Czechoslovak Mathematical Journal

Zdeněk Vavřín

Seventy years of Professor Miroslav Fiedler

Czechoslovak Mathematical Journal, Vol. 46 (1996), No. 2, 369–373

Persistent URL: http://dml.cz/dmlcz/127299

Czechoslovak Mathematical Journal, 46 (121) 1996, Praha

SEVENTY YEARS OF PROFESSOR MIROSLAV FIEDLER

ZDENĚK VAVŘÍN, Praha

In the article [R1], J. Sedláček and A. Vrba described life events and work of Professor Miroslav Fiedler on the occasion of his sixtieth birthday. Also, the list of Fiedler's publication was included.

On April 7, 1996, Fiedler celebrated his seventieth birthday. We shall try here to continue the article [R1] and show that though retired since 1992, Fiedler's activities by no means diminished during the past ten years.[1]

He still is Chief Editor of the Czechoslovak Mathematical Journal, editor of three other journals: Linear Algebra and Its Applications, Mathematica Slovaca, and Numerische Mathematik. Since 1994, he chairs the Czech Committee for Mathematics. His world recognition found its expression in the Hans Schneider ILAS (International Linear Algebra Society) Prize which was bestowed on him in 1993.

We shall briefly describe Fiedler's scientific achievements. (The list of publications below includes a few papers which were listed in [R1] but were not published at that time. The numbering continues that in [R1].)

In the past ten years, Fiedler published almost 50 papers. A vast majority of these concern matrix theory, in particular special classes of matrices.

Fiedler returned to study Hankel matrices (first his paper on this topic was published in 1964) and related classes, such as Toeplitz, Bézout, and Loewner matrices, in mid-eighties [106, 107, 109, 110, 117, 118, 121, 122, 123, 135, 140, 143].

While the basis of their theory was given by famous mathematicians of the end of the last and the beginning of this century, these matrices won a new wave of popularity from the seventies, especially due to their occurrance in linear systems theory. Fiedler (partly jointly with his colleague and for decades closest collaborator V. Pták) studied mutual relations and connections with associated polynomials and rational functions.

[1] In the last year a special issue of Linear Algebra and Its Applications has been dedicated to M. Fiedler and V. Pták which contains description of their whole scientific life up to present days [R2].

It is maybe surprising that Loewner matrices played a role in the solution [132] of the following problem: If a polynomial $\varphi(x)$ has all roots real, to find its symmetric companion matrix (the characterictic polynomial of which equals $\varphi(x)$) [133],[134].

Another series of papers, mostly jointly with T.L. Markham, concerned classes related to M-matrices [119, 120, 125, 126, 129, 136, 159], completion problems [114, 116], Hadamard products of matrices [120, 124, 148, 154], and generalized inverses [129, 139, 141, 151]. Several of these papers [125, 126, 136] gave a complete answer to topics studied previously by other authors.

Let us also mention an interesting new notion introduced and studied in a recent joint paper of Fiedler and Pták [156], the notion of spectral geometric mean of two positive definite matrices A and B (of the same order). It is the matrix F (always existing and unique) which satisfies $F = CAC$ and $F = C^{-1}BC^{-1}$ for some positive definite matrix C.

In graph theory, one of Fiedler's pioneering ideas was his algebraic connectivity [59], defined as the second smallest eigenvalue of the Laplacian matrix of the graph (i.e. the matrix of the quadratic form $\sum_{(i,k)\in E}(x_i - x_k)^2$ if $G = (V, E)$, $V = \{1, \ldots, n\}$ being the set of vertices and E the set of edges.) It is interesting that it found important applications in the numerical solution of large systems of linear equations as well as in so called seriation problems. In fact, it served as basis for spectral methods in both areas. It turned out that the eigenvector (now generally called *Fiedler vector*) of the Laplacian corresponding to the algebraic connectivity has good both separation and ordering properties for the vertex set of the graph.

Another original Fiedler's idea was to study classes of minimax problems for graphs ([131], [137], [142]) based on minimizing (or, maximizing) various characteristics of a weighted graph when all weightings on edges with constant sum are considered, thus obtaining ***absolute characteristics***. In particular, an explicit formula for the absolute algebraic connectivity of a tree was obtained [130].

Quite recently, Fiedler returned [144, 151] to the topic which interested him decades ago—simplex geometry and its connection with graphs, matrices and resistive electrical networks. In [151], he found a simple relationship between the Menger matrix and the Moore-Penrose inverse of the Gram matrix of outward normals to the simplex (normalized in such a way that the sum of the normals is zero).

In conclusion, we take this opportunity of wishing Professor Miroslav Fiedler good health and every success in his life and in his further scientific work.

[R1] *J. Sedláček, A. Vrba*: Sixty years of Professor Miroslav Fiedler. Czechoslovak Math. J. *36(111)* (1986), 495–510.

[R2] *Z. Vavřín, Miroslav Fiedler and Vlastimil Pták*: Life and Work, Linear Algebra Appl. *223/224* (1995), 3–29.

[105] S-matrices. Linear Algebra Appl. *57* (1984), 157–167.

[106] Hankel and Loewner matrices. Linear Algebra Appl. *58* (1984), 75–95.

[107] Binomial matrices. Math. Slovaca *34* (1984), 229–237.

[108] On a conjecture of P. R. Vein and its generalization. Lin. Multilin. Algebra *16* (1984), 147–154.

[109] Quasidirect decompositions of Hankel and Toeplitz matrices. Linear Algebra Appl. *61* (1984), 155–174.

[110] Polynomials and Hankel matrices. Linear Algebra Appl. *66* (1985), 235–248.

[111] A trace inequality for M-matrices and the symmetrizability of a real matrix by a positive diagonal matrix (with C. R. Johnson, T.L. Markham, M. Neumann). Linear Algebra Appl. *71* (1985), 81–94.

[112] Signed graphs and monotone matrices. In: Graphs, Hypergraphs and Applications, Eyba 1984. Teubner 1985, 36–40.

[113] Some applications of graph theory in numerical mathematics. In: Proceedings of the Summer School of Numerical Mathematics and Theory of Graphs. Štrbské Pleso 1986, 4–12.

[114] Completing a matrix when certain entries of its inverse are specified (with T.L. Markham). Linear Algebra Appl. *74* (1986), 225–237.

[115] Some numerical aspects of Loewner matrices. In: Numerical Methods, Coll. Soc. J. Bolyai 50. N. Holland 1987, 160–184.

[116] Rank-preserving diagonal completions of a matrix (with T.L. Markham). Linear Algebra Appl. *85* (1987), 49–56.

[117] Bézoutians and intertwining matrices (with V. Pták). Linear Algebra Appl. *86* (1987), 43–51.

[118] Intertwining and testing matrices corresponding to a polynomial (with V. Pták). Linear Algebra Appl. *86* (1987), 53–74.

[119] Notes on inverse M-matrices (with C. R. Johnson and T.L. Markham). Linear Algebra Appl. *91* (1987), 75–81.

[120] An inequality for the Hadamard product of an M-matrix and an inverse M-matrix (with T.L. Markham). Linear Algebra Appl. *101* (1988), 1–8.

[121] Loewner and Bézout matrices (with V. Pták). Linear Algebra Appl. *101* (1988), 187–220.

[122] Bézout, Hankel and Loewner matrices. Linear Algebra Appl. *104* (1988), 185–193.

[123] Characterizations of Bézout and Hankel-Bézout matrices. Linear Algebra Appl. *105* (1988), 77–89.

[124] On the range of the Hadamard product of a positive definite matrix and its inverse (with T.L. Markham). SIAM J. on Matrix Theory and Appl. *9* (1988), 343–347.

[125] A characterization of the closure of inverse M-matrices (with T. L. Markham). Linear Algebra Appl. *105* (1988), 209–223.

[126] Characterizations of MMA-matrices. Linear Algebra Appl. *106* (1988), 233–244.

[127] Doubly stochastic matrices and optimization. In: Advances in Mathematical Optimization (J. Guddat et al., Editors), Math. Res. vol. 45, AW Berlin 1988, 44–51.

[128] Laplacian of graphs and algebraic connectivity. In: Combinatorics and Graph Theory, Banach Center Publ. vol. 25, PWN, Warszawa 1989, 57–70.

[129] Some connections between the Drazin inverse, P-matrices and the closure of inverse M-matrices (with T.L. Markham). Linear Algebra Appl. *132* (1990), 163–172.

[130] Absolute algebraic connectivity of trees. Lin. Multilin. Algebra *26* (1990), 85–106.

[131] A minimax problem for graphs and its relation to generalized doubly stochastic matrices. Lin. Multilin. Algebra *27* (1990), 1-23.
[132] Pencils of real symmetric matrices and real algebraic curves. Linear Algebra Appl. *141* (1990), 53-60.
[133] Expressing a polynomial as characteristic polynomial of a symmetric matrix. Linear Algebra Appl. *141* (1990), 265–270.
[134] A symmetric companion matrix of a polynomial (with Z. Vavřín). In: Coll. Math. Soc. J. Bolyai vol. 59 (1990), 9–16.
[135] A subclass of symmetric Loewner matrices (with Z. Vavřín). Linear Algebra Appl. *170* (1992), 47–51.
[136] A classification of matrices of class Z (with T.L. Markham). Linear Algebra Appl. *173* (1992), 115–124.
[137] An extremal problem for the spectral radius of a graph. Discrete Math. *108* (1992), 149–158.
[138] Structure ranks of matrices. Linear Algebra Appl. *179* (1993), 119–128.
[139] A characterization of the Moore-Penrose inverse (with T.L. Markham). Linear Algebra Appl. *179* (1993), 129–134.
[140] Polynomials compatible with a symmetric Loewner matrix (with Z. Vavřín). Linear Algebra Appl. *190* (1993), 235–251.
[141] Quasidirect addition of matrices and generalized inverses (with T.L. Markham). Linear Algebra Appl. *191* (1993), 165–182.
[142] Some minimax problems for graphs. Discrete Mathematics *121* (1993), 65–74.
[143] Remarks on eigenvalues of Hankel matrices. IMA Preprint Series, # 903. Minneapolis 1992.
[144] A geometric approach to the Laplacian matrix of a graph. In: Combinatorial and Graph-Theoretical Problems in Linear Algebra (R.A. Brualdi, S. Friedland, V. Klee, Editors), Springer, New York 1993, 73–98.
[145] Elliptic matrices with zero diagonal. Linear Algebra Appl. *197,198* (1994), 337–347.
[146] On a theorem of Everitt, Thompson and de Pillis (with T.L. Markham). Math. Slovaca *44* (1994), 441–444.
[147] An estimate for the non-stochastic eigenvalues of doubly stochastic matrices. Linear Algebra Appl. *214* (1995), 133–143.
[148] An observation on the Hadamard product of Hermitian matrices (with T.L. Markham). Linear Algebra Appl. *215* (1995), 179–182.
[149] Numerical range of matrices and Levinger's theorem. Linear Algebra Appl. *220* (1995), 171–180.
[150] On a special type of generalized doubly stochastic matrices and its relation to Bézier polygons. SIAM J. Matrix Anal. Appl. 16 (1995), 735–742.
[151] Moore-Penrose involutions in the classes of Laplacians and simplices. Lin. Multilin. Algebra. 39 (1995), 171–178.
[152] A note on the row-rhomboidal form of a matrix. Linear Algebra Appl. *232* (1996), 149–154.
[153] Some results on the Bergström and Minkowski inequalities (with T.L. Markham). Linear Algebra Appl. *232* (1996), 199–212.
[154] Some inequalities for the Hadamard product of matrices (with T.L. Markham). Linear Algebra Appl. (To appear.)
[155] Diagonal blocks of two mutually inverse positive definite matrices (with V. Pták). Czechoslovak Math. J. (To appear.)
[156] A new geometric mean of two positive definite matrices (with V. Pták). Linear Algebra Appl. (To appear.)

[157] Some inverse problems for acyclic matrices. Linear Algebra Appl. (To appear.)
[158] Strong majorization for hermitian matrices (with V. Pták). Linear Algebra Appl. (To appear.)
[159] Block analogies of comparison matrices (with V. Pták). Linear Algebra Appl. (To appear.)
[160] Consecutive-column and -row properties of matrices and the Loewner-Neville factorization (with T.L. Markham), Linear Algebra Appl. (Submitted.)