, particularly of graph theory in the study of electric circuits.

Fiedler's first significant research was in the theory of simplices. In the light of his later fundamental contribution to algebraic graph theory, it is interesting to note that he was one of the innovators of their combinatorial study and obtained several results characterizing graphs in terms of their interpretability as graphs of simplices. Because of the role of positive definite matrices in the theory of simplices, he began his examination on the influence of the diagonal. Among his striking results are:

1. Given any complex $n \times n$ matrix A , there exists a diagonal matrix D such that $A + D$ has given complex spectrum. He has also proved a multiplicative analog and made significant contributions to several other inverse eigenvalue problems, including those for nonnegative matrices. In this connection he proved a refinement of Pringsheim's theorem on rational functions and applied it to show the existence of a eventually nonnegative matrix whose spectrum is the union of given self-conjugate Frobenius sets.
2. He has found an effective solution to the simultaneous (linear) similarity problem for matrices. He has also extended Wasow's Theorem on the relation between the pointwise and analytic similarity of matrices whose entries are complex valued analytic functions.
3. He has obtained best possible bounds for the permanent and related functions on certain classes of matrices.
4. A lovely theorem of Motzkin and Taussky states that if A and B are given $n \times n$ complex matrices such that $xA + yB$ is diagonalizable for all x, y then $AB = BA$. Friedland has generalized it and in the process obtained a very elegant analytic proof.

5. He has made very significant contributions to combinatorial matrix theory. Examples are a combinatorial lower bound for the index of a matrix, and the relation of combinatorial structure of a nonnegative matrix to the growth of its powers. Recently, he has proved an upper bound for the spectral radius of even sized tournament matrices.
6. He has developed a powerful method of attack on the graph isomorphism problem through the congruence theory for rational and integer matrices. As a by-product, he has obtained very interesting results on the sublattices of integral lattices.

His methods of proof are innovative and inspiring and employ ideas from many areas of mathematics.

Fiedler gave the prize lecture in March at the ILAS Pensacola meeting. Gohberg will present a prize lecture at the August 1994 ILAS Rotterdam meeting and Friedland will give his lecture at the August 1995 Atlanta meeting.

The Hans Schneider Prize Committee is chaired by Thomas J. Laffey, University College, Dublin. Other members of the committee are Gene Golub, Stanford University, Alan Hoffman, IBM Thomas J. Watson Research Center, Robert Thompson, University of California, Santa Barbara, and Hans Schneider, (ex-officio).

NEXT ISSUE OF *IMAGE* PLANNED FOR JANUARY 1994

IMAGE is edited by S. J. Leon. The Production Editor is Ann Cox. News items for the next issue should be sent no later than December 1, 1993 to:

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FAX: (508) 999-8901

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. Articles should be no more than four pages in length. 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.

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

ILAS TREASURER'S REPORT March 1, 1992 - Feb. 28, 1993

Report by James R. Weaver

| | | | |
|---|-----------|----------|-----------|
| Balance on hand March 1, 1992 | | | |
| Certificate of Deposit | 10,000.00 | | |
| Checking | 6,388.68 | | 16,388.68 |
| Checking Account Balance on March 1, 1992 | | | 6,388.68 |
| March 1992 | | | |
| Income: | | | |
| Dues | 156.00 | | |
| Interest on CD | 63.56 | | |
| Interest (First Union) | 12.35 | | |
| Contribution (Regular) | 16.00 | 247.91 | |
| Expenses: | | | |
| Service Charge (First Union) | 11.20 | | |
| Sec. of State | 70.00 | 81.20 | 166.71 |
| April 1992 | | | |
| Income: | | | |
| Dues | 168.00 | | |
| Interest on CD | 67.95 | | |
| Interest (First Union) | 12.24 | | |
| Contribution (Regular) | 8.00 | 256.19 | |
| Expenses: | | | |
| | 00.00 | 00.00 | 256.19 |
| May 1992 | | | |
| Income: | | | |
| Dues | 84.00 | | |
| Interest (First Union) | 13.09 | 97.09 | |
| Expenses: | | | |
| | 00.00 | 00.00 | 97.09 |
| June 1992 | | | |
| Income: | | | |
| Dues | 132.00 | | |
| Interest (First Union) | 133.79 | | |
| Contributions | | | |
| Regular | 8.00 | | |
| F. Uhlig Ed. Fund | 200.00 | | |
| OTT-JT Lec. Fund | 700.00 | 1,186.25 | |
| Expenses: | | | |
| Postage (Ballots) | 169.45 | | |
| Supplies (Waller Bros.) | 40.13 | | |
| 1,000 CD (F. Uhlig Ed.) | 1,000.00 | 1,209.58 | (23.33) |
| July 1992 | | | |
| Income: | | | |
| Dues | 36.00 | | |
| Interest on CD | 65.75 | | |
| Interest (First Union) | 10.88 | | |
| Contributions | | | |
| Regular | 46.00 | | |
| OTT-JT Lec. Fund | 400.00 | 542.59 | |
| Expenses: | | | |
| Supplies (Mayes) | 17.07 | | |
| Dixon Brothers (T-Shirts) | 171.20 | 188.27 | 354.32 |
| August 1992 | | | |
| Income: | | | |

| | | | | |
|----------------|-------------------------------|----------|----------|----------|
| | Dues | 168.00 | | |
| | T-Shirts | 200.00 | | |
| | Interest on CD (HS) | 67.94 | | |
| | Interest (First Union) | 11.25 | | |
| | Contributions | | | |
| | H. Schneider Prize | 235.00 | | |
| | F. Uhlig Ed. Fund | 100.00 | | |
| | Regular | 46.00 | | |
| | OTT-JT Lec. Fund | 200.00 | 1,028.19 | |
| | Expenses: | | | |
| | Shipping Poste (Dues Notices) | 224.80 | | |
| | Returned Check | 12.00 | 336.80 | 791.39 |
| September 1992 | Income: | | | |
| | Dues | 840.00 | | |
| | Interest on CD (HS) | 67.95 | | |
| | Interest (First Union) | 12.36 | | |
| | Contributions | | | |
| | H. Schneider Prize | 41.00 | | |
| | F. Uhlig Ed. Fund | 25.00 | | |
| | Regular | 138.00 | | |
| | Expenses: | 00.00 | 00.00 | 373.33 |
| October 1992 | Income: | | | |
| | Dues | 342.00 | | |
| | Interest on CD (FU) | 9.45 | | |
| | Interest (First Union) | 13.88 | | |
| | Contribution | | | |
| | H. Schneider Prize | 8.00 | 373.33 | |
| | Expenses: | 00.00 | 00.00 | 373.33 |
| November 1992 | Income: | | | |
| | Dues | 324.00 | | |
| | Interest on CD (HS) | 133.70 | | |
| | Interest (First Union) | 15.14 | | |
| | Contributions | | | |
| | OTT-JT Lec. Fund | 1,180.00 | | |
| | Conf. Fund | 5,125.00 | 6,777.84 | |
| | Expenses: | | | |
| | BYU (IMAGE) | 556.38 | 556.36 | 6,211.46 |
| December 1992 | Income: | | | |
| | Dues | 276.00 | | |
| | Interest on CD (HS) | 65.75 | | |
| | Interest on CD (FU) | 9.35 | | |
| | Contributions | | | |
| | H. Schneider Prize | 48.00 | | |
| | F. Uhlig Ed. Fund | 5.00 | | |
| | OTT-JT Lec. Fund | 1,392.16 | | |
| | Regular | 10.00 | 1,830.10 | |
| | Expenses: | | | |
| | Shipping Poste | 141.35 | | |
| | Patricia Enfinger | 29.96 | | |
| | Federal Express | 9.00 | 180.30 | 1,649.79 |
| January 1993 | Income: | | | |
| | Dues | 348.00 | | |
| | Interest (First Union) | 26.29 | | |
| | Interest on CD (HS) | 29.73 | | |

| | | | | |
|-------------------|----------------------------------|-----------|-----------|-----------|
| | Contributions | | | |
| | H. Schneider Prize | 48.00 | | |
| | F. Uhlig Ed. Fund | 14.00 | | |
| | OTT-JT Lec. Fund | 1,425.00 | | |
| | Regular | 40.00 | 1,905.02 | |
| Expenses: | Shipping Poste (HS) | 17.50 | | |
| | Conference Expenses | 129.42 | | |
| | Auburn | 662.53 | 809.45 | 1,095.57 |
| February 1993 | Income: | | | |
| | Dues | 168.00 | | |
| | Interest on CD (HS) | 28.77 | | |
| | Interest (First Union) | 24.68 | | |
| | Contributions | | | |
| | Conference Fund | 65.00 | | |
| | Hospitality Room Fund | 300.00 | 586.45 | |
| | Regular | 41.00 | | |
| Expenses: | Bentons | 99.67 | | |
| | Patricia Enfinger (Conf, Fund) | 12.84 | | |
| | Dixon Brothers | 487.39 | 599.90 | (13.45) |
| | | | | 18,472.06 |
| February 29, 1993 | | | | |
| Account Balance | | | | |
| | Checking Account | 18,472.06 | | |
| | Certificate of Deposit (FU) | 1,000.00 | | |
| | Certificate of Deposit (HS) | 10,000.00 | 29,472.06 | |
| | | | | |
| | General Fund | 5,099.84 | | |
| | Frank Uhlig Educational Fund | 1,471.80 | | |
| | Hans Schneider Prize | 12,255.52 | | |
| | Olga Taussky Todd-John Todd Fund | 5,297.16 | | |
| | Conference Fund | 5,047.74 | | |
| | Hospitality Room Fund | 300.00 | 29,472.06 | |

NEWS ITEMS

WUARCHIVE Announces Linear Algebra Directory

The WUARCHIVE at Washington University in St. Louis is now a site for the storage of public domain and shareware software and other materials which can be utilized in the teaching of mathematics at the college and university levels. Earl D. Fife, Calvin College, serves as the Mac moderator and the MSDOS moderator is Larry Husch, University of Tennessee.

The Mathematics Archives has recently added two new moderators: Richard E. Faulkenberry and Louis J. Gross.

Richard Faulkenberry (rfaulkenberr@umassd.edu) is an assistant professor at the University of Massachusetts, Dartmouth and is assistant director of the ATLAST project which offers faculty workshops on the use of software in teaching linear algebra. Richard will moderate the linear.algebra directory which will contain software and other materials which can be used in the teaching of linear algebra at the undergraduate level. These materials will include computer exercises developed by participants of the ATLAST workshop and public domain MATLAB modules.

Lou Gross (gross@math.utk.edu) is a professor of mathematics and ecology at the University of Tennessee, Knoxville. He is the principal investigator of an NSF grant to develop a quantitative curriculum for undergraduate life science students. Lou will moderate the life.sciences directory which will contain software and other materials which can be used in the teaching of calculus for biology majors and other mathematical biology courses at the undergraduate level.

To access Archive files, use anonymous FTP to wuarchive.wustl.edu, switch to the subdirectory /edu/math/msdos if you are interested in software which can be used on msdos computers or switch to the subdirectory /edu/math/mac for software which can be used on macintosh computers. Change to the subdirectory which is the subject area for which you would like to obtain software. In each subject area there is a file 00info.txt which contains a listing of all programs in the area together with a short abstract similar to the above abstracts.

If you have any comments, suggestions about, problems with, etc. the Mathematics Archives, please contact one of the moderators (macintosh) Earl Fife at fife@calvin.edu or (msdos) Larry Husch at husch@wuarchive.wustl.edu. If you want to be added to the mailing list of this newsletter please send your email address to Larry. If you would like to submit program(s) and/or other appropriate material or know of material which you believe should be made available in the Mathematics Archives, then get in contact with one of the moderators at the addresses listed at the top of this newsletter.

Western Canada Linear Algebra Meeting

Report by Steve Kirkland

We are planning a small regional meeting for people in western Canada working in linear algebra and closely related fields. The meeting is scheduled to take place on September 24 and 25, 1993, at the University of Regina. The purpose of the meeting is to provide an occasion for linear algebraists in western Canada to meet, present accounts of their recent research, and to have informal discussions. Participants are invited to contribute a talk on linear algebra or its applications of 30-45 minutes duration, depending on the number of participants.

To facilitate planning of the meeting, please contact one of the organizers by August 15, 1993 if you intend to come. The local organizers (Doug Farenick and Steve Kirkland) will arrange the accommodations, but no financial support can be provided for travel or accommodation expenses incurred by participants.

We hope to see you in Regina.

Organizers:

Doug Farenick, Department of Mathematics and Statistics, University of Regina, Regina, Saskatchewan, S4S 0A2. Phone: (306) 585-4425, e-mail: farenick@abel.math.uregina.ca

Steve Kirkland, Department of Mathematics and Statistics, University of Regina, Regina, Saskatchewan, S4S 0A2. Phone: (306) 585-4352, e-mail: kirkland@max.cc.uregina.ca

Peter Lancaster, Department of Mathematics and Statistics, University of Calgary, Calgary, Alberta, T2N 1N4. Phone: (403) 282-5150, e-mail: lancaste@acs.ucalgary.ca

Second Symposium on Matrix Analysis and Applications "A Look at Recent Developments"

The symposium will be held on Friday and Saturday, October 22 & 23, 1993 at Western Michigan University, Kalamazoo, Michigan. The Principal Speakers will include: David H. Carlson, San Diego State University, Roger A. Horn, University of Utah, Charles R. Johnson, College of William and Mary, Chi-Kwong Li, College of William and Mary, Stephen J. Pierce, San Diego State University

There will be additional invited speakers along with a number of contributed papers. Preceding the Symposium, at 4:00 p.m. on Thursday, 21 October 1993, will be a University Visiting Scholar lecture

by Stephen J. Pierce entitled "When is your Matrix Nilpotent?". A Symposium Banquet is scheduled on Friday evening. The Symposium is dedicated to the memory of Professor Erik A. Schreiner.

This symposium is intended for those who are active in matrix analysis and also for those who are interested in the applications of matrix theory in other fields. Graduate students, college faculty members, and others who are interested in learning about recent developments in matrix analysis and about the current thinking regarding the teaching of linear algebra are encouraged to attend and participate. A special session of the Symposium will be devoted to discussing the impact of technology on the undergraduate curriculum in linear algebra.

The deadline for submitting abstracts for 20 minute contributed papers is **31 July 1993**. The Organizing Committee consists of Yousef Alavi, Western Michigan University, Charles R. Johnson, College of William and Mary, and John W. Petro, Western Michigan University.

For further information on the Symposium contact

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CALENDAR OF COMING CONFERENCES

August 16-19, 1993 Third SIAM Conference on Linear Algebra in Signals, Systems, and Control, University of Washington, Seattle

Information: Biswa N. Datta, Dept. of Mathematical Sciences, Northern Illinois University

September 24-25, 1993 Western Canada Linear Algebra Meeting

Information: See article in this issue of *IMAGE*

October 22-23, Second Symposium on Matrix Analysis and Applications

Information: See article in this issue of *IMAGE*

November 6, 1993 "Southern California" Matrix Theory Meeting, San Jose State University, San Jose, California

Information: Jane Day, San Jose State University, E-mail: day@jsumcs.sjsu.edu

December 13-17, 1993 International Cornelius Lanczos Centenary Conference, North Carolina State University, Raleigh, North Carolina

Information: R. J. Plemmons, North Carolina State University, Raleigh, NC 27695-8205

April 10-16, 1994, Numerical Linear Algebra with Applications, Oberwolfach, Fed. Republic of Germany
Information: Mathematisches Forschungsinstitut Oberwolfach Geschäftsstelle: Alberstrasse 24 W-7800 Freiburg im Breisgau

August 15-19, 1994, ILAS Conference, Erasmus University, Rotterdam

Information: See future issues of *IMAGE*

August, 1995 ILAS Conference, Atlanta, Georgia, U.S.A.

Information: See future issues of *IMAGE*.

REPORTS ON CONFERENCES ATTENDED



Auckland Matrix Workshop

Back two rows (left to right): A. R. Sen, George Seber, Jon Stene, Siew Choo Soo, Simo Puntanen, Peter Clifford, Thomas Yee, John Maindonald, Antony Gomez, Alain Vandal, Ron Christensen
Front two rows: Renate Meyer, Alastair Scott, Snehalata Huzurbazar, Thomas Mathew, Andrew Gilmour, Jeffrey Hunter, Shaytle Searle, Graham Wood, John Thompson, Bill Farebrother, George Styan, Gita Mishra.
Other participants included: John Chipman, Harold Henderson, Richard Jarrett, Chris Paige, Michael Schimek, Garry Tee, and David Vere-Jones.

International IMS-ILAS Workshop on Matrix Methods for Statistics

Report by George Styan

Co-sponsored by the Institute of Mathematical Statistics (IMS) and the International Linear Algebra Society (ILAS), an International Workshop on Matrix Methods for Statistics was held at the University of Auckland in Auckland, New Zealand, Friday-Saturday 4-5 December 1992. This Workshop was organized by Harold V. Henderson, Jeffrey J. Hunter, Bryan F. J. Manly, Simo Puntanen, Alastair J. Scott, and George P. H. Styan. Participants came from Australia, Austria, Canada, Denmark, Finland, Germany, New Zealand, the United Kingdom, and the United States.

The Workshop began with a talk by John S. Chipman (University of Minnesota) on "The Generalized matrix Schwarz inequality and its application to biased estimation in linear regression". This was followed by George P. H. Styan (McGill University, Montreal) speaking on "The efficiency of a linear unbiased estimator and on a matrix version of the Cauchy-Schwarz inequality"; it was observed that Styan's results complemented those published by Chipman (1976) in *Generalized Inverses and Applications* (M. Z. Nashed, ed., Academic Press, 549-769). This first session ended with the presentation by Simo Puntanen (University of Tampere) on "Matrix tricks related to deleting an observation in the general linear model".

The afternoon sessions on the Friday started with a talk by Garry J. Tee (University of Auckland) on Alexander Craig Aitken: Garry's plans for publication of Aitken's Collected Papers were also discussed. Richard William Farebrother (University of Manchester) spoke about statistical contributions to matrix methods in an historical context, while Peter Clifford (Oxford University) spoke on "The distribution of Pearson's correlation coefficient in the presence of spatial autocorrelation" and David J. Vere-Jones (Victoria University of Wellington) spoke on "Generalized permanents and their applications to multivariate negative binomial distributions".

These talks were followed by a reception featuring Bluff oysters (courtesy Peter Mullins) and an excellent dinner in Berlin (organized by Alan Lee).

The sessions on the Saturday started with Graham R. Wood (University of Canterbury, Christchurch) telling us "How not to use matrices when teaching statistics" (joint work with David J. Saville, New Zealand Pastoral Agriculture Research Institute Ltd., Lincoln). This was followed by Thomas Mathew (University of Maryland, Baltimore-County) speaking on "Combining independent tests for a common mean: an application of the parallel sum of matrices" and by an in-depth study by Renate Meyer (Technical University of Aachen) on "Invariant preorderings of matrices and approximation problems in multivariate statistics and multidimensional scaling". Shayle R. Searle (Cornell University, Ithaca, New York) presented "Further results and proofs for the singular linear model", while Michael G. Schimek (University of Graz Medical Schools) told us about "Problems with direct solutions of the normal equations for nonparametric models".

The Saturday afternoon session started with a tour de force by Chris C. Paige (McGill University, Montreal) on "The full CS-decomposition of a partitioned orthogonal matrix" (joint work with Musheng Wei, East China Normal University, Shanghai). The CS (cosine/sine)-decomposition (CSD) of a 2-block by 2-block partitioned unitary matrix reveals the relationships between the singular-value decompositions of each of its 4 sub-blocks. The CSD was originally proposed by C. Davis and W. Kahan, and is important in finding the principal angles between subspaces (Davis and Kahan, Björck and Golub), such as in computing canonical correlations between two sets of variates. It also arises in, for example, the Total Least Squares problem.

The Workshop ended with talks by Jeffrey J. Hunter (Massey University, Palmerston North) on the "Stationary distributions and mean first passage times in Markov chains using generalized inverses" and by Alastair J. Scott (University of Auckland) "Characterizing invariant convex functions of matrices" (joint work with James V. Bondar, Carleton University, Ottawa).

New-Delhi Workshop on Generalized Inverses

Report by Bob Hartwig

From December 11-16 the Indian Statistical Institute in New-Delhi, hosted a very successful workshop on Generalized Inverses. Close to fifty participants attended, coming from such far away countries as India, the U.S., Canada, Germany, Japan, China, Finland, Ukraine and Singapore.

The topics presented in the workshop illustrated the wide scope of research within the field of g -inverses. Indeed they ranged from Classical Linear Algebra papers to Linear Programming, Banach Algebras, Signal Processing, Linear Models, Total Least Squares, Ring Theory, Prediction and Estimation Theory and Semigroups.

The workshop was well balanced in that no one area dominated the meeting. Moreover the various research areas well complemented each other and allowed for useful "cross-fertilization" of ideas. This was illustrated, for example, by the fact that the concept of "volume" made its simultaneous entry in at least three research areas. After decades of neglect, Moore's original formulae for his inverse and the related concept of volume, now turn out to be indispensable in such fields as MP-inverses over rings, g -inverses in Banach Algebra and the study of Affine Mappings in Linear Programming as initiated by Karmarkar. Without g -inverses some of these results would not have been possible. This workshop should perhaps be remembered as Moore's "vindication."

Three popular short courses were given on Toeplitz matrices and iterative least squares, on Matrix Partial orders and on the Extended matrix Schwarz inequality with applications to Least Squares and Econometrics.

A round-table discussion was held discussing the future of Generalized Inverses and the consensus that emerged will be published elsewhere. The workshop was concluded with a successful open problem session, where many questions and ideas were floated. It was a great opportunity for many of us to meet some of the people behind familiar name tags.

The host institute did a wonderful job, and apart from a postponed trip to the Taj Mahal, all went very well.

JOURNAL NEWS

LINEAR ALGEBRA AND ITS APPLICATIONS (LAA)

Special Issues in Progress

- Title: Special Issue Honoring Ingram Olkin
Special Editors: Friedrich Pukelsheim, George P. H. Styan, Henry Wolkowicz, and Ion Zaballa
Submission Deadline: August 31, 1992
- Title: Proceedings of the Workshop on Computational Linear Algebra in Algebraic and Related Problems
Special Editors: R. M. Guralnick and G. O. Michler
Submission Deadline: October 30, 1992
- Title: Proc. of the Second Conference of the ILAS, Lisbon
Special Editors: J. A. Dias Da Silva, Chi-Kwong Li, and Graciano de Oliveira
Submission Deadline: October 30, 1992
- Title: Third Special Issue on Linear Systems and Control
Special Editors: A. C. Antoulas, P. A. Fuhrmann, M. L. J. Hautus and Y. Yamamoto
Submission Deadline: February 28, 1993
- Title: Special Issue Honoring Marvin Marcus
Special Editors: Bryan E. Cain, Moshe Goldberg, Robert Grone, Nicholas J. Higham
Submission Deadline: December 31, 1992
- Title: Workshop on Generalized Inverses
(A special section of one issue will be devoted to this workshop.)
Special Editors: R. P. Bapat, Robert E. Hartwig, and S. K. Mitra
Submission Deadline: March 15, 1993
- Title: Special Issue honoring Chandler Davis
Special Editors: Rajendra Bhatia, Shmuel Friedlund, and Peter Rosenthal
Submission Deadline: March 31, 1993
- Title: Special Pensacola Conference Issue
Special Editors: Diane P. O'Leary, Leiba Rodman, and Helene Shapiro
Submission Deadline: June 30, 1993
- Title: Special Issue Honoring Miroslav Fiedler and Vlastimil Ptak
Special Editors: Wayne Barrett, Angelika Bunse-Gerstner, and Nicholas Young
Submission Deadline: August 30, 1993
- Title: Proceedings of the conference "Matrices and Graphs" in honor of John Maybee's 65th birthday, Boulder, Colorado, May, 1993
Special editors: C. R. Johnson and J. R. Lundgren
Submission deadline: August 31, 1993

Title: Fourth Special Issue on Linear Algebra and Statistics
Special Editors: Jeffrey J. Hunter, Simo Puntanen, and George P. H. Styan
Submission deadline: June 30, 1993

Title: Proceedings of the workshop "Nonnegative Matrices, Applications and Generalizations" and the Eighth Haifa Matrix Theory
Special editors: S. Friedland, D. Hershkowitz, and R. Loewy
Submission deadline: September 15, 1993

Special issues of LAA are available to individuals at a reduced rate. For further information, please contact Yusuf Guvenc, Journals Customer Service, Elsevier Science Publishing Co., 655 Avenue of the Americas, New York, NY 10010; Tel. 212-633-3955; Fax 212-633-3990.

LINEAR AND MULTILINEAR ALGEBRA (LAMA)

Special Issues in Progress

Title: Special Issue on Algebraic Graph Theory
Special Editors: D. Cvetkovic, R. Merris, and P. Rowlinson
Submission Deadline: November 1, 1993

BOOKS

Some Paperback Bargains

by Steven J. Leon

If you often see books that you would like to have in your personal library but are scared off by the outrageous prices that publishers charge, you will be pleased to hear about the following two paperback books.

Linear Algebra and Linear Models by R. B. Bapat, Hindustan Book Agency, 17 U B Jawahar Nagar, Delhi 110 007.

This book was published in January, 1993 as part of a new series of Texts and Readings in Mathematics (TRIM). This beautifully written monograph is 124 pages long and sells for only \$16. The book is suitable for use in either an advanced undergraduate or first year graduate course.

The book covers the following topics: Linear Spaces and Matrices, Linear Estimation, Tests of Linear Hypotheses, Singular Values and their Applications, Rank Additivity. Throughout the concept of generalized inverse is used to develop basic results on linear estimation and hypothesis testing. Indeed, the author states in the preface

We put a great deal of emphasis on the generalized inverse and its applications. This amounts to avoiding the "geometric" or the "projections" approach which is favoured by some authors and taking a more algebraic approach. Partly as a personal bias, I feel geometric works well in understanding why a result should be true but has limitations when it comes to proving the results rigorously.

From this point of view the author succeeds admirably in giving a concise and rigorous coverage of the subject matter. Readers will find this book a welcome addition to their libraries.

A Survey of Matrix Theory and Matrix Inequalities by Marvin Marcus and Henryk Minc, Dover Books, 1992.

This book covers a wealth of material in only 180 pages. Dover has done the Linear Algebra community a great service by reprinting this classic book which was originally published in 1964, but has long been out of print. Furthermore the book is available at the super bargain price of \$5.95, (less than half the price of your yearly membership in ILAS).

The book is divided into three parts. The first part is a survey of matrix theory which includes many classical results. Some of the topics covered in Part I are: Kronecker product, permanents, and the various types of canonical forms. Part II is titled "Convexity and Matrices". Major topics here include convex functions and matrix inequalities, nonnegative matrices and stochastic matrices. Part III surveys results relating to the localization of characteristic roots.

In short Marcus and Minc give us a wealth of material in a compact form. This is a book you can't afford not to have in your library.