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NAME: Tyrone E. Duncan
BORN: July 16, 1941, New York, NY
EDUCATION:
1963 B.E.E., Rensselaer Polytechnic Institute
1964 M.S., (Electrical Engineering), Stanford University
1967 Ph.D., (Electrical Engineering), Stanford University
POSITIONS HELD:
1960-62 (Summers) Mathematician, Douglas Aircraft Company
1963 (Summer) Member of Technical Staff, Hughes Aircraft Company
1964 Consultant, RAND Corporation
1967-71 Assistant Professor, Department of Aerospace Engineering,
University of Michigan
1969-70 Visiting Assistant Professor, Department of Electrical Engineering and
Computer Sciences, University of California, Berkeley
1971-74 Associate Professor, Department of Applied Mathematics and Statistics,
State University of New York, Stony Brook
1972 Visiting Research Professor, Control Theory Centre, University of
Warwick, England (June-July)
1975 Lecturer, Centre de Recherche de Mathematiques de la Decision,
Universite Paris IX Dauphine (January)
1974-78 Associate Professor, Department of Mathematics, University of Kansas
1978-79 Gastprofessor, Institut fur Angewandte Mathematik und Informatik,
Universitat Bonn
1979 Courtesy Professor, Department of Electrical Engineering, University of
Kansas
1979-80 Visiting Scholar and Research Fellow, Division of Applied Sciences,
Harvard University
1979-Present Professor, Department of Mathematics, University of Kansas
HONORS:
1999 IEEE Fellow
1999 Olin K. Petefish Award in the Basic Sciences of the Higuchi/Endowment
Research Achievement Awards (annual award to one researcher among
the universities in Kansas)
2010 IFAC Fellow
2012 Max Wells Teaching Award, Mathematics Department, University of
Kansas
2013 W. T. and Idalia Reid Prize from SIAM
2015 Simons Fellow
2015 SIAM Fellow
SELECTED PUBLICATIONS:
1. T. E. Duncan, Evaluation of likelihood functions, Inform. Control, 13, 1968, 62-74.
2. T. E. Duncan, On the calculation of mutual information, SIAM J. Appl. Math., 19 (1970),
215-220.
3. T. E. Duncan, On the absolute continuity of measures, Ann. Math. Stat., 41 (1970), 30-38.
4. T. E. Duncan, Likelihood functions for stochastic signals in white noise, Inform. Control,
16 (1970), 303-310.
5. T. E. Duncan and P. Varaiya, On the solutions of a stochastic control system, SIAM J.
Control, 9 (1971), 354-371.
6. T. E. Duncan, Existence of optimal controls for some Frechet-valued stochastic systems,
Seminaires IRIA, Analyse et controle des systemes, 1973, 175-182.

7. T. E. Duncan, Absolute continuity for abstract Wiener space, *Pacific J. Math.*, 52 (1974), 359-367.
8. T. E. Duncan and P. Varaiya, On the solutions of a stochastic control system II, *SIAM J. Control*, 13 (1975), 1077-1092.
9. T. E. Duncan, Frechet-valued martingales and stochastic integrals, *Stochastics*, 1 (1975), 269-284.
10. T. E. Duncan, A note on some laws of the iterated logarithm, *J. Multivariate Anal.* 5 ((1975), 425-433.
11. T. E. Duncan, Stochastic integrals in Riemann manifolds, *J. Multivariate Anal.*, 6 (1976), 397-413.
12. T. E. Duncan, Dynamic programming optimality criteria for stochastic systems in Riemannian manifolds, *Appl. Math. Optim.*, 3, (1977), 191-208.
13. T. E. Duncan, Some filtering results in Riemann manifolds, *Inform. Control*, 35 (1977), 182-195.
14. T. E. Duncan, Estimation for jump processes in the tangent bundle of a Riemann manifold, *Appl. Math. Optim.*, 4 (1978), 265-274.
15. T. E. Duncan, Optimal control of stochastic systems in a sphere bundle, *Lecture Notes in Math.*, 695, 1978, 51-62, Springer-Verlag, New York.
16. T. E. Duncan, The heat equation, the Kac formula and some index theorems, *Lecture Notes in Pure and Appl. Math.*, 48, 1979, 57-76, Marcel Dekker.
17. T. E. Duncan, Stochastic systems in Riemannian manifolds, *J. Optimization Theory Appl.*, 27 (1979), 399-426.
18. T. E. Duncan, A geometric approach to linear control and estimation, *Lecture Notes in Control and Information Sci.*, 16, 1979, 118-141, Springer-Verlag.
19. T. E. Duncan, An algebro-geometric approach to estimation and stochastic control for linear pure delay time systems, *Lecture Notes in Control and Information Sci.*, 16, 1979, 332-343, Springer-Verlag.
20. T. E. Duncan, On the steady state filtering problems for linear pure delay time systems, *Seminaires IRIA 1979*, 25-42.
21. T. E. Duncan, Optimal control of continuous and discontinuous processes in a Riemannian tangent bundle, *Lecture Notes in Math.*, 794, 1980, 396-411, Springer-Verlag.
22. C. I. Byrnes and T. E. Duncan, A note on the topology of spaces of Hamiltonian transfer functions, *Lectures in Appl. Math.*, 18 (1980), Amer. Math. Soc., 7-26.
23. T. E. Duncan, Estimation for linear pure delay time systems, *Proc. XVI Semester on Mathematical Control Theory*, Banach Center, 199-227, 1980.
24. T. E. Duncan, Some topological properties of electrical machines, *Lecture Notes in Control and Information Sci.*, 39, (1982) 57-72, Springer-Verlag.
25. C. I. Byrnes and T. E. Duncan, On certain topological invariants arising in system theory *New Directions in Appl. Math.*, 29-71, P.J. Hilton and G.S. Young, eds., Springer-Verlag, 1982.
26. T. E. Duncan, A topological invariant for linear systems describing some random fields, *Lecture Notes in Control and Info. Sci.* 49 (1983), 19-27, Springer-Verlag.
27. T. E. Duncan, A solvable stochastic control problem in hyperbolic three space, *Systems Control Lett.* 8 (1987), 435-439
28. T. E. Duncan, Explicit solutions for an estimation problem in manifolds associated with Lie groups, *Differential Geometry: The Interface Between Pure and Applied Mathematics* (M. Luksic, C. Martin and W. Shadwick, eds.), *Contemporary Mathematics* 68 (1987), 99-109, Amer. Math. Soc., Providence.
29. T. E. Duncan and B. Pasik-Duncan, Adaptive control of linear delay time systems, *Stochastics* 24 (1988), 45-74.

30. T. E. Duncan, An estimation problem in compact Lie groups, *Systems and Controls Letters* 10 (1988), 257-263.
31. T. E. Duncan, P. Mandl, and B. Pasik-Duncan, On the consistency of a least squares identification procedure (with P. Mandl and B. Pasik-Duncan), *Kybernetika* 24 (1988), 340-346.
32. T. E. Duncan, Brownian motion and affine Lie algebras, *J. Functional Analysis*. 84 (1989), 135-145.
33. T. E. Duncan, Adaptive control of some partially observed linear stochastic systems, *Lecture Notes in Control and Info. Sci.* 126 (1989), 102-114.
34. T. E. Duncan and B. Pasik-Duncan, Adaptive control of continuous time linear stochastic systems, *Math. Control, Signals, Systems*, 3 (1990), 45-60.
35. T. E. Duncan, P. Mandl and B. Pasik-Duncan, On exponentially discounted adaptive control, *Kybernetika* 26 (1990), 361-372.
36. T. E. Duncan and H. Upmeyer, Stochastic control problems in symmetric cones and spherical functions, *Diffusion Processes and Related Problems in Analysis*, Vol. 1 Birkhauser, 1990, 263-283.
37. T. E. Duncan, An introduction to stochastic calculus in manifolds with applications, *Recent Advances in Stochastic Calculus* (J.S. Baras and V. Mirelli, eds.) 105-140, 1990 Springer-Verlag.
38. T. E. Duncan and Y. Nakumura, Remarks on the moduli space of SU(2) monopoles and Toda flow, *Lett. Math. Phy.* 19(1990), 127-131.
39. T. E. Duncan and B. Pasik-Duncan, Some methods for the adaptive control of continuous time linear stochastic systems, *Topics in Stochastic Systems: Modelling, Estimation and Adaptive Control*, *Lecture Notes in Control and Info. Sci.* 161 (1991), 242-267, Springer-Verlag.
40. T. E. Duncan, Some solvable stochastic control problems in noncompact symmetric spaces of rank one, *Stochastics and Stochastic Reports* 35 (1991), 129-142.
41. T. E. Duncan, B. Goldys, and B. Pasik-Duncan, Adaptive control of linear stochastic evolution systems, *Stochastics* 36 (1991), 71-90.
42. A. Chojnowska-Michalik, T. E. Duncan and B. Pasik-Duncan, Uniform operator continuity of the stationary Riccati equation in Hilbert space, *Appl. Math. Optim.*, 25 (1992), 171-187.
43. T. E. Duncan, A solvable stochastic control problem in real hyperbolic three space II, *Ulam Quarterly* (1992), 13-18.
44. T. E. Duncan, P. Mandl and B. Pasik-Duncan, On least squares estimation in continuous time linear stochastic systems, *Kybernetika* 28 (1992) 169-180.
45. T. E. Duncan, b. Maslowski, and B. Pasik-Duncan, On boundary control of unknown linear stochastic distributed parameter systems , *Lecture Notes in Control and Info Sci.* 180 (1992), 500-509.
46. T. E. Duncan, P. Mandl, and B. Pasik-Duncan, Control theory methods for consistency in some least squares identification problems, *IEEE Trans. Auto. Control* 38 (1993), 1289-1292.
47. T. E. Duncan, B. Pasik-Duncan and L. Stettner, Almost self-optimizing strategies for the adaptive control of diffusion processes, *J. Optim. Th. Appl.* 81 (1994), 479-507.
48. T. E. Duncan, B. Pasik-Duncan and L. Stettner, On the ergodic and the adaptive control of stochastic differential delay systems, *J. Optim. Th. Appl.* 81 (1994), 509-531.
49. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Adaptive boundary and point control of linear stochastic distributed parameter systems, *SIAM J. Control Optim.* 32 (1994), 648-672.
50. T. E. Duncan, P. Mandl, and B. Pasik-Duncan, On statistical sampling for system testing, *IEEE Trans. Auto. Control* 39 (1994), 118-122.

51. T. E. Duncan, M. Faul, B. Pasik-Duncan and O. Zane, On the stochastic adaptive control of an investment model with transaction fees, *Ulam Quarterly* 4 (1994), 1-15.
52. T. E. Duncan, Some results for the adaptive boundary control of stochastic linear distributed parameter systems, *Adaptive Control, Filtering and Signal Processing, IMA Volumes in Mathematics and its Applications*, 74 (1995) 43-64, Springer-Verlag.
53. T. E. Duncan, Solvable optimal control of Brownian motion in symmetric spaces and spherical polynomials, *Geometry in Nonlinear Control and Differential Inclusions, Banach Center Publ.* 32 (1995), 183-197.
54. T. E. Duncan and H. Upmeyer, Stochastic control problems on real and complex symmetric spaces, *Stochastic Processes, Physics and Geometry II*, (eds. S. Albeverio, U. Cattaneo and D. Merlini), World Scientific 1995, 209-220.
55. T. E. Duncan and H. Upmeyer, Stochastic control problems and spherical functions on symmetric spaces, *Trans. Amer. Math. Soc.*, 347 (1995), 1083-1130.
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57. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Adaptive boundary control of linear distributed parameter systems described by analytic semigroups, *Appl. Math. Optim.* 33 (1996), 107-138.
58. T. E. Duncan, P. Mandl and B. Pasik-Duncan, Numerical differentiation and parameter estimation in higher order stochastic systems, *IEEE Trans. Autom. Control*, 41 (1996), 522-532.
59. T. E. Duncan and B. Pasik-Duncan, Stochastic adaptive control, *The Controls Handbook*, W. S. Levine, ed. CRC Press, 1996, 1127-1136.
60. T. E. Duncan, L. Stettner and B. Pasik-Duncan, On ergodic control of stochastic evolution equations, *Stoc. Proc. Appl.* 15 (1997), 723-750.
61. T. E. Duncan, Identification and control of a stochastic manufacturing system with noisy demand, *Lec. Appl. Math.*, 33 (1997), 83-88 Amer. Math. Soc.
62. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Ergodic distributed control for parameter dependent stochastic semilinear systems in Hilbert space, *Proc. Conf. Stochastic Differential and Differential Equations*, Birkhäuser 1997.
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64. T. E. Duncan, L. Stettner and B. Pasik-Duncan, Discretized maximum likelihood estimates for adaptive control of ergodic Markov models, *SIAM J. Control Optim.* 36 (1998), 422-446.
65. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Ergodic boundary/point control of stochastic semilinear systems, *SIAM J. Control Optim.* 36 (1998), 1020-1047.
66. H. F. Chen, T. E. Duncan and B. Pasik-Duncan, A Kiefer-Wolfowitz algorithm with randomized differences, *IEEE Trans. Autom. Control* 44 (1999), 442-453.
67. T. E. Duncan, L. Guo and B. Pasik-Duncan, Adaptive continuous time linear quadratic Gaussian control, *IEEE Trans. Autom. Control* 44 (1999), 1653-1662.
68. T. E. Duncan, Filtering and estimation, nonlinear, *Wiley Encyclopedia of Electrical and Electronics Engineering*, v. 7 (ed. J. G. Webster), 480-493, J. Wiley & Sons, 1999.
69. T. E. Duncan, P. Mandl and B. Pasik-Duncan, A note on sampling and parameter estimation in linear stochastic systems, *IEEE Trans. Autom. Control* 44 (1999), 2120-2125.
70. T. E. Duncan, Some solvable infinite time horizon stochastic control problems in hyperbolic three space, *Proc. Symposia Pure Math.*, 64, *Differential Geometry and Control* (eds. G. Ferreyra, R. Gardner, H. Hermes and H. Sussmann), Amer. Math. Soc., 1999, 199-206.

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72. T. E. Duncan, Solvable infinite time horizon stochastic control problems in noncompact symmetric spaces, *Stochastic Analysis, Control, Optimization and Applications* (W. McEneaney, G. G. Yin and Q. Zhang, eds.) Birkhauser 1999, 373-390.
73. T. E. Duncan, Some approaches to ergodic and adaptive control of stochastic semilinear systems, *Control of Distributed Parameter and Stochastic Systems*, (eds. S. Chen, X. Li, J. Yong and X. Y. Zhou), Kluwer, 1999, 199-206.
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76. T. E. Duncan, B. Pasik-Duncan, and L. Stettner, Adaptive control of discrete time Markov processes by the large deviations methods, *Applicationes Mathematicae* 27(2000), 265-285.
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80. T. E. Duncan, Y. Yan and P. Yan, Exact asymptotics for a queue with fractional Brownian motion input and applications in ATM networks, *J. Appl. Prob.* 38 (2001), 932-945.
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83. T. E. Duncan, A. Poznyak, B. Pasik-Duncan, and V. Boltyanski, Robust maximum principle for minimax linear quadratic problem, *Int. J. Control* 75 (2002), 1054-1065.
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85. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Fractional Brownian motion and linear stochastic equations in Hilbert space, *Stochastics Dynamics* 2(2002), 225-250.
86. T. E. Duncan, Some processes associated with a fractional Brownian motion, *Mathematics of Finance*, (eds. G. Yin and Q. Zhang) *Contemp. Math.* 351 (2004), 93-102.
87. T. E. Duncan, B. Pasik-Duncan and L. Stettner, Ergodic and adaptive control of hidden Markov models, *Math. Meth. Oper. Res.*, 62 (2005), 297-318.
88. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Stochastic equations in Hilbert space with a multiplicative fractional Gaussian noise, *Stoc. Proc. Appl.* 115 (2005), 1357-1383.
89. S. Bali, Y. Jin, T. E. Duncan and V. Frost, Characterizing user-perceived impairment events using end-to-end measurements, *Intern. J. Commun. Systems*, 18 (2005), 935-960.
90. T. E. Duncan, J. Jakubowski and B. Pasik-Duncan, Stochastic integration for fractional Brownian motion in Hilbert spaces, *Stochastics Dynamics*, 6 (2006), 53-75.
91. T. E. Duncan, Prediction for some processes related to a fractional Brownian motion, *Stat. Prob. Lett.* 76 (2006), 128-134.
92. T. E. Duncan, Some bilinear stochastic equations with a fractional Brownian motion, *Stochastic Processes, Optimization, and Control Theory: Applications in Financial Engineering, Queueing Networks and Manufacturing* (H. Yan, G. Yin and Q. Zhang, eds.), Springer Science + Business Media, 2006, 97-108.

93. T. E. Duncan, B. Maslowski, and B. Pasik-Duncan, Linear stochastic equations in a Hilbert space with a fractional Brownian motion, *Stochastic Processes, Optimization, and Control Theory: Applications in Financial Engineering, Queueing Networks and Manufacturing* (H. Yan, G. Yin and Q. Zhang, eds.) Springer Science + Business Media, 2006, 201-222.
94. Y. Jin, S. Bali, T. E. Duncan and V. Frost, Predicting properties of congestion events for a queueing system with fBm traffic, *IEEE Trans. Networking* 15 (2007), 1098-1108.
95. T. E. Duncan, Mutual information for stochastic signals and fractional Brownian motion, *IEEE Trans. Inf. Theory* 54 (2008), 4432- 4438.
96. T. E. Duncan and Y. Jin, Maximum queue length of a fluid model with an aggregated fractional Brownian motion, *Markov Processes and Related Topics: A Festschrift for Thomas G. Kurtz* (S.N. Ethier, J. Feng and R. H. Stockbridge eds.), *IMS Collections*, 4 (2008), 235-251.
97. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Semilinear stochastic equations in a Hilbert space with a fractional Brownian motion, *SIAM J. Math. Analysis*, 40 (2009), 2286-2315.
98. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Solutions of linear and semilinear distributed parameter equations with a fractional Brownian motion, *Int. J. Adapt. Control Signal Process.*, 23 (2009), 114-130.
99. T. E. Duncan and D. Nualart, Existence of strong solutions and uniqueness in law for stochastic differential equations driven by fractional Brownian motion, *Stochastics Dynamics*, 9 (2009), 423-435.
100. T. E. Duncan, Some topics in fractional Brownian motion, (special issue) *Risk Decision Analysis* 1 (2009), 145-153.
101. T. E. Duncan, Nonlinear filtering and fractional Brownian motions, *Handbook of Nonlinear Filtering* (eds. D. Crisan and B. Rozovsky) Oxford University Press, Ch. 16, 450-468, 2010.
102. T. E. Duncan, Mutual information for stochastic signals and Levy processes, *IEEE Trans. Inf. Theory*, 56 (2010), 18-24.
103. T. E. Duncan, Some topics in stochastic control theory, (invited paper for special issue for D.L. Russell), *Discrete and Continuous Dynamical Systems—Series B*, 14 (2010), 1361-1373.
104. T. E. Duncan and B. Pasik-Duncan, Stochastic adaptive control, *The Control Handbook, Second Edition* (W. Levine ed.), 64: 1-14, Taylor and Francis, CRC Press, 2010.
105. T. E. Duncan and Z. Talata, BIC context tree estimation for stationary ergodic processes, *IEEE Trans. Inf. Theory*, 57 (2011), 3877-3886..
106. T. E. Duncan, B. Pasik-Duncan and L. Stettner, Growth optimal portfolio under proportional transaction costs with obligatory diversification, *Appl. Math. Optim.*, 63 (2011), 107-132.
107. T. E. Duncan, Stochastic linear-quadratic control revisited, *Stochastic Processes, Finance and Control: A Festschrift in Honor of Robert J. Elliott* (eds. S. N. Cohen, T. K. Siu and H. Yang) *Advances in Statistics, Probability and Actuarial Sciences*, Vol. 1, World Scientific, 2012, 451-463.
108. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Linear-quadratic control for stochastic equations in a Hilbert space with a fractional Brownian motion, *SIAM J. Control Optim.*, 50 (2012), 507-531.
109. T. E. Duncan and B. Pasik-Duncan, Discrete time linear quadratic control with arbitrary correlated noise, *IEEE Trans. Autom. Control* 58 (2013), 1290-1293.
110. T. E. Duncan and B. Pasik-Duncan, Linear-exponential-quadratic control for stochastic equations in a Hilbert space, *Dynamic Systems and Applications* 21 (2012), 407-416.
111. T. E. Duncan, Linear-exponential-quadratic Gaussian control, *IEEE Trans. Autom. Control*, 58 (2013), 2910-2911.

112. T. E. Duncan and B. Pasik-Duncan, A direct method for solving stochastic control problems, *Commun. Info. Systems*, (special issue for H. F. Chen), 12 (2012), 1-14.
113. T. E. Duncan, Linear-quadratic stochastic differential games with general noise processes, *Models and Methods in Economics and Management Science: Essays in Honor of Charles S. Tapiero*, (eds. F. El Ouardighi and K. Kogan) , *Operations Research and Management Series*, Springer Intern. Publishing, Switzerland, Vol. 198, 2014, 17-26.
114. T. E. Duncan and B. Pasik-Duncan, Linear-quadratic fractional Gaussian control, *SIAM J. Control Optim.* 51 (2013), 4604-4619.
115. T. E. Duncan and B. Pasik-Duncan, *Encyclopedia of Systems and Control*, Springer, 1324-1328, 2014.
116. T. E. Duncan, Some linear-quadratic stochastic differential games for equations in a Hilbert space with fractional Brownian motions, *Discrete Cont. Dyn. Systems, Ser. B*, 2015 to appear.
117. T. E. Duncan, B. Maslowski and B. Pasik-Duncan, Ergodic control of some linear stochastic partial differential equations with fractional Brownian motion, *Stochastic Analysis and Control*, (eds. A. Chojnowska-Michalik, Sz. Peszat, L. Stettner), Banach Center Publications, 105 (2015).
118. T. E. Duncan, Linear exponential quadratic stochastic differential games, *IEEE Trans. Autom. Control*, 61 (2016) to appear.
119. T. E. Duncan, J. Jakubowski, and B. Pasik-Duncan, Stochastic volatility models with volatility driven by fractional Brownian motion, *Commun. Info. Systems*, 15 (2015), 47-55.
120. T. E. Duncan and B. Pasik-Duncan, Explicit strategies for some linear and nonlinear stochastic differential games, *J.Math. Engrg. Sci. Aerospace*, 7 (2016), 83-92.
121. T. E. Duncan and B. Pasik-Duncan, Some solvable stochastic differential games in $SU(3)$, *Commun. Info. Systems*, 15 (2016) (no.4), 477-487.

RESEARCH SUPPORT:

1. NSF 1970-1978, 1981-2017 (PI) (Appl. Math. Program since 1976)
2. AFOSR 1967-68 (co-PI), 1976-80, 2009-15. 2016-2019 (PI)
3. ONR 1969-70 (co-PI)
4. Sprint Corp. 1/97-7/97, 1/98-12/98 (PI)
5. NASA EPSCOR 2001-2002 (PI)
6. ARO 2010-2017 (PI)

SELECTED PROFESSIONAL ACTIVITIES:

1. Corresponding Editor for *SIAM Journal on Control and Optimization*, 1999-2007
2. Associate Editor for *SIAM Journal on Control and Optimization*, 1994-1999
3. *SIAM Committee on Paper Awards* 2006
4. *SIAM Committee on SIAG/CST Prize* 2009
5. Organizing Committee *SIAM Control Conference* 2001
6. *SIAM Representative on Program Committee for 33rd IEEE CDC Conf.*
7. Editorial Board, *Communications on Stochastic Analysis*, 2006- present.
8. Editorial Board, *Risk and Decision Analysis*, 2007-present
9. *IFAC Technical Committee on Modeling, Identification and Signal Processing*, 1999-2013
10. *IFAC Technical Committee on Adaptive and Learning Systems*, 2002-2013
11. *International Program Committee, MTNS* 2010
12. Associate Editor for *IEEE Transactions on Automatic Control*, 1997-1998
13. *SIAM Conference on Control and Its Applications*, plenary speaker, 25-27 July 2011, Baltimore.
14. *SIAM Annual Meeting, Reid Prize Lecture*, 10 July 2013, San Diego.