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## VITA

### Degrees:

B.S. in Mathematics (minor in Physics), Florida Southern College, 1958  
Ph.D. in Mathematics, Massachusetts Institute of Technology, 1963  
Thesis: *Domains of Dependence and Causal S-operators for hyperbolic equations*  
Advisor: Prof. Irving E. Segal

### Full-time Positions:

Instructor in Mathematics, MIT, 1962/63  
Research Associate, Harvard University, 1963/64  
Lecturer in Mathematics, MIT, 1964/66  
Assistant Professor of Mathematics, MIT, 1966/71  
Associate Professor of Mathematics, Rutgers University, 1971/75  
Professor I of Mathematics, Rutgers University, 1975-1987  
Professor II of Mathematics, Rutgers University, 1988-present  
Acting chair, Department of Mathematics, Rutgers University:  
7/1/2000 - 6/30/2001 and 7/1/2003 - 12/31/2003

### Visiting Positions:

Visiting Scholar, Math. Dept., University of California, Berkeley, *July/August*, 1965  
Visiting Member, Institute for Advanced Study (Princeton), 1968/69  
Visiting Member, Institut des Hautes Etudes Scientifiques (Paris), 1975/76  
Visiting Professor, University of Bielefeld, Germany, *December/January*, 1975-76  
Visiting Member, Mathematical Sciences Research Institute, Berkeley, CA, *May*, 1984  
Visiting Fellow, Australian National University, Canberra, *July/August*, 1987  
Visiting Scholar, University of California, Berkeley, *July/August*, 1994  
Visiting Scholar, University of California, San Diego, *January/February*, 1995  
Visiting Professor, Université de Metz, France, *March/April*, 1995  
Visiting Professor, Humbolt University, Berlin, *February*, 1999 and *June*, 2000  
Visiting Professor, Université de Metz, France, *February/March*, 1999  
Visiting Professor, University of Hong Kong, *April/June*, 1999  
Visiting Professor, National University of Singapore, *January/February*, 2003

### Awards:

Warren I. Susman Award for Excellence in Teaching, Rutgers University, May 1985

Faculty of Arts and Sciences Award for Distinguished Contributions to Undergraduate Education, Rutgers University, May 2000

## PUBLICATIONS

### Books authored:

1. **Nilpotent Lie groups: Structure and Applications to Analysis**, Lecture Notes in Math., Springer Verlag, **562** (1976), 210 pgs.
2. **Introduction to Stochastic Models**, Benjamin-Cummings, 1988, 370 pgs (+ solutions manual and computer diskette); revised second edition, Dover Publications 2006.
3. (with N.R.Wallach) **Representations and Invariants of the Classical Groups**, *Encyclopedia of Mathematics and its Applications*, vol. 68, Cambridge U. Press, 1998. Second revised printing, 2000, Third revised printing 2003.
4. (with N.R.Wallach) **Symmetry, Representations, and Invariants**, *Graduate Texts in Mathematics* **255**, Springer, 2009.

### Books edited:

1. **Mathematical Theory of Elementary Particles** (Proceedings of Endicott House Conference, Sept. 1965), Roe Goodman and I.E. Segal, ed., M.I.T. Press, Cambridge, MA, 1966
2. **Proceedings of Conference on Representation theory and Analysis on Homogeneous spaces**, (in memory of L. Corwin), S. Gindikin, R. Goodman, F. Greenleaf, P. Sally ed., AMS Cont. Math. **177**, 1994

### Publications in Refereed Journals:

1. One-sided invariant subspaces and domains of uniqueness for hyperbolic equations, Proc. AMS, **15** (1964), 653-660.
2. (with I.E. Segal) Anti-locality of certain Lorentz-invariant operators, Jour. of Math. & Mech., **14** (1965), 629-639.
3. Invariant subspaces for normal operators, Jour. of Math. & Mech., **15** (1966), 123-238.
4. On localization and domains of uniqueness, Trans. AMS, **127** (1967), 98-106.
5. Analytic domination by fractional powers of a positive operator, Bull. AMS, **74** (1968), 702-704.
6. Analytic domination by fractional powers of a positive operator, Jour. of Funct. Analysis, **3** (1969), 246-264.
7. Analytic and entire vectors for representations of Lie groups, Trans. of the AMS, **143** (1969), 55-76.
8. Differential operators of infinite order on a Lie group I, Jour. of Math. & Mech., **19** (1970), 879-894.
9. One-parameter groups generated by operators in an enveloping algebra, Jour. of Funct. Anal., **6** (1970), 218-236.
10. Complex Fourier analysis on nilpotent Lie groups, Trans. AMS, **160** (1971), 373-391.
11. Differential operators of infinite order on a Lie group II, Indiana Jour. of Math., **21** (1971), 383-401.

12. Some regularity theorems for operators in an enveloping algebra, *Jour. of Diff. Equations*, **10** (1971), 448-470.
13. On the boundedness and unboundedness of certain convolution operators on nilpotent Lie groups, *Proc. AMS*, **39** (1973), 409-413.
14. Positive-definite distributions and intertwining operators, *Pacific Jour. of Math.*, **48** (1973), 83-91.
15. Filtrations and asymptotic automorphisms on nilpotent Lie groups, *Jour. Diff. Geometry*, **12** (1977), 183-196.
16. Filtrations and canonical coordinates on nilpotent Lie groups, *Trans. AMS*, **237** (1978), 189-204.
17. Lifting vector fields to nilpotent Lie groups, *Jour. de Math. Pure et Applique*, **57** (1978), 77-86.
18. Holomorphic representations of nilpotent Lie groups, *Jour. of Funct. Anal.*, **31** (1979), 115-137.
19. Elliptic and subelliptic estimates for operators in an enveloping algebra, *Duke Math. Jour.*, **47** (1980), 763-777.
20. (with Nolan R.Wallach) Conical vectors and Whittaker vectors, *Jour. of Funct. Analysis*, **39** (1980), 199-279.
21. Interpolation spaces and unitary representations, *Proc. AMS*, **83** (1981), 153-158.
22. Singular integral operators on nilpotent Lie groups, *Arkiv. for Math.*, **18** (1980), 1-11.
23. (with Nolan R.Wallach) Classical and quantum-mechanical systems of Toda lattice type, I, *Comm. Math. Physics*, **83** (1982), 355-386.
24. (with Nolan R.Wallach) Structure and unitary cocycle representations of loop groups and the group of diffeomorphisms of the circle, *Crelles Journal*, **347** (1984), 69-133.
25. (with Nolan R.Wallach) Classical and quantum-mechanical systems of Toda lattice type, II, *Comm. Math. Physics*, **94** (1984), 177-217.
26. (with Nolan R.Wallach) Projective unitary positive-energy representations of  $\text{Diff}(S^1)$ , *Jour. of Funct. Anal.* **63** (1985), 299-321.
27. (with Nolan R.Wallach) Classical and quantum-mechanical systems of Toda-lattice type, III, *Comm. Math. Physics* **105** (1986), 473-509.
28. (with Nolan R.Wallach) Higher-order Sugawara operators for affine Lie algebras, *Trans. AMS*, **315** (1989), 1-55.
29. Whittaker Transforms on real-rank one Lie Groups, *Colloquium Mathematicum* 60/61 (1990), 99-128.
30. On the algebra of  $K$ -invariant vector fields on a symmetric space  $G/K$  (with Ilka Agricola), *Mich. Math. J.* **51** (2003), 607-630.
31. Alice through looking glass after looking glass: The Mathematics of Kaleidoscopes, *Amer. Math. Monthly* **111** (2004), 281-298.
32. Restricted roots and restricted form of Weyl dimension formula for spherical varieties (with Simon Gindikin), *J. Lie Theory* **23** (2013), 257-311.

### Conference Proceedings:

1. A group-theoretical approach to causal systems, in *Symp. on System Theory*, Polytechnic Inst. of Brooklyn, 1965.

2. Approximating Lie algebras of vector fields by nilpotent Lie algebras, **Analyse Harmonique sur les Groupes de Lie** (Seminaire Nancy-Strasbourg 1978/78), Lecture Notes in Math., Springer-Verlag, **739** (1979), 293-307.
3. Singular integral operators on nilpotent Lie groups, Proc. Symp. Pure Math. XXXV, AMS, Providence, RI (1979), 375-378.
4. Horospherical functions on symmetric spaces, Canadian Math. Soc. Conf. Proceedings, **1** (1981), AMS, Providence, RI, 125-133.
5. (with Nolan R. Wallach) Positive-energy representations of the group of diffeomorphisms of the circle, **Infinite-dimensional Lie Groups** (V.Kac, ed.), MSRI Berkeley Conf. Proceedings, Springer-Verlag, NY (1984), 125-135.
6. Integration of infinitesimally unitary representations, Proceedings of Conf. on Harmonic Analysis and Operator Algebras, CMA, Australian National Univ., 1987.
7. (with L. Corwin and I.M. Gelfand) Quadratic algebras and skew-fields, in *Representation Theory and Analysis on Homogeneous Spaces*, Cont. Math. **177**, Amer. Math. Soc., 1994.

### Chapters in Books:

1. Multiplicity-free Spaces and Schur-Weyl-Howe Duality, in *Representations of Real and  $p$ -adic Groups*, E.-C. Tan and C.B. Zhu (editors), Lecture Note Series, Institute of Mathematical Sciences National University of Singapore, World Scientific, 2004, pp. 305-415.
2. Harmonic Analysis on Compact Symmetric Spaces: the Legacy of Élie Cartan and Hermann Weyl in *Groups and Analysis: The legacy of Hermann Weyl*, K. Tent (editor), London Mathematical Society Lecture Note Series **354**, Cambridge University Press, 2008, pp. 1-23.

### Preprints:

1. Integrable Hamiltonian systems on solvable Lie groups, 1983 (6 pages)
2. Completely integrable quantum systems associated with Dynkin diagrams, 1985 (9 pages)
3. Kirillov character formula for loop groups, July, 1987 (13 pages)
4. Current Algebras and classical invariant theory, 1988 (8 pages)
5. Lie Algebra-Lie Group Correspondences and Integrable Hamiltonian Systems, 1991 (11 pages)
6. Integrable Hamiltonian Systems, Commuting Flows on Flag Manifolds, and the QR Algorithm, 1999 (9 pages)
7. Introduction to Signal and Image Processing by Discrete Fourier Transform and Wavelet Transform (Lecture Notes for course 640:357), 2013 (151 pages)

### Editorial Boards and Conference Organization

Executive secretary for Organizing Committee, Conference on Mathematical Theory of Elementary Particles, Endicott House, M.I.T., 1965

Co-organizer, Conference on Harmonic Analysis and Representation Theory of Topological Groups, Oberwolfach, Germany, *June*, 1987

Co-organizer, Conference on Representation theory and analysis on homogeneous spaces (in memory of Larry Corwin), 1992/93

Editor, *Proceedings of the American Mathematical Society*, (papers in Lie algebra, Lie Groups, and Topological Groups) 1992-1999

**Doctoral Dissertations Directed:**

1. Ronald L. Lipsman, “Uniformly Bounded Representations and the Kunze-Stein Phenomenon”, M.I.T., 1968
2. Elliot C. Gootman, “ $C^*$  Algebras associated with Transformation Groups”, M.I.T., 1970
3. Richard C. Penney, “Entire Vectors for Representations of Lie Groups”, M.I.T., 1971
4. Gary Gundersen, “Exponential Operators from Anharmonic Oscillators” Rutgers, 1975
5. Luis Frota-Matos, “Analytic Continuation of the Fourier Series on Connected Compact Lie Groups”, Rutgers, 1975
6. Peter Ostapenko, “Gevrey Completions of Enveloping Algebras and Whittaker Vectors for Semisimple Lie Groups”, Rutgers, 1990
7. Jiahai Xie, “Restriction of Discrete Series for Real Reductive Groups to Certain Subgroups”, Rutgers, 1993

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