VITA

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HOME	135 Fuller Street	
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	Married, four children	
EDUCATION	1960-1964	Technion, Haifa, Aeronautics, Bsc.
	1964-1966	Ecole National Superieur de L'Aeronautique, Paris. M.Sc. Ae.
	1969-1971	MIT, Cambridge, Aeronautics and Astronautics, Ph.D.
EMPLOYMENT	1966-1969	Institut für statik und Dynamik der Luft und Raumfahrtkonstruktionen, University of Stuttgart, Stuttgart. Senior research fellow.
	1971-2013	Boston University, Department of Mathematics. Professor.

3. **Courses Given**

MA120 Applied Math. with Calculus for the Social Sciences.

MA121 Calculus One for the Sciences and Business.

MA123 Calculus for the Sciences and Engineering.

MA124 Advanced Calculus.

MA225 Multivariable Calculus.

MA226 Differential Equations.

MA242 Linear Algebra.

MA555 Numerical Analysis.

MA556 Advanced Numerical Analysis-Finite Element method.

4. **List of Publications**

Papers in Professional Journals

Published

[1.] J.H. Argyris and I. Fried: The LUMINA element for the matrix displacement method. *J. of the Royal Aero. Soc.*, 514-517, June (1968).

[2.] J.H. Argyris, I. Fried and D.W. Scharpf: The TET 20 and TEA 8 element for matrix displacement method. *J. of the Royal Aero. Soc.* July (1968).

[3.] J.H. Argyris, I. Fried and D.W. Scharpf: The HERMES 8 element for the matrix displacement method. *J. of Royal Aero. Soc.*, 613-617, July (1968).

[4.] I. Fried: Finite element analysis of time dependent phenomena. *AIAA Journal* **7**, 6 (1969).

[5.] J.H. Argyris, I. Fried and D.W. Scharpf: The TUBA family of plate elements for the matrix displacement method. *J. of the Royal Aero. Soc.*, August (1968).

[6.] I. Fried: More on gradient iterative methods in finite element analysis, *AIAA Journal*, **7**, 3 March (1969).

[7.] I. Fried: Gradient iterative methods for eigenproblems in the finite element analysis. *AIAA Journal*, **7**, 4 (1969).

[8.] I. Fried: Some aspects of the natural coordinate system in the finite element method. *AIAA Journal*, **7**, 7 July (1969).

[9.] I. Fried: A computational procedure for the solution of large problems arising from the finite element method. *Int. J. for Numer. Methods in Engineering*, **2**, 477-494 (1970).

[10.] I. Fried: Basic computational problems in the finite element analysis of shells. *Int. J. Solids Structures*, Dec. (1971).

[11.] I. Fried: Accuracy of finite element eigenproblems. *J. Sound and Vibration*, **8**, 2 (1971), 289-295.

[12.] I. Fried: Discretization and computational errors in high order finite elements. *AIAA Journal*, **9**, 10 (1971).

[13.] I. Fried: N-step conjugate gradient minimization scheme for non-quadratic functions. *AIAA Journal*, **9**, 2286-2287 (1971).

[14.] I. Fried: Optimal gradient minimization scheme for finite element eigen-problems. *Journal Sound and Vibration*, **20**, 3, 333-342 (1972).

[15.] I. Fried: Accuracy of complex finite elements. *AIAA Journal*, **10**, 3, 347-349 (1972).

[16.] I. Fried: Condition of finite element matrices generated from non-uniform meshes. *AIAA Journal*, **10**, 2, 219-221 (1972).

[17.] I. Fried: Bounds on the extremal eigenvalues of the finite element matrices and their spectral condition number. *J. Sound and Vibration*, **22**, 4, 407-418.

[18.] I. Fried and Shok Keng Yang: Best finite element distribution around a singularity. *AIAA Journal*, **10**, 3, 1244-1246 (1972).

[19.] I. Fried: Possible loss of accuracy in curved (isoparametric) finite elements. *Journal of Sound and Vibration*, **23**, 4, 507-513 (1972).

[20.] I. Fried: Perturbation errors in the finite element method. *J. Appl. Mech.*, 629-631, June (1972).

[21.] I. Fried: Condensation of finite element eigenproblems. *AIAA Journal*, **10**, 11, 15292-1530, November (1972).

[22.] I. Fried: Shape functions and the accuracy of arch finite elements. *AIAA Journal*, **11**, 3, 287-291 (1973).

[23.] I. Fried: Influence of Poisson's ratio on the condition of the stiffness matrix. *Int. J. Solids Structures*, **9**, 323-329 (1973).

[24.] I. Fried: Shear in C^0 and C^1 bending finite elements. *Int. J. Solids and Structures*, **9**, 449-460 (1973).

[25.] I. Fried and Shok Keng Yang: Triangular nine-degrees-of-freemon, C^0, plate bending element of quadratic accuracy. *Quart. of App. Math.*, 303-312, Oct. (1973).

[26.] I. Fried: Finite element methods; accuracy at a point. *Quart. of App. Math.*, 149-161, July (1974).

[27.] I. Fried: Accuracy and condition of curved (isoparametric) finite elements. *Journal of Sound and Vibration*, **31**, 345-357 (1973).

[28.] I. Fried: Boundary and interior approximation errors in the finite element method, *J. App. Mech. Paper No. 73-APM-A1A* (1973).

[29.] I. Fried: Bounds on the spectral and maximum norms of the finite element stiffness, flexibility and mass matrices. *Int. J. Solids and Structures*, **9**, 1013-1034 (1973).

[30.] I. Fried: Residual energy balancing technique in the generation of plate bending finite elements. *Computers and Structures*, **2**, 771-778 (1974).

[31.] I. Fried: Numerical integration in the finite element method. *Computers and Structures*, **4**, 921-932 (1974).

[32.] I. Fried: Note on the finite element analysis of the axisymmetric elastic solid. *Ind. J. Solids and Structures*, **10**, 383-386 (1974).

[33.] I. Fried: Finite element analysis of incompressible material by residual energy balancing. *Int. J. Solids and Structures*, **10**, 993-1002 (1974).

[34.] I. Fried and D.S. Malkus: Finite element mass matrix lumping by numerical integration with no convergence loss. *Int. J. Solids and Structures*, **11**, 461-466 (1975).

[35.] I. Fried: Monoton finite element matrices and their computed condition numbers. *Computers and Structures*, **5**, 317-319 (1975).

[36.] I. Fried: Finite element analysis of thin elastic shells with residual energy balancing and the role for rigid body modes. *J. App. Mech. paper No. 75-APM-6* (1975).

[37.] I. Fried and J. Metzler: SOR vs. conjugate gradients in a finite element discretization. *Int. J. Numer. Methods in Eng.*, **12**, 1329-1342 (1978).

[38.] I. Fried and J. Metzler: Displacement, strain and stress error nodal lines in finite elements. *Computers and Structures*, **9**, 335-339 (1978).

[39.] I. Fried and J. Metzler: Conjugate gradient solution of a finite element elastic problem with high Poisson ratio. *Comp. Meth. App. Mech., Eng.* **15**,1, 83-84 (1978).

[40.] I. Fried: Accuracy of string element man matrix. *Comp. Meth. App. Mech. Eng.* **20**, 317-321 (1979).

[41.] I. Fried: On the optimality of the pointwise accuracy of the finite element solution, *IJNME*, **15**, 451-476 (1980).

[42.] I. Fried: Irregular finite element meshes in elastodynamics, *IJNME*, **15**, 626-628 (1980).

[43.] I. Fried: Meaningful existance of finite element solutions to off-limit problems, *CMAME*, **22**, 229-240 (1980).

[44.] I. Fried: Nonlinear finite element computations of the equilibrium and stability of the circular plate, *IJNME*, **17**, 1427-1440 (1981).

[45.] I. Fried: Large deformation static and dnamic finite element analysis of extensible cables, *Computers and Structures*, **15**, 315-319 (1982).

[46.] I. Fried: Stability and equilibrium of the straight and curved elastica-finite element computation. *CMAME*, **28**, 49-61 (1981).

[47.] I. Fried: Finite element computation of large rubber membrane deformations. *IJNME*, **18**, 653-660 (1982).

[48.] I. Fried: Finite element computation of large elastic deformations: Proceedings of the Brunel Conference of the mathematics of finite elements and applications, *MEFLAP IV*, J.R. Whiteman Editor, Academic Press, 143-159 (1982).

[49.] I. Fried: Nonlinear finite element computation of the equilibrium stability and motion of the extensional beam and ring. *CMAME* **38**, 29-44 (1983).

[50.] I. Fried: Reflections on the computational approximation of elastic incompressibility. *Computers and Structures* **17**, 161-168 (1983).

[51.] I. Fried: Condition of finite element matrices. Proceedings of the International Society for Optical Engineering, L.M. Cohen, Editor, 450, 76-80 (1983).

[52.] I. Fried: On a deficiency in conditionally stable time integration methods in elastodynamics and heat transfer. *CMAME* **46**, 195-200 (1984).

[53.] I. Fried: Orthogonal trajectory accession to the nonlinear equilibrium curve. *CMAME* **47**, 283-297 (1984).

[54.] I. Fried: Nonlinear finite element analysis of the thin elastic shell of revolution. *CMAME* **48** 283-299 (1985).

[55.] I. Fried: Large deflection computation of the plastica. *CMAME* **49**, 163-173 (1985).

[56.] I. Fried, A. Johnson and A. Tessler: Minimal-degree thin triangular plate and shell bending finite element of order two and four. *CMAME* **56**, 283-307 (1986).

[57.] I. Fried: Round off errors in the stiffness equation. *CMAME* **57**, 245-252 (1986).

[58.] I. Fried: The advantage of an implicit corrector at bifurcation. *JSV* Nov. 1999.

[59.] I. Fried: Period preserving schemes for the numerical integration of the equation of motion. *JSV* May 2000.

[60.] I. Fried and L. S. Waldrop: KIRA is energy consuming. *JSV* (2001) **244**(1), 169-172.

[61.] I. Fried: Period preserving and period adjustment in the numerical integration of the linear and non-linear equations of motion. *JSV* (2002) **249**(5),995-998.

[62.] I. Fried and M. Chavez: Superaccurate finite element eigenvalue computation. *JSV* Aug (2004).

[63.] I. Fried and M. Coleman: Improvable bounds on the largest eigenvalue of a completely positive finite element flexibility matrix. *JSV* May (2005).

[64.] I. Fried and Kaiwen Leong: Superaccurate finite element eigenvalues via a Rayleigh quotient correction. *JSV* Volume 288(1-2), 375-386, November 2005.

[65.] I. Fried: Oppositely converging Newton-Raphson method for non-linear equilibrium problems. IJNME 79, 375-378, 2009.

[66.] I. Fried: High-order iterative bracketing methods. Int. J. Numer. Meth. Engng. 94, 708-714, May 2013.

Theses

1. Etude de flambage d'une coque conique sous l'effet combine d'une force axiale et torsion en presence d'une pression interne; Travail elabore dans le cadre d'un program d'obtention de diplome de Maitre es-science Aeronautique (M.Sc.Ae.), Ecole National Superieure de l'Aeronautique, Paris, Dec. (1965).

2. Discretization and round-off errors in the finite element analysis of elliptic boundary value problems; Ph.D. Massachusetts Institute of Technology, June (1971).

Books

1. I. Fried: Numerical Solution of Differential Equations, Academic Press, London, New York (1979).

2. I. Fried: The Analytic and Synthetic Etymology of the Hebrew Language, The Hebrew Etymology Project 2004.

Papers in Professional Conferences

1. J.B. Spooner, O.E. Brönlund, I. Fried, J.H. Argyris: The change in the (two dimensional) stress distribution round a rectangular hole with rounded corners, caused by a varying internal pressure and temperature. Proc. XVII International Aeronautical Congress, Belgrad, 24-29 Sept. (1967).

2. I. Fried: A computational procedure for gradient iterative techniques in the finite element method. EUROMECH II Conference, Stuttgart, 8-10 April (1968).

3. J.H. Argyris, K.E. Buck, I. Fried, H.M. Hilbert, G. Mareczek and D.W. Scharpf: Some new elements for the matrix displacement method. 2nd Conference on Matrix Methods in Structural Mechanics, Wright-Patterson Air Force Base, Ohio, 15-17 October (1968).

4. I. Fried: The L_2 and L_∞ condition numbers of the finite element matrices and the pointwise convergence of the method. Proc. Conference on the Mathematics of the Finite Element Method, Edited by J.R. Whiteman, Academic Press, Brunel University, 18 April (1972).

5. I. Fried: Finite element analysis of eigenproblems - theory and practice. National Symposium on Computerized Structural Analysis and Design, the George Washington University, Washington, D.C. 27-29 March (1972).

6. I. Fried and D.S. Malkus: Energy error in the elastic solution when an incompressible solid is assumed compressible. Proceedings of the U.S.-Germany Seminar on the Finite Element Method, Edited by K.J. Bathe, J.T. Oden and W. Wunderlich, MIT Press, August (1976).

7. I. Fried, J. Carson and Y. Park: Nonlinear finite element analysis of gas flow in a contact bed reactor. Proc. Conference on Finite Element Analysis in Flow Problems, Portofino, Italy, 16-18 June (1976).

8. J.A. Metzler and I. Fried: The conjugate gradient method with finite elements. 2nd IMACS (AICA) International Symposium on Computer Methods for Partial Differential Equations, Lehigh University, June 22-24 (1977).

9. I. Fried and J. Metzler: Successive overrelaxation parameters for general finite element meshes, 1978 ACM Computer Science Conference, February 21-23, Detroit, Michigan.

10. I. Fried: High order nonlinear tangent element data by discrete integration, Proc. of the 5th Invitational symposium on Finite Elements, Finite Differences and Calculus of Variations, 81-118, H. Kardestuncer Editor, University of Connecticut, May 2 (1980).

Reports

1. I. Fried: Finite element method in fluid dynamics and heat transfer. Report No. 38, Institut für statik und Dynamik der Luft-und Raumfhartkonstruktionen, April (1967).

2. J.H. Argyris, W. Bossard, I. Fried and H.M. Hilbert: A fully compatible place bending element. ISD Report No. 42, Universität Stuttgart, December (1967).

3. I. Fried and D.S. Malkus: A finite element displacement model valid for any value of the compressibility. Report to the US Office of Naval Research (1976).

4. A. Johnson and I. Fried: High order nonlinear finite element analysis of the axisymmetric rubber membrane, Report 6-80 to the Office of Naval Research (1980).

Symposia

1. The 17th International Aeronautical Congress. Belgrad, 24-29 September, 1967.

2. EUROMECH 11, Experience in Computer-Based Analysis of Three-Dimensional Media. University of Stuttgart, 8-10 April 1968. Invited.

3. Second Conference on Matrix Methods in Structural Mechanics. Wright-Patterson Air Force Base, Ohio, 15-17 October, 1968.

4. Seminar, McGill University, Department of Electrical Engineering, Montreal, December 1971. Invited.

5. Seminar on the Role of Computers in Structural Analysis, Design and Optimization. Indian Institute of Technology, Madras, December 11-13, 1972.

6. National Symposium on Computerized Structural Analysis and Design. George Washington University, March 27-29, 1972.

7. Boston Numerical Mathematics Seminar. Harvard University, April 12, 1972. Invited.

8. Seminar on the Mathematical Theory of Finite Elements Approximations. The University of Alabama in Huntsville, June 6-8, 1972. Invited.

9. New England Bioengineering Conference. The University of Vermont, April 19-20, 1973. Invited.

10. US-Japan Symposium on the Mathematics of Finite Elements with Emphasis on Nonlinear Problems. Lake Hakone, August, 1975. Invited.

11. Applied Mechanics Conference. Rensselaer Polytechnic Institute, Troy, New York, June 23-25, 1975.

12. The Mathematics of Finite Elements and Applications. Brunel University, April 15-17, 1975.

13. National Bureau of Standards Mathematics Colloquium on Deformation and Mechanical Failures. Gaithersburg, May 16, 1975. Invited.

14. ICAD-International Computer Analysis and Design, Second Symposium on the Finite Element Analysis of Fluid Flow, Santa Margharita Ligure, Italy, June 14-18, 1975.

15. US-Germany Symposium on Finite Element Analysis. Massachusetts Institute of Technology, 9-13 August 1976.

16. Second IMCA (AICA) International symposium on Computer Methods for Partial Differential Equations, Lehigh University, June 22-24, 1977.

17. Fifth Invitational symposium on Finite Elements, Finite Differences and calculus of Variations, University of Connecticut, May 2 (1980). Invited.

18. Fourth conference on the Mathematics of Finite Elements and Applications, MEFLAP IV, Brunel University, May 1, 1981. Invited.

19. Cambridge symposium on optical and Electro-optical Engineering, Nov. 6-10 (1983). Invited.