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Preface



Shmuel Friedland

Biographical Sketch Shmuel Friedland

Professional Preparation

Israel Institute of Technology	Mathematics, B.Sc., 1967
Israel Institute of Technology	Mathematics, M.Sc., 1969
Israel Institute of Technology	Mathematics, D.Sc., 1971
Israel Institute of Technology	Postdoc in Mathematics, 1971–1972
Weizmann Institute of Science	Postdoc in Mathematics, 1972–1973
Stanford University	Postdoc in Mathematics, 1973–1974
IAS, Princeton	Postdoc in Mathematics, 1974–1975

Appointments

Regular

- 1985–, Professor, University of Illinois at Chicago
- 1982–1985, Professor, Hebrew University
- 1978–1982, Associate Professor, Hebrew University
- 1975–1978, Senior Lecturer, Hebrew University

Visiting

- 2007–2008, Visiting Professor in Berlin Mathematical School, Berlin, Germany
- 2003–2004, New Directions Professor, IMA, University of Minnesota
- 9/2000–12/2000, Visiting Professor, Technion, Israel
- 1/1994–6/1994, Visiting Professor, IHES, France
- 9/1991–12/1991, Visiting Professor, IMA, University of Minnesota
- 9/1989–3/1990, Visiting Professor, Northwestern University
- 9/1978–8/1980, Visiting Professor, University of Wisconsin

Prizes

- The first Hans Schneider prize in Linear Algebra awarded by ILAS (International Linear Algebra Society) in 1993.

Short biography of Shmuel Friedland for his special LAA volume

1. Short vitae

Shmuel Friedland was born in Uzbekistan, then part of the USSR, September 27, 1944. He emigrated to Israel in November 1957. He got his higher education at Technion, Israel. He started in the program in mathematics and physics, 1963–1965, and then continued in Mathematics in 1965–1967, obtaining his B.Sc. in Mathematics, cum laude.

His studies were combined with the compulsory military service in Israel, named the *atuda* program, which is similar to the American ROTC program. He participated in the six day war as an officer. He did his military service from 1967 to 1971 as a scientist in the Defence Ministry, and worked in Rafael on mathematical aspects of weapons development. During his service he was allowed to continue his mathematical graduate studies. He got his M.Sc. in 1969, and his Ph.D. in 1971. After completing his military services he was appointed as a lecturer in Technion, in Spring 1971. In the AY 1972–1973 he was a senior scientist in the Weizmann Institute. In 1973–1974 he was a Visiting Assistant Professor in Stanford University, and in 1974–1975 he was a member of the Institute for Advanced Study in Princeton. In 1975 he got a tenure track position as a Senior Lecturer in the Institute of Mathematics, Hebrew University, Jerusalem, Israel. He was promoted to Associate Professor in 1978, and to Professor in 1982. Since Fall 1985 he is Professor in University of Illinois at Chicago.

He was a visitor in University of Madison, Wisconsin; Northwestern University, Evanston; Institut des Hautes Études Scientifiques, Bur-sur-Yvette; Technion, Haifa; Berlin Mathematical School, Berlin.

2. Short description of mathematical activity

The lectures of Menahem Schiffer, from Stanford University, on the Fredholm theory and general relativity, in Spring 1966 at Technion, made a profound influence on Friedland's mathematical education and his perception of mathematics, as one big field with many interesting correlated subjects. His Master thesis was on the coefficient problems of univalent functions, under the supervision of Elisha Netanyahu, which was published in [3]. Friedland pursued his interest in the coefficients of analytic functions in joint works with Dov Aharonov [7,11]. The matrix course of Binyamin Schwarz raised the vivid interest of Shmuel to matrix theory. The visit of Zeev Nehari in Technion in 1969, and the joint paper with him [4], inspired the topic of Friedland's doctoral dissertation on the extremal problem of eigenvalues of real symmetric matrices [8]. He continued his interest in eigenvalue problems since then. Shmuel's visit to Imperial College, London, 1971, to collaborate with Walter K. Hayman, stimulated his interest in the eigenvalue problems in differential geometry [19,24]. Shmuel combined his knowledge of matrices with the subject of interests of Nehari and Schwarz: nonoscillation and disconjugacy, to produce a fundamental contribution in this field [9,16,18].

Friedland's assistantship to Yehuda Stavsky, Professor in Mechanical Engineering in Technion, which resulted in [1,2,5], emphasized the importance of mathematics in scientific applications. His contact with Samuel Karlin in the Weizmann Institute and Stanford University raised his interest in the subject of totally positivity and its applications [14,25]. Shmuel contacts with Henrik Minc, during his visits in Technion, raised his interest in the van der Waerden conjecture [28,31,35,46].

Friedland's visit to Stanford University in AY 1973–1974 was very influential in his mathematical development. First, he collaborated with Menahem Schiffer on study of the coefficients region of univalent functions using control theory [20,27,22]. Second, he audited a course on algebraic topology, which was given by Hans Samelson. Third, he met in Stanford a young Associate Professor Shing-Tung Yau, later Fields Medalist, who introduced Shmuel to algebraic geometry and the Jacobian conjecture. These contacts inspired Shmuel to use various topological and algebraic geometry tools to study problems in matrices, and other fields as well, e.g. [6,15,21]. During his visit to the Institute for Advanced Study in Princeton he started to collaborate with Raphael Loewy [17,120,130].

The visit of Friedland to University of Wisconsin, Madison in AY 1978–80, started his collaborations with Carl de Boer [52], Nimrod Moiseyev [38,43], Joel Robbin [48,55], Hans Schneider [37,72,77,103,123]. His contact with Wolfgang Wasow raised Friedland's interests in analytic similarity of matrices [36,39,40]. Shmuel realized that these problems are intimately related to the problem of simultaneous similarity of matrices, which is a *wild problem*. In the fundamental work [53,54] Friedland gave a solution to the simultaneously similarity problem.

After returning to Hebrew University 1980–1983 Shmuel collaborated with Noga Alon and Gil Kalai [59,60,161]. His contact with John Hubbard, during his visit to Cornell University in 1983–1985, raised Shmuel's interest in dynamical systems. His joint work with Fields Medalist John Milnor [80], is his most cited work. He wrote a few papers in this subject [88,93,98,106,108,110,111,114,117,118,119,122,131,142,157].

In the early nineties Shmuel started a fruitful collaboration with Ludwig Elsner from University of Bielefeld, which resulted in a number of papers with him and his student Reinhard Nabben [107,109,113,115,124,127,129].

Since 2000 most of the research of Shmuel is devoted to the following areas: matrices [128,136,143,145,151,152,153,156,160,163,166,169]; operators [125,137]; geometry of matrix spaces [133,134,135]; graphs and combinatorics [138,149,154,155,158,161,162,164,165,167]; algebraic geometry [121,126,132]; applications to mathematical physics [139,140,159,168]; math. biology [146,147,148]; numerical linear algebra [144]; and complexity [150].

3. Additional information

Friedland shared together with Miroslav Fiedler and Israel Gohberg the first Hans Schneider Prize in Linear Algebra in 1993.

Shmuel had four Ph.D. students: Pedro Freitas – 1999, Elliot Krop – 2007, Amir Niknejad – 2005, Gaspar Porta – 1999.

He serves on the editorial boards of Electronic Journal of Linear Algebra and Linear Algebra and its Applications, and served on the editorial board of Random and Computational Dynamics, 1992–1997.

List of publications of Shmuel Friedland

- [1] Free edge buckling of heterogeneous cylindrical shells in axial compression (with Y. Stavsky), *Int. J. Mech. Sci.* 11 (1969) 217–223.
- [2] Stability of heterogeneous orthotropic cylindrical shells in axial compression (with Y. Stavsky), *Israel J. Technol.* 7 (1969) 111–119.
- [3] On a conjecture of Robertson, *Arch. Rational Mech. Anal.* 37 (1970) 255–261.
- [4] Univalence conditions and Sturm–Liouville eigenvalues (with Z. Nehari), *Proc. Amer. Math. Soc.* 24 (1970) 595–603.
- [5] Buckling of composite circular plates under radial compression (with Y. Stavsky), *Acta Mech.* 11 (1971) 87–98.
- [6] Matrices with prescribed off-diagonal elements, *Israel J. Math.* 11 (1972) 184–189.
- [7] On an inequality connected with the coefficient conjecture for functions of bounded boundary rotations (with Aharonov), *Ann. Acad. Sci. Fenn. AI* 524 (1972) 14 pp.
- [8] Extremal eigenvalue problems for convex sets of symmetric matrices and operators, *Israel J. Math.* 15 (1973) 311–331.
- [9] Nonoscillation and integral inequalities, *Bull. Amer. Math. Soc.* 80 (1974) 715–717.
- [10] Matrices satisfying the van der Waerden conjecture, *Linear Algebra Appl.* 8 (1974) 521–528.
- [11] On functions of bounded boundary rotation (with Aharonov), *Ann. Acad. Sci. Fenn. AI* 585 (1974) 18 pp.
- [12] Generalized Hadamard inequality and its applications, *Linear and Multilinear Algebra* 2 (1975) 327–333.
- [13] On matrix approximation, *Proc. Amer. Math. Soc.* 51 (1975) 41–43.
- [14] Some inequalities for the spectral radius of nonnegative matrices and applications (with S. Karlin), *Duke Math. J.* 42 (1975) 459–490.
- [15] On inverse multiplicative eigenvalue problems for matrices, *Linear Algebra Appl.* 12 (1975) 127–137.
- [16] Nonoscillation and integral inequalities, *International Conference on Differential Equations*, Academic Press, Inc., New York, 1975, pp. 812–813.
- [17] Subspaces of symmetric matrices containing matrices with a multiple first eigenvalue (with R. Loewy), *Pacific J. Math* 62 (1976) 389–399.
- [18] Nonoscillation, disconjugacy and integral inequalities, *Memoirs Amer. Math. Soc.* 176 (1976) 78 pp.
- [19] Eigenvalue inequalities for Dirichlet problem on spheres and the growth of subharmonic functions (with W.K. Hayman), *Comment. Math. Helvetici* 51 (1976) 133–161.
- [20] Global results in control theory with applications to univalent functions (with M. Schiffer), *Bull. Amer. Math Soc.* 82 (1976) 913–915.
- [21] Inverse eigenvalue problems, *Linear Algebra Appl.* 17 (1977) 15–51.

- [22] On coefficient region of univalent functions (with M. Schiffer), *J. Analyse Math.* 31 (1977) 125–168.
- [23] On an inverse eigenvalue problem arising in circuit theory, in: *Proc. First International Conference on Math Modelling*, St. Louis, Missouri, 1977, pp. 1591–1601.
- [24] Extremal eigenvalue problems defined for certain classes of bounded functions, *Arch. Rational Mech. Anal.* 67 (1977) 73–81.
- [25] Bounds on the solutions of difference equations and spline interpolation at knots (with C.A. Micchelli), *Linear Algebra Appl.* 20 (1978) 219–251.
- [26] On inverse problem for nonnegative and eventually nonnegative matrices, *Israel J. Math.* 29 (1978) 43–60.
- [27] Global principle for free end point problems in optimal control and differential games, *J. Optim. Theory Appl.* 24 (1978) 293–303.
- [28] A study of the van der Waerden conjecture, *Linear and Multilinear Algebra* 6 (1978) 123–143.
- [29] Extremal eigenvalue problems, *Bull. Brazilian Math. Soc.* 9 (1978) 13–40.
- [30] On the eigenvalues of nonnegative Jacobi matrices (with A. Melkman), *Linear Algebra Appl.* 25 (1978) 239–253.
- [31] Monotonicity of permanents of doubly stochastic matrices (with H. Minc), *Linear and Multilinear Algebra* 6 (1978) 227–231.
- [32] Extremal eigenvalue problems defined on conformal classes of compact Riemannian manifolds, *Comment. Math. Helvetici* 54 (1979) 494–507.
- [33] The reconstruction of a symmetric matrix from the spectral data, *J. Math. Anal. Appl.* 71 (1979) 412–422.
- [34] A characterization of transform absolute norms, *Linear Algebra Appl.* 28 (1979) 63–68.
- [35] A lower bound for the permanent of doubly stochastic matrices, *Ann. Math.* 110 (1979) 167–176.
- [36] On pointwise and analytic similarity of matrices, *Israel J. Math.* 35 (1980) 89–108.
- [37] The growth of powers of nonnegative matrix (with H. Schneider), *SIAM J. Algebraic Discrete Methods* 1 (1980) 185–200.
- [38] The association of resonance states with incomplete spectrum of finite complex scaled Hamiltonian matrices (with N. Moiseyev), *Phys. Rev. A* 22 (1980) 619–624.
- [39] Analytic similarity of matrices, Algebraic and Geometric Methods in Linear System Theory, *Lectures in Applied Math.*, Amer. Math. Soc. 18 (1980) 43–85 (edited by C.I. Byrnes and C.F. Martin).
- [40] A generalization of the Motzkin–Tausky theorem, *Linear Algebra Appl.* 36 (1981) 103–109.
- [41] Convex spectral functions, *Linear and Multilinear Algebra* 9 (1981) 299–316.
- [42] Extremal eigenvalue problems with indefinite kernels (with P. Nowosad), *Adv. in Math.* 40 (1981) 128–154.
- [43] Cusps, θ -trajectories, and the complex virial theorem (with N. Moiseyev and P. Certain), *J. Chem. Phys.* 74 (1981) 4739–4740.
- [44] Variation of Grassman powers and spectra (with R. Bhatia), *Linear Algebra Appl.* 40 (1981) 1–18.
- [45] A generalization of the Kreiss matrix theorem, *SIAM J. Math. Anal.* 12 (1981) 826–832.
- [46] A proof of a generalized van der Waerden conjecture on permanents, *Linear and Multilinear Algebra* 11 (1982) 107–120.
- [47] Codimension of degenerate pencils (with B. Simon), *Linear Algebra Appl.* 44 (1982) 41–53.
- [48] Symmetry of tensor products (with J. Robbin), *Linear Algebra Appl.* 44 (1982) 97–123.
- [49] A characterization of normal operators, *Israel J. Math.* 42 (1982) 235–240.
- [50] Variation of tensor powers and spectra, *Linear and Multilinear Algebra* 12 (1982) 81–98.
- [51] Eigenvalues inequalities for the products of matrix exponentials (with J. Cohen, T. Kato and F. Kelley), *Linear Algebra Appl.* 45 (1982) 55–95.
- [52] Inverses of infinite sign regular matrices (with C. de Boer and A. Pincus), *Trans. Amer. Math. Soc.* 274 (1982) 59–68.
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- [58] Stable convex sets of matrices, *Linear and Multilinear Algebra* 14 (1984) 283–292.
- [59] Regular subgraphs of almost regular graphs (with N. Alon and G. Kalai), *J. Graph Theory* 37 (1984) 79–91.
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