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Gatlinburg VIII

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The eighth meeting in the Gatlinburg series on linear algebra was held in Oxford from 5th to 11th July, 1981. The formal sessions were held in the Mathematical Institute while the many informal sessions, which are a characteristic feature of the Gatlinburgs, were mostly held in Lady Margaret Hall, the residential centre for the conference.

Although the formal programme appeared on the surface to be less arduous than that at the previous Gatlinburg, it was still very full, particularly since cutting classes is not a common practice in such a specialized meeting. Indeed the level of presentation was generally so high that one was reluctant to let extended coffee break discussions sabotage attendance at the lectures. As was customary, there was no parallelism in the formal sessions. This was, however, unavoidable with some of the informal sessions which tended to fill all of the time on the face of the clock causing, on at least one occasion, a desperate sprint to the bar which only succeeded by virtue of a most amenable barmaid, a necessary ingredient to a successful Gatlinburg. In a meeting at this level, it would be a disservice to single out a few lectures for particular comment. The whole range of linear algebra was covered from the historical to the theoretical to the computational and software end of the spectrum. The formal programme of lectures follows this article. Since there are no proceedings published, any interested reader should contact speakers directly.

At the conference dinner, Jim Wilkinson gave his recollections on the history of the Gatlinburgs which, in addition to reading like a who's who of linear algebra, emphasized the dynamism of Alston Householder who not only established the meetings on a regular basis but had the energy to host the first four of them. Certainly, it seemed as if Jim, Leslie Fox and their wives enjoyed organising this meeting but any thoughts that the Gatlinburgs could become Oxfords were firmly dismissed by Jim. Not only is there considerable work in the planning and organisation of the meeting itself but, from the moment the venue for the next meeting is decided, there is much work in preparing proposals for funding agencies. We are very grateful to the SERC, the London Mathematical Society, British Aerospace, Imperial Chemical Industries, Office of Naval Research (US Navy), and the European Research Office of the US Army for responding to the appeals on this occasion.

A feature of the more recent Gatlinburgs (a short history of which can be found in SIAM News 10, February 1977) is the presentation of the Householder Award. The Householder Award is funded solely by contributions from those attending the previous Gatlinburg meeting and was founded as a spontaneous gesture of recognition of the amount of work that Alston Householder has done for the numerical analysis community. The chairman of the Householder Award committee Dick Varga announced the winner of the fourth Householder Award at the conference dinner. On this occasion, the prize was shared between Dr. Paul Van Dooren for his thesis on "The generalised eigenstructure problem. Applications in system theory" and Dr. Eduardo Marques de Sa for his thesis on "Matrices, submatrices and invariant factors". The general level of entries was so high that the committee, as on the previous occasion, did not feel that it should rank the others in any particular order. The two prizewinners gave talks on their research and their presentations were equal to the high standard of their work. A collection was made after the dinner for the next Householder Award. Richard Varga will remain chairman of the organising committee whose other members are Hans Schneider, Josef Stoer, and Pete Stewart who replaces William Gragg.

It is not uncommon for speakers to pose an open problem to their audience during their talk. What is unprecedented is for such a proposition to be backed by some stake money. Perhaps a new era in numerical analysis sponsorship began at Gatlinburg VIII when three of the participants offered prize money for the solution of problems which they posed during the meeting. I list the challenges below so that you can make a bid for glory (or cash) by solving them.

A prize of $500 has been offered by Gene Golub for the construction of a 3-term conjugate gradient like descent method for non-symmetric real matrices or a proof that there can be no such method.

A prize of $250 has been offered by Don Rose for the best algorithmic result on iteration by Gatlinburg IX. The assessment is to be made by a committee consisting of G. Golub, W. Kahan, R. Varga and D. Young (Chairman).

And, after a collection from his other Dutch colleagues and in a bout of generosity unmatched by my native race, Dirk Dekker has established that it is the glory that counts by staking 2.50 guilders for results about strong pivoting and double pivoting.

Already plans are afoot for the next Gatlinburg which will probably be held in Eastern Canada in about three years time. Although it will continue to be, by necessity, an invitation only event, the organising committee are planning to publish details of the next meeting well in advance to allow proposals for attendees to be submitted for their consideration. Any such announcement will appear in a future issue of this newsletter.

Finally, I am sure that I echo the sentiments of all those present at this Gatlinburg when I express my sincere thanks to Leslie Fox and Jim Wilkinson for maintaining the fine tradition of the Gatlinburgs and creating the framework for such a stimulating intellectual and social environment.

GATLINBURG VIII: Formal Programme

Monday, 6th July

STATISTICAL COMPUTATIONS - CHAIRMAN B. PARLETT

G. Stewart, Stochastic Perturbation Theory for Least Squares

M. Cox, Parameters and Statistics of Separable Linear Models

M. Powell, Downdating the Cholesky Factorization

A. George, On Row and Column Ordering for Sparse Least Squares Problems

Wei-Lu Tsao, Solving Large Scale Least Squares Problems on a Small Computer

J. Varah, On the Numerical Solution of Linear Systems Arising from Ill-Posed Problems

A. Bjorck, A Bidiagonalization Algorithm for Solving Ill-Posed Systems of Linear Equations

D. O'Leary, Ill-Posed Toeplitz Systems

P. Deuflhard, On Rank-Deficient Pseudo Inverses

MISCELLANEOUS

W. Gander, Algorithmic Differentiation: Examples and Applications

Tuesday, 7th July

CONTROL THEORY COMPUTATIONS - CHAIRMAN I. MAREK

J. Wilkinson, Kronecker's Canonical Form for Numerical Analysts

P. Van Dooren (Joint Winner of 1981 Householder Award), The Generalised Eigenstructure Problem in Linear System Theory

M. Engel, Stability and Eigenvalue Monotonicity of Linear Systems

P. Lancaster, The Factorization of Matrix Valued Functions

E. Deutsch, Derivatives of the Perron Root of a Nonnegative Irreducible Matrix

C. Van Loan, Computations with Hamiltonian and Symplectic Matrices

D. Carlson, Controllability and Stability of Tridiagonal Matrices

INVERSE EIGENVALUES AND RELATED PROBLEMS - CHAIRMAN D. MARTIN

G. Golub, A Survey of Inverse Eigenvalue Algorithms

L. Fletcher, An Inverse Eigenvalue Problem in Multivariate Control Theory

N. Young, A New Solution for a Classical Interpolation Problem for Complex Functions

J. Cuppen, An Inverse Problem from Electrocardiology

C. Paige, Eigenvalue Allocation

Wednesday, 8th July

DIAGONAL DOMINANCE - CHAIRMAN J. TODD

H. Schneider, The Diagonal Dominance Theory: A Brief History

R. Varga, Gerschgorin and His Circles 1931-1981

R. Plemmons, Diagonal Dominance and Numerical Stability of Sparse Elimination Methods for Homogeneous Linear Systems

MISCELLANEOUS

V. Kublanovskaya, AB-Algorithm and Its Modifications for the Spectral Problems of Linear Pencils of Matrices

O. Taussky, Hermitian Pencils

W. Hackbusch, Multigrid Methods

Thursday, 9th July

SPARSE SYSTEMS - CHAIRMAN P. CONCUS

J. Stoer, On the Convergence of the Conjugate Gradient Method for Solving Indefinite Systems

G. Dahlquist, On the Uniform Power-Boundedness of Families of Companion Matrices

O. Axelsson, State of the Art of Theory of Preconditioning and Modified Incomplete Factorization of Finite Element Matrices

D. Jacobs, Extensions to Preconditioned Conjugate Gradient Methods

O. Widlund, Conjugate Gradient Algorithms Applied to a Special Family of Discrete Elliptic Problems

C. DeBoor, What is the Main Diagonal of a Biinfinite Band Matrix?

SPARSE SYSTEMS (Continued) - CHAIRMAN P. DEUFLHARD

I. Duff and J. Reid, A Multi-Frontal Approach for Solving Sparse Linear Equations

A. Jennings, On an Algorithm for Incomplete Factorization

P. Swarztrauber, Notes on the Accuracy of a Parallel Algorithm for Solving General Tridiagonal Systems

D. Young, Generalized Conjugate Gradient Procedures for Nonsymmetric and Indefinite Linear Systems

H. Van Der Vorst, A Vectorizable Variant of some ICCG Methods (Conjugate Gradients with Incomplete Cholesky)

Friday, 10th July

MATRIX THEORY - CHAIRMAN F. BAUER

M. Fielder, Quasidirect Decompositions of Hankel and Toeplitz Matrices

H. Wozniakowski, Computational Complexity for Numerical Analysis

E. Marques De Sa (Joint Winner of 1981 Householder Award), Matrices, Submatrices and Invariant Factors

V. Ptak, Non-Discrete Induction and the Newton Process

W. Meixner, Duality of Vector-Valued Norms in Ordered Vector Spaces

Chandler Davis, Estimates of Eigensystem Perturbation in the Hermitian and Normal Cases

EIGENVALUE PROBLEMS - CHAIRMAN I. DUFF

J. Reid and B. Parlett, Lanczos Algorithm for Finding the Spectrum of a Huge Symmetric Sparse Matrix

Jiguang Sun, Perturbation Theorems for Eigenvalues

A. Ruhe, New Developments of the Spectral Transformation Lanczos Algorithm

R. Ward, Solving Sparse, Symmetric, Definite, Quadratic λ-Matrices

B. Parlett, The Look-Ahead Lanczos Algorithm for Non-normal Matrices

O. Widlund, Computation of Eigenvalues of Jacobi Matrices by Solving Systems of ODE's

GATLINBURG VII: Informal Sessions Etc.

Monday, 6th July

INFORMAL SESSION (NO UNIFIED THEME)

D. Rose, Iterative Methods for Coupled 3-Dimensional PDE's

R. Bank, Non-Linear Multigrid

J. Bunch, Stable Decomposition of Skew Symmetric Matrices

J. Dongarra, Improving the Accuracy of Computed Eigenvalues

SPECIAL EVENING SESSION

C. Moler, Continuous Practical Demonstration of "MATLAB"

Tuesday, 7th July

OPTIMIZATION

K. Tanabe, Linear Algebra in Constrained Optimization

P. Gill, Preconditioned Non-linear Conjugate Gradient Methods

M. Saunders, Sparse Non-Linear Programming; a Review of Minos/Augmented

CLUSTERING EIGENVALUES AND NEARLY-INVARIANT SUBSPACES

B. Parlett, Almost Defective Matrices

W. Kahan, Ill-Conditioned Eigensystem Calculations

A. Ruhe, On Nearest Defective Matrix

Wednesday, 8th July

M-MATRICES AND RELATED TOPICS

W. Kahan, Diagonal Dominance Applied to Gaussian Elimination without Pivotal Interchanges

R. Varga, M-Matrix Factorizations

E. Deutsch, Bounds for the Perron Root of a Non-Negative Matrix

H. Schneider, Roots of M-Matrices and Generalizations

A. Berman, Signs of Inverse-Positive Matrices

I. Marek, Perron-Frobenius for Rectangular Pencils

M. Fiedler, An M-Matrix Inequality

W. Kahan, Small Plastic Packages of Mathematics for the Millions

Friday, 10th July

EIGENVALUE PROBLEMS

D. Scott, $Ax = \lambda Mx$ by Shifting and Lanczos

O. Widlund, Preconditioned C.G. Iterations in Inverse Iteration for $Ax = \lambda Mx$

A. Ruhe, Subspace Ritz Iteration for $Ax = \lambda Mx$

T. Yamamoto, Improved Error Bounds for Eigenvalu Problems

Saturday, 11th July -- DIRECT METHODS

J. Cuppen, Absorption of Plane Rotations in Householder Matrices

M. Heath, Large Sparse Linear Least-Squares Problems

T. Dekker, Pivoting Strategies for Full LU-Decomposition