

Pravin Varaiya

Nortel Networks Distinguished Professor
Department of Electrical Engineering & Computer Sciences
University of California, Berkeley, CA 94720-1770
varaiya@eecs.berkeley.edu

Field of Specialization

Communication networks, transportation systems, hybrid systems

Education

B.S. in Electrical Engineering, University of Bombay, 1960
Ph.D. in Electrical Engineering, University of California, Berkeley, 1966

Experience

Member of Technical Staff, Bell Laboratories, June 1962-June 1963
Research Assistant, University of California, June 1963-September 1965
Acting Assistant Professor, University of California, September 1965-September 1966
Assistant Professor, University of California, September 1966-June 1968
Associate Professor, University of California, June 1968-July 1971
Professor of EECS, University of California, July 1971-present
Professor of Economics, July 1975-1992
Visiting Professor, MIT, January 1974-January 1975
Distinguished Visiting Professor, University of Hong Kong, December 2006-February 2007

Honors

Guggenheim Fellow, 1972
Miller Research Professor, July 1978-June 1979
Docteur Honoris Causa, L'Institut National Polytechnique de Toulouse, 1999; and L'Institut National Polytechnique de Grenoble, 2006
IEEE Control Systems Society Field Award, 2002
Hendrik W. Bode Lecture Prize, 2005
Fellow, IEEE
Member, National Academy of Engineers
Fellow, American Academy of Arts and Sciences

Associate Editor

Discrete Event Dynamical Systems, Transportation Research—C.

Publications

A. Books

1. *Notes on Optimization*, Van Nostrand Reinhold, New York, 1972.
2. *Stochastic Systems: Estimation, Identification, and Adaptive Control*, (with P.R. Kumar), Prentice-Hall, 1986.
3. *High-Performance Communication Networks*, (with J. Walrand), First Edition, 1996; Second Edition, Morgan-Kaufmann, 2000.
4. *Structure and Interpretation of Signals and Systems*, (with E.A. Lee), Addison Wesley, 2002.

B. Edited Volumes

5. P. Varaiya and A.B. Kurzhanski, Editors, *Discrete Event Systems: Models and Applications*, Springer-Verlag, Lecture Notes in Control and Information Sciences, No. 103, 1988.
6. P.R. Kumar and P.P. Varaiya, Editors, *Discrete Event Systems, Manufacturing Systems, and Communication Networks*, IMA Volumes in Mathematics and Its Applications, Vol. 73, Springer-Verlag, 1995.

C. Papers

7. "A comparison principle for equations of the Hamilton-Jacobi type in set-membership filtering," (with A.B. Kurzhanski), *Communications in Information and Systems*, vol. 6 no. 3, 179-192, 2006.
8. "Formulation of Distribution Coordination Function of IEEE 802.11 for Asynchronous Networks: Mixed Data Rate and Packet Size," (with M. Ergen), *IEEE Transactions on Vehicular Technology*, vol. 56, no. 6, xxx-yyy, November 2007.
9. "Simulation-based uniform value function estimates of Markov decision processes," (with R. Jain), *SIAM J. Control. Optimization*, vol. 45, no. 5, 1633-1656, 2006.
10. "Ellipsoidal methods for dynamics and control. Part I," (with A.B. Kurzhanski), *Journal of Mathematical Sciences*, Vol. 139, no. 5, 6863-6900, 2006. Translated from *Sovremennaya Matematika i Ee Prilozheniya (Contemporary Mathematics and Its Applications)*, Vol. 23, Optimal Control, 2005.
11. "Probe Vehicle Runs or Loop Detectors? Effect of Detector Spacing and Sample Size on the Accuracy of Freeway Congestion Monitoring," (with J. Kwon and K. Petty), *Transportation Research Board, 85th Annual Meeting*, Washington, D.C., January 2007. To appear in *Transportation Research Record, 2007*.
12. "Ellipsoidal techniques for reachability analysis of discrete-time linear systems," (with A.A. Kurzhanskiy), *IEEE Trans. Automatic Control*, vol. 52, no. 1, 26-38, Jan. 2007.
13. "Ellipsoidal techniques for reachability under state constraint," (with A.B. Kurzhanski), *SIAM J. Control. Optimization*, vol. 45, no. 4, 1369-1394, 2006.
14. "Heuristic Methods for Delay Constrained Least Cost Routing Using k -Shortest-Paths," (with Z. Jia), *IEEE Trans. Automatic Control*, vol. 51, no. 4, 707-712, April 2006.

15. "Small pay access control via incentive alignment," (with J. Shu), *IEEE Journal on Selected Areas in Communication*, vol. 24, no. 5, 1051-1060, May, 2006.
16. "Optimal placement of relay nodes for energy efficiency in sensor networks," (with S. Coleri Ergen), *Proceedings International Conference on Communications (ICC2006)*, Istanbul, June 2006.
17. "Energy efficient routing with delay guarantee for sensor networks," (with S. Coleri Ergen), *Wireless Networks*, vol 13, no. 5 to appear, October 2007.
18. "The components of congestion: delay from incidents, special events, lane closures, weather, ramp metering gain, and excess demand," (with J. Kwon and M. Mauch), *Transportation Research Board, 85th Annual Meeting*, Washington, D.C., January 2006
19. "Traffic surveillance with wireless magnetic sensors," (with S.-Y. Cheung and S. Coleri Ergen), *Proc. 12th ITS World Congress*, San Francisco, Nov. 2005.
20. "Trigonometric K clustering (TKC) for censored distance estimation," (with D. Lee and R. Sengupta), in S. Phoha, T.F.L. LaPorta and C. Griffin, (Eds), *Sensor Network Operations*, IEEE Press, May 2006.
21. "What we've learned about highway congestion," *Access*, 27: 2-10, Fall 2005.
22. "On verification of controlled hybrid dynamics through ellipsoidal techniques," (with A.B. Kurzhanski), *Proc. 44th IEEE Conference on Decision and Control and the European Control Conference*, 4682-4687, Seville, Spain, December 12-15, 2005.
23. "Efficient market mechanisms for network resource allocation," (with R. Jain) *Proc. 44th IEEE Conference on Decision and Control and the European Control Conference*, 1056-1061, Seville, Spain, December 12-15, 2005.
24. "PEDAMACS: Power efficient and delay aware medium access protocol for sensor networks," (with S. Coleri), *IEEE Trans. Mobile Computing*, Vol 5. no. 7, pp 920-930, July 2006.
25. "Ellipsoidal Techniques for Hybrid Dynamics: the Reachability Problem," (with A.B. Kurzhanski), in W.P. Dayawansa, A. Lindquist, and Y. Zhou (Eds) *New Directions and Applications in Control Theory*, Lecture Notes in Control and Information Sciences, vol 321, pp.193-205, Springer, 2005.
26. "Optimization techniques for state-constrained control and obstacle problems," (with A.B. Kurzhanski and I.M. Mitchell), *J. Optimization Theory and Applications*, vol 128, no. 3, pp. 499-521, March 2006.
27. "Reducing highway congestion: An empirical approach," *European Journal of Control*, vol 11, pp. 1-9, 2005.
28. "Throughput analysis and admission control of IEEE 802.11," (with M. Ergen), *Mobile Networks and Applications*, vol 10, pp. 705-716, 2005.
29. "An empirical assessment of traffic operations," (with C. Chen and J. Kwon), in H. Mahmasani (Ed), *Proc. 16th International Symposium on Transportation and Traffic Theory*, pp. 105-124, Elsevier, 2005.

30. "Saturation throughput analysis of IEEE 802.11 wireless LANs for a lossy channel," (with X. Dong), *IEEE Communications Letters*, Vol. 9, No. 2, February 2005.
31. "Ellipsoidal techniques for hybrid dynamics: The reachability problem," (with A.B. Kuzhanski), *16th Mathematical Theory of Networks and Systems Conference (MTNS2004)*, July 5-9, 2004, Leuven, Belgium.
32. "Distributed control of teams of unmanned air vehicles," (with J. Sousa, T. Simsek), *16th Mathematical Theory of Networks and Systems Conference (MTNS 2004)*, July 5-9, 2004, Leuven, Belgium.
33. "Traffic measurement and vehicle classification with a single magnetic sensor," (with S-Y. Cheung, S. Coleri, B. Dunder, S. Ganesh, C-W. Tan), *Transportation Research Board, 84th Annual Meeting*, Washington, D.C., January 2005. Also *Transportation Research Record*, No. 1917, pp. 173-181, 2005.
34. "The congestion pie: Delay from collisions, potential ramp metering gain, and excess demand," (with J. Kwon), *Transportation Research Board, 84th Annual Meeting*, Washington, D.C., January 2005.
35. "Real-time estimation of O-D matrices with partial trajectories from ETC tag data," (with J. Kwon), *Transportation Research Board, 84th Annual Meeting*, Washington, D.C., January 2005. Also *Transportation Research Record*, No. 1923, pp. 119-126, 2005.
36. "WTRP—Wireless token ring protocol," (with M. Ergen, D. Lee and R. Sengupta), *IEEE Trans. Vehicular Technology*, Vol. 53, No. 9, pp. 1863-1881, November 2004.
37. "An efficient incentive-compatible combinatorial market mechanism," (with R. Jain), *Proc. 42nd Allerton Conference on Communication, Control, and Computing*, University of Illinois, Urbana, IL, September 2004.
38. "Sensor networks for traffic monitoring," (with S. Coleri and S. Cheung), *Proc. 42nd Allerton Conference on Communication, Control, and Computing*, University of Illinois, Urbana, IL, September 2004.
39. "Fault tolerance and energy efficiency of data aggregation schemes for sensor networks," (with S. Coleri), *Proc. IEEE Vehicle Technology Conference*, Los Angeles, September 2004.
40. "Hybrid algorithm for indoor positioning using wireless LAN," (with J. Kwon, B. Dunder and M. Ergen), *Proc. IEEE Vehicular Technology Conference*, Los Angeles, September 2004.
41. "Combinatorial bandwidth exchange: Mechanism design and analysis," (with R. Jain), *Communications in Information and Systems*, Vol. 3, No. 4, pp. 305-324, September 2004.
42. "Extensions of PAC learning for partially observable Markov decision processes," (with R. Jain), *Proc. Conf. on Information Sciences and Systems (CSIS)*, Princeton University, March 2004.
43. "Scalar estimation and control with noisy binary observations," (with T. Simsek and R. Jain), *IEEE Trans. Automatic Control*, Vol. 49, No. 9, pp. 1598-1603, 2004.
44. "Systematic identification of freeway bottlenecks," (with C. Chen and A. Skabardonis), *Transportation Research Board, 83rd Annual Meeting*, Washington, D.C., January 2004. Also *Transportation Research Record*, No. 1867, pp. 46-52, 2004.

45. "Statistical methods for detecting errors in spatial configuration information of traffic surveillance sensors," (with J. Kwon, C. Chen), *Transportation Research Board, 83rd Annual Meeting*, Washington, D.C., January 2004. Also *Transportation Research Record*, No. 1870, pp. 124-132, 2004.
46. "A system for displaying travel times on changeable message signs," (with C. Chen and A. Skabardonis), *Transportation Research Board, 83rd Annual Meeting*, Washington, D.C., January 2004.
47. "Measuring traffic," (with P. Bickel, C. Chen, J.Kwon, J. Rice and E. van Zwet), *Statistical Science*, to appear.
48. "Grid discretization based method for anisotropic shortest path problem over continuous regions," (with Z. Jia), *Proc. IEEE Conference on Decision and Control*, 2004.
49. "On some nonstandard dynamic programming problems of control theory," (with A.B. Kurzhanski), in *Variational Analysis and Applications*, F. Giannessi and A. Maugeri, Eds., Kluwer Acad. Pubs., NY, 2004.
50. "Reachability under uncertainty and measurement noise," (with A.B. Kurzhanski), accepted for publication in *Computation and Control*, 2004.
51. "On the problem of control synthesis through available measurements," (with A.B. Kurzhanski), accepted for publication in *Applied Mathematics and Mechanics (PMM)*, 2004.
52. "Control synthesis for state constrained systems and obstacle problems," (with A.B. Kurzhanski and I. Mitchell), *Proc. of IFAC Symposium on Nonlinear Control Systems (NOLCOS)*, 2004, Stuttgart.
53. "Improving the aggregate throughput of access points in IEEE 802.11 wireless LANs," (with X. Dong, M. Ergen and A. Puri), *Proc. IEEE WLN*, Bonn, Germany, October 2003.
54. "Router scheduling configuration based on the maximization of benefit and carried best effort traffic," (with E. Magana and D. Morato), *Telecommunication Systems*, Vol. 24, Nos. 2-4, pp. 275-292, 2003.
55. "Comparison of wireless token ring protocol with IEEE 802.11," (with M. Ergen, D. Lee, R. Datta, J. Ko, A. Puri and R. Sengupta), *J. of Internet Technology*, Vol. 4, No. 4, 2003.
56. "Mechanism design for networking research," (with J. Shu), *Information Systems Frontiers*, Vol. 5, No. 1, pp. 29-37, January 2003.
57. "QoS Aware adaptive resource allocation techniques for fair scheduling in OFDMA based broadband wireless access," (with M. Ergen and S. Coleri), *IEEE Transactions on Broadcasting*, Vol. 49, No. 4, pp. 362-370, December 2003.
58. "Pricing network services," (with J. Shu), *Proc. INFOCOM 2003, San Francisco*, Vol. 2, pp. 1221-1230, April 2003.
59. "Travel time reliability as a measure of service," (with C. Chen, E. van Zwet, A. Skabardonis), *Transportation Research Board, 82nd Annual Meeting*, Washington, D.C., January 2003. To appear in *Transportation Research Record*.

60. "Detecting errors and imputing missing data for single loop surveillance systems," (with C. Chen, J. Kwon, A. Skabardonis and J. Rice), *Transportation Research Board, 82nd Annual Meeting*, Washington, D.C., January 2003. Also *Transportation Research Record*, No. 1855, pp. 160-167, 2003.
61. "Measuring recurrent and nonrecurrent traffic congestion," (with A. Skabardonis), *Transportation Research Board, 83rd Annual Meeting*, Washington, D.C., January 2003. Also *Transportation Research Record*, No. 1856, pp. 118-124, 2003. Also U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *Compendium on Congestion: Issues and Analyses Across Modes*, Washington, DC, 2007.
62. "Estimation of truck volume from single loop detector using lane-to-lane speed correlation," (with J. Kwon and A. Skabardonis), *Transportation Research Board, 83rd Annual Meeting*, Washington, D.C., January 2003. Also *Transportation Research Record*, No. 1856, pp. 106-117, 2003.
63. "Tuning the weights in WFQ schedulers for the maximization of carried best effort traffic," (with E. Magana and D. Morato), *10th International Conference on Telecommunications, ICT'2003*, Tahiti, February 2003.
64. "Reachability under uncertainty," (with A. Kurzhanski), *Proc. IEEE Conf. on Decision and Control*, Las Vegas, pp. 1982-1987, December 2002.
65. "Control under communication constraints," (with T. Simsek), *Proc. IEEE Conf. on Decision and Control*, Las Vegas, pp. 3209-3216, December 2002.
66. "Freeway performance measurement system (PeMS): An operational analysis tool," (with T. Choe and A. Skabardonis), *TRB 81st Annual Meeting*, Washington, D.C., January 2002.
67. "Reachability under state constraints – the ellipsoidal technique," (with A.B. Kurzhanski), in *Proc. of the IFAC World Congress*, Barcelona, Spain, 2002.
68. "Optimization methods for target problems of control," (with A.B. Kurzhanski), *Proc. MTNS-2002*, Notre Dame, Indiana, 2002.
69. "On the existence of competitive equilibria in bandwidth markets," (with R. Jain and A. Dimakis), *40th Annual Allerton Conference on Communication, Control, and Computing*, Urbana, IL, October 2002.
70. "On reachability under uncertainty," (with A.B. Kurzhanski), *SIAM J. Control and Optimization*, Vol. 41, No. 1, pp. 181-216, 2002.
71. "Application of GPS to mobile IP and routing in wireless networks," (with M. Ergen, S. Coleri, B. Dunder, R. Jain and A. Puri), *Proc. IEEE Vehicular Technology Conference*, pp. 1115 - 1119, 24-28 September 2002.
72. "Ellipsoidal techniques for reachability, Part I," (with A.B. Kurzhanski), *Optimization: Methods and Software*, Vol. 17, No. 2, pp. 177-206, 2002.
73. "Ellipsoidal techniques for reachability, Part II," (with A.B. Kurzhanski), *Optimization: Methods and Software*, Vol. 17, No. 2, pp. 207-237, 2002.

74. "California's performance measurement system: Improving freeway efficiency through transportation intelligence," *TR News*, No. 218, pp. 18-24, Jan.-Feb. 2002.
75. "A game-theoretic model for generation expansion planning: problem formulation and numerical comparisons," (with A. Chuang and F. Wu), *IEEE Trans. Power Systems*, Vol. 16, No. 4, pp. 885-891, November 2001.
76. "Causes and cures of highway congestion," (with C. Chao and Z. Jia), *IEEE Control Systems Magazine*, Vol. 21, No. 4, pp. 26-33, Dec. 2001.
77. "The PeMS algorithm for accurate, real-time estimates of g -factors and speeds from single-loop detectors," (with Z. Jia, C. Chen, B. Coifman), *4th IEEE ITSC Conference*, Oakland, CA, August 2001.
78. "Space division multiple access (SDMA) for robust ad hoc vehicle communication networks," (with S.V. Bana), *4th IEEE ITSC Conference*, Oakland, CA, August 2001.
79. "Real-time vehicle location with desired accuracy," (with S.V. Bana), *4th IEEE ITSC Conference*, Oakland, CA, August 2001.
80. "Freeway performance measurement system: mining loop detector data," (with C. Chen, K. Petty et al), *Transportation Research Board, 80th Annual Meeting*, January 2001, Washington D.C. Also, *Transportation Research Record*, No. 1748, 96-102, 2001.
81. "Dynamic optimization for reachability problems," (with A.B. Kurzhanski), *J. Optimization Theory and Applications*, Vol. 108, No. 2, pp. 227-251, 2001.
82. "Ellipsoidal techniques for reachability analysis," (with A.B. Kurzhanski), *Hybrid Systems: Computation and Control*, N. Lynch and B.H. Krogh Eds., Springer-Verlag, LNCS Vol. 1790, pp. 202-214, 2000.
83. "On the reachability problem under persistent disturbances," (with A.B. Kurzhanski), *Doklady Mathematics*, Vol. 61, No. 3, pp. 3809-384, 2000.
84. "Reachability under disturbances," (with A.B. Kurzhanski), Proc. 21st Allerton Conference on Communication, Control, and Computing, Univ. of Illinois at Urbana-Champaign, October 2000.
85. "Ellipsoidal techniques for reachability analysis: Internal approximation," (with A.B. Kurzhanski), *Systems and Control Letters*, Vol. 41, pp. 201-211, 2000.
86. "Control design of an automated highway system," (with R. Horowitz), *Proc. of the IEEE*, Vol. 88, No. 7, pp. 913-925, July 2000.
87. "Quality matters: Some remarks on Internet service provisioning and tariff," (with J. Altmann and B. Rupp), *Teletronik*, Vol. 96, No. 2, pp. 20-25, 2000.
88. "A question about hierarchical systems," in T.E. Djaferis and I.C. Schick, Eds., *System Theory: Modeling, Analysis and Control*, SESC 158, Kluwer, 2000.
89. "Coordinated multilateral trades for electric power markets: Theory and implementation," (with F.F. Wu), *Electrical Power and Energy Systems*, Vol. 21, pp. 75-102, 1999.

90. "Internet demand under different pricing schemes," (with J. Altmann and B. Rupp), *Proc. of the ACM Conference on Electronic Commerce (E-COMMERCE '99)*, Denver, 1999.
91. "Managing usage-based pricing in a future telecommunication market," (with B. Altmann), *PAAM'99, Fourth International Conference on Practical Application of Intelligent Agents and Multi-Agents*, London, April 1999.
92. "Towards an integrated services Internet: The demand side of things," (with B. Rupp and R. Edell), *Proc. of the 1998 Conf. of the International Telecommunications Society*, 1998.
93. "Providing Internet access: What we learn from INDEX," (with R. Edell), *IEEE Network*, Vol. 13, No. 4, 18-25, 1999.
94. "SmartAHS: A simulation framework for Automated Vehicles and Highway Systems," (with A. Gollu), *Mathematical and Computer Modelling*, Vol. 27, Nos. 9-11, pp. 103-128, 1998.
95. "Bifurcations associated with sub-synchronous resonance," (with Y. Mitani, K. Tsuji, M. Varghese and F.F. Wu), 1997 Summer IEEE Power Meeting, Berlin; also *IEEE Trans. on Power Systems*, Vol. 13, No. 1, pp. 139-144, February 1998.
96. "Capacity of fading channels with side information," (with A. Goldsmith), *IEEE Trans. Information Theory*, Vol. 43, No. 6, pp. 1986-1992, November 1997.
97. "I-880 Field experiment: Analysis of incident data," (with A. Skabardonis, K. Petty, R.L. Bertini, H. Noeimi and D. Rydzewski), *Transportation Research Record*, Vol. 1603, pp. 72-79, 1997.
98. "Capacity, mutual information, and coding for finite-state Markov channels," (with A. Goldsmith), *IEEE Transactions on Information Theory*, Vol. 42, No. 3, pp. 468-486, May 1996.
99. "The freeway service patrol evaluation project: Database support programs and accessibility," (with K. Petty, H. Noeimi, K. Sanwal, D. Rydzewski, A. Skabardonis and H. Al-Deek), *Transportation Research - C*, Vol. 4, No. 2, pp. 71-85, 1996.
100. "Folk theorems on transmission access: proofs and counterexamples," (with F. Wu, P. Spiller and S. Oren), *Journal of Regulatory Economics*, Vol. 10, No. 1, pp. 5-23, July 1996.
101. "Decidable hybrid systems," (with A. Puri), *Mathl. Comput. Modelling*, Vol. 23, Nos. 11/12, pp. 191-202, 1996.
102. "What's decidable about hybrid automata?," (with T.A. Henzinger, P.W. Kopke and A. Puri), in *Proceedings of the 27th Annual ACM Symposium on Theory of Computing (STOC 1995)*, pp. 373-382, Las Vegas, 29 May-1 June 1995.
103. "What's decidable about hybrid automata?," (with T.A. Henzinger, P.W. Kopke and A. Puri), *Journal of Computer and System Sciences*, Vol. 57, pp. 94-124, 1998.
104. "Stability of hybrid systems," (with M. Kourjanski), in *Hybrid Systems III: Verification and Control*, R. Alur, T.A. Henzinger and E.D. Sontag, Eds., Lecture Notes in Computer Science, Vol. 1066, Springer-Verlag, Berlin, pp. 413-423, 1996.

105. "Design and evaluation tools for automated highway systems," (with A. Deshpande, D. Godbole, A. Gollu), in *Hybrid Systems III: Verification and Control*, R. Alur, T.A. Henzinger and E.D. Sontag, Eds., Lecture Notes in Computer Science, Vol. 1066, Springer-Verlag, Berlin, pp. 138-148, 1996.
106. "Epsilon-approximation of differential inclusions," (with V. Borkar and A. Puri), in *Hybrid Systems III: Verification and Control*, R. Alur, T.A. Henzinger and E.D. Sontag, Eds., Lecture Notes in Computer Science, Vol. 1066, Springer-Verlag, Berlin, pp. 362-376, 1996.
107. "Epsilon-approximation of differential inclusions," (with V. Borkar and A. Puri), *Proc. 34th IEEE Conf. on Decision and Control*, New Orleans, pp. 2892-2897, Dec. 1995.
108. "The I-880 field experiment: database development and incident delay estimation procedures," (with A. Skabardonis, K. Petty and H. Noeimi), *Seventy-Fifth Annual Meeting of the Transportation Research Board*, Washington, D.C. January 7-11, 1996. Also *Transportation Research Record*, vol. 1554, 204-212, 1996.
109. "Theory of traffic flow in automated highway systems," (with M. Broucke), *75th Annual Meeting of the Transportation Research Board*, Washington, D.C. January 7-11, 1996. Also, *Transportation Research-C*, Vol. 4, No. 4, pp. 181-210, 1997.
110. "Verification of hybrid systems using abstraction," (with A. Puri), in *Hybrid Systems II*, P. Antsaklis, W. Kohn, A. Nerode and S. Sastry, Eds., Lecture Notes in Computer Science, Vol. 999, Springer-Verlag, Berlin, pp. 359-369, 1995.
111. "Viable control of hybrid systems," (with A. Deshpande), in *Hybrid Systems II*, P. Antsaklis, W. Kohn, A. Nerode and S. Sastry, Eds., Lecture Notes in Computer Science, Vol. 999, Springer-Verlag, Berlin, pp. 128-147, 1995.
112. "Bifurcation, chaos, and voltage collapse in power systems," (with C-W Tan, M. Varghese and F.F. Wu), *Proceedings of the IEEE* Vol. 83, No. 11, pp. 1484-1495, November 1995.
113. "Modeling and verification of hybrid systems," (with A. Puri), *Proc. American Control Conference*, pp. 4466-4470, 1995.
114. "Information structures for control and verification of hybrid systems," (with A. Deshpande), *Proc. American Control Conference*, pp. 2642-2647, 1995.
115. "Design of entry and exit maneuvers of IVHS," (with F. Eskafi and E. Singh), *Proc. American Control Conference*, pp. 3566-3570, 1995.
116. "Driving safely in smart cars," (with A. Puri), *Proc. American Control Conference*, pp. 3597-3599, 1995.
117. "Billing users and pricing for TCP," (with R. Edell and N. McKeown), *IEEE J. Selected Areas in Communications*, Vol. 13, No. 7, pp. 1162-1175, September 1995.
118. "Modeling and Performance of Real-Time Disk Access Policies," (with J. Yee), *Computer Communications*, Vol. 18, No. 10, pp. 725-741, October, 1995.
119. "Burst reducing servers in ATM networks," (with S. Low), *Queueing Systems: Theory and Applications*, Vol. 20, Nos. 1-2, pp. 61-84, 1995.

120. "Pricing of electric power under uncertainty: Information and efficiency," (with T. Ishikida), IEEE Power Engineering Society Summer Meeting, Paper No. 94/SM/526-6/PWRS, San Francisco, July 24-28, 1994. Also, *IEEE Transactions on Power Systems*, Vol. 10, No. 2, pp. 884-890, May 1995.
121. "An automated highway system simulator," (with F. Eskafi and D. Khorramabadi), *Transportation Research-C*, Vol. 3, No. 1, pp. 1-17, 1995.
122. "Nodal prices and transmission rights: a critical appraisal," (with S.S. Oren, P.T. Spiller, and F. Wu), *The Electricity Journal*, Vol. 8, No. 3, pp. 24-35, April 1995.
123. "The Rabin index and chain automata, with applications to automata and games," *Proc. Computer Aided Verification'95*, Brussels, Belgium, pp. 253-266, July 3-6, 1995.
124. "Modeling real-time systems using rate automata," (with J. McManis), in P.R. Kumar and P.P. Varaiya, Eds., *Discrete Event Systems, Manufacturing Systems, and Communication Networks*, pp. 177-200, IMA Volumes in Mathematics and its Applications, Vol. 73, Springer-Verlag, 1995.
125. "An algorithm for optimal service provisioning using resource pricing," (with S. Low), *Proceedings IEEE Infocom '94*, 368-373, Vol. 1, Toronto, Canada.
126. "The entropy of traffic streams in ATM virtual circuits," (with N.T. Plotkin), *Proc. IEEE INFOCOM*, Toronto, pp. 1038-1045, 1994.
127. "Control issues in automated highway systems," (with J.K. Hedrick and M. Tomizuka), *IEEE Control Systems Magazine*, Vol. 14, No. 6, pp. 21-32, December 1994.
128. "Control of multiple service, multiple resource communication networks," (with S. Jordan), *IEEE Transactions on Communications*, Vol. 42, No. 11, pp. 2979-2988, November 1994.
129. "Multi-armed bandit problem revisited," (with T. Ishikida), *J. Optimization Theory and Applications*, Vol. 83, No. 1, pp. 113-154, October 1994.
130. "Discretization of timed automata," (with A. Gollu and A. Puri), *Proc. 33rd IEEE Conference on Decision and Control*, Lake Buena Vista, FL, pp. 957-958, December 1994.
131. "Formal verification of the PATHO real-time operating system," (with F. Balarin, K. Petty and A.L. Sangiovanni-Vincentelli), *Proc. 33rd IEEE Conf. Decision and Control*, Lake Buena Vista, FL, pp. 2459-2465, December 1994.
132. "SmartDb: An object-oriented simulation framework for Intelligent Vehicle Highway Systems," (with A. Gollu, A. Deshpande and P. Hingorani), *Proceedings of the Fifth Annual Conference on AI, Simulation, and Planning in High Autonomy Systems*, Gainesville, FL, pp. 244-250, December 1994.
133. "A decision-feedback maximum-likelihood decoder for finite-state Markov channels," (with A. Goldsmith), *Proc. IEEE Internat. Conference on Communications*, pp. 1546-1550, May 1994.
134. "Capacity, mutual information, and coding for finite-state Markov channels," (with A. Goldsmith), *Proc. IEEE Internat. Symp. Information Theory*, Trondheim, Norway, p. 322, 1994.

135. "Roadside intelligence for flow control in an intelligent vehicle and highway system," (with B.S.Y. Rao), *Transportation Research—C*, Vol. 2, No. 1, pp. 49-72, 1994.
136. "Decidability of hybrid systems with rectangular differential inclusions," (with A. Puri), *Proc. Computer Aided Verification '94 Lecture Notes in Computer Science*, Vol. 818, Springer-Verlag, pp. 95-104, 1994.
137. "Suspension automata: A decidable class of hybrid automata," (with J. Mcmanis), *Proc. Computer Aided Verification '94*, Lecture Notes in Computer Science, Vol. 818, Springer-Verlag, pp. 105-117, 1994.
138. "An analytical model for real-time multimedia disk scheduling," (with J. Yee), in P. Venkat Rangan, Ed., *Network and Operating System Support for Digital Audio and Video*, Third International Workshop Proceedings, Springer-Verlag, pp. 315-320, 1993.
139. "Bifurcation and chaos in power systems," (with C-W Tan, M. Varghese and F. Wu), *Sadhana, Proc. Indian Academy of Sciences*, Vol. 18, Part 5, pp. 761-786, September 1993.
140. "A new approach to service provisioning in ATM networks," (with S. Low), *IEEE/ACM Transactions on Networking*, Vol. 1, No. 5, pp. 547-553, October 1993.
141. "Scheduling cells in an input-queued switch," (with N. McKeown and J. Walrand), *Electronics Letters*, Vol. 29, nO. 25, pp. 2174-2175, December 1993.
142. "Investigations into achievable capacities and stream stability with coordinated intelligent vehicles," (with B.S.Y. Rao and F. Eskafi), *Transportation Research Record*, No. 1408, pp. 27-35, 1993.
143. "Flow benefits of autonomous intelligent cruise control in mixed manual and automated traffic," (with B.S.Y. Rao), *Transportation Research Record*, No. 1408, pp. 35-43, 1993.
144. "Protocol design for an automated highway system," (with A. Hsu, F. Eskafi and S. Sachs), *Discrete Event Dynamic Systems*, Vol. 2, pp. 183-206, 1993.
145. "Interruptible electric power service contracts," (with C.-W. Tan), *J. Economic Dynamics and Control*, Vol. 17, No. 3, pp. 495-517, May 1993.
146. "Smart cars on smart roads: Problems of control," *IEEE Transactions on Automatic Control*, Vol. 38, No. 2, pp. 195-207, Feb. 1993.
147. "Optimizing demand side contributions to power system security," (with R.J. Kaye and F.F. Wu) in S.S. Oren and S.A. Smith, Eds., *Service Opportunities for Electric Utilities: Creating Differentiated Products*, Kluwer, pp. 147-168, 1993.
148. "Design of interruptible electric power service contracts with stochastic demands," (with C.-W. Tan and T. Ishikida), *Elektrik: Turkish Journal of Electrical Engineering and Computer Sciences*, Vol. 1, No. 1, pp. 14-26, 1993.
149. "A deterministic fluid model for cell loss in ATM networks," (with M.K. Wong), *Proc. IEEE INFOCOM '93, San Francisco*, pp. 395-400, March 30-April 1, 1993.
150. "Burstiness bounds for some burst reducing servers," (with S.H. Low), *Proc. IEEE INFO-COM '93, San Francisco*, pp. 2-9, March 30-April 1, 1993.

151. "Performance analysis of parallel ATM connections for gigabit speed applications," (with N.T. Plotkin), *Proc. IEEE INFOCOM '93, San Francisco*, pp. 1186-1193, March 30-April 1, 1993.
152. "Stability of a class of dynamic routing protocols (IGRP)" (with S.H. Low), *Proc. IEEE INFOCOM '93, San Francisco*, pp. 610-616, March 30-April 1, 1993.
153. "Increased spectral efficiency through power control," (with A. Goldsmith), *IEEE Internat. Conf. on Communications*, Geneva, pp. 600-604, May 1993.
154. "Real-time task management for communications and control in multi-car platoons," (with K.S. Chang, W. Li and I. Porche), *Proc. Intelligent Vehicles '92*, Detroit, MI, pp. 409-414, June 29-July 1, 1992.
155. "Coordinating vehicles in an automated highway," in A. Bensoussan and J.-P. Verjus, Eds., *Future Tendencies in Computer Science, Control and Applied Mathematics. Proc. International Conference on the Occasion of the 25th Anniversary of INRIA*, Springer-Verlag, pp. 315-330, 1992.
156. "Markets and pricing for interruptible power," (with T.W. Gedra), *IEEE Power Engineering Society 1992 Winter Meeting*, New York, January 26-30, 1992. Also *IEEE Transactions on Power Systems*, Vol. 8, No. 1, pp. 122-128, Feb. 1993.
157. "Chaos in a simple power system," (with H.-D. Chiang, C.-W. Liu, F.F. Wu and M.G. Lauby), *IEEE Power Engineering Society 1992 Winter Meeting*, New York, Paper No. 92/WM/151-1/PWRS, January 26-30, 1992. Also *IEEE Transactions on Power Systems*, Vol. 8, No. 4, pp. 1407-1417, Nov. 1993.
158. "Pricing for system security," (with R.J. Kaye and F.F. Wu), *IEEE Power Engineering Society 1992 Winter Meeting* New York, January 26-30, 1992. Also, *IEEE Transactions on Power Systems*, Vol. 10, No. 1, pp. 575-583, May 1995.
159. "A BCU method for direct analysis of power system transient stability," (with H.D. Chiang and F.F. Wu), Paper No. 91/SM/423-4/PWRS *IEEE Power Engineering Society 1991 Summer Meeting* July 28-August 1, 1991, San Diego, CA. Also *IEEE Transactions on Power Systems*, Vol. 9, No. 3, pp. 1194-1208, August 1994.
160. "The design of platoon maneuvers for IVHS," (with A. Hsu, S. Sachs and F. Eskafi), *Proc. American Control Conference*, Boston, MA, pp. 2545-2550, June 26-28, 1991.
161. "Two proposals to improve traffic flow," (with U. Karaaslan and J. Walrand), *Proc. American Control Conference*, Boston, MA, pp. 2539-2544, June 26-28, 1991.
162. "A preliminary implementation for vehicle platoon control system," (with K.S. Chang, W. Li, A. Shaikhbahai and F. Assaderaghi), *Proc. American Control Conference*, Boston, MA, pp. 3078-3083, June 26-28, 1991.
163. "A model for pricing interruptible electric power service," (with C.-W. Tan), in G.B. Di Masi, A. Gombani and A.B. Kurzhanski, Eds., *Modelling, Estimation and Control of Systems with Uncertainty*, pp. 423-444, Birkhauser, Boston, 1991.

164. "A simple theory of traffic and resource allocation in ATM," (with S. Low), *Proc. IEEE Global Telecommunications Conference*, Phoenix, AZ, Paper 45.5.1, pp. 1633-1637, December 2-5, 1991.
165. "Simulating finitely recursive processes in LISP," (with R.A. Cieslak), *Discrete Event Dynamic Systems: Theory and Applications*, Vol. 1, pp. 373-392, 1992.
166. "Sketch of an IVHS systems architecture," (with S.E. Shladover), *Proc. Vehicle Navigation and Information Systems Conference (VNIS)*, Dearborn, MI, pp. 909-922, October 20-23, 1991.
167. "Experimentation with a vehicle platoon control system," (with K.S. Chang, W. Li, P. Devlin, A. Shaikhbahai, J.K. Hedrick, D. MacMahon, V. Narendran and D. Swaroop), *Proc. Vehicle Navigation and Information Systems Conference (VNIS)*, Dearborn, MI, pp. 1117-1124, October 20-23, 1991.
168. "Averaged dynamics and large deviations theory for the analysis and synthesis of communication network protocols," (with R.K. Boel and J. Walrand), in J.W. Cohen and C.D. Pack, Eds., *Queueing, Performance and Control in ATM: ITC-13 Workshops, Proceedings of the 13th International Teletraffic Congress*, North-Holland, pp. 225-230, 1991.
169. "Throughput in multiple service, multiple resource communication networks," (with S. Jordan), *IEEE Trans. on Communications*, Vol. 39, No. 8, pp. 1216-1222, August 1991.
170. "A method for specifying, implementing, and verifying media access control protocols," (with C. Brooks and R. Cieslak), *IEEE Control Systems Magazine* Vol. 10, No. 4, pp. 87-94, June 1990.
171. "Undecidability results for deterministic communicating sequential processes," (with R. Cieslak), *IEEE Trans. on Automatic Control*, Vol. 35, No. 9, pp. 1032-1039, September 1990.
172. "Stochastic dynamic optimization, approaches and computation," (with R.J-B. Wets) in: E M. Iri and E K. Tanabe, Eds., *Mathematical Programming: Recent Developments and Applications*, pp. 309-332, Kluwer Academic Publishers, Dordrecht, 1989.
173. "Process models for discrete event models," in: M.A. Kaashoek et al., Eds., *Realization and Modelling in System Theory: Proc. Internat. Symposium MTNS-89, Vol. 1*, pp. 23-42, Birkhauser, Boston, 1990.
174. "Algebras of discrete event models," (with K. Inan), *Proceedings of the IEEE*, Vol. 77, No. 1, pp. 24-38, 1989.
175. "The programmable network prototyping system," (with R. Cieslak, A. Fawaz, S. Sachs, J. Walrand and A. Li), *Computer Magazine*, 67-76, May 1989. Also,
176. "The programmable network prototyping system," (with R. Cieslak, A. Fawaz, S. Sachs, J. Walrand and A. Li), *Proc. IEEE INFOCOM, 393-399, April 1989, Ottawa, Canada*.
177. "A language for specifying and implementing low-level functions of media access protocols," (with R. Cieslak), *Proc. IEEE Internat. Phoenix Conf. on Computers and Communications*, pp. 428-433, April 1989, Phoenix, AZ.

178. "On the dynamics of regulated markets, construction standards, energy standards and durable goods: A cautionary tale," (with J. Quigley) in A. Andersson et al., Eds., *Advances in Spatial Theory and Dynamics*, pp. 263-272, North-Holland, 1989.
179. "Analysis of interrupt handling schemes in real-time systems," (with A. Fawaz and J. Walrand), *Proc. IEEE Internat. Conf. on Computers and Communications*, Phoenix, AZ, pp. 260-263, April 1989.
180. "Hybrid dynamical systems," (with A. Gollu), *Proc. 28th IEEE Conference on Decision and Control*, Tampa, FL, pp. 2708-2712, December 1989.
181. "Implementing finitely recursive processes in LISP," (with R. Cieslak), in E. Arikan, Ed., *Communication, Control, and Signal Processing*, Elsevier, pp. 954-968, 1990.
182. "Throughput in multiple service, multiple resource communication networks," (with S. Jordan), *Proc. 28th IEEE Conference on Decision and Control*, pp. 236-241, Tampa, FL, December 1989.
183. *Discrete Event Systems: Models and Applications*, (P. Varaiya and A.B. Kurzhanski, Editors), Lecture Notes in Control and Information Sciences, Vol. 103, Springer-Verlag, 1988.
184. "Finitely recursive processes," (with K. Inan) in *Lecture Notes in Control and Information Sciences*, Vol. 103, Springer-Verlag, 1988.
185. "Foundations of the potential energy boundary surface method for power system transient stability analysis," (with H.-D. Chiang and F.F. Wu), *IEEE Trans. on Circuits and Systems*, Vol. CAS-35, No. 6, pp. 712-728, 1988.
186. "Degenerate Hopf bifurcations in power systems," (with R.-L. Chen), *IEEE Trans. on Circuits and Systems*, Vol. CAS-35, No. 7, pp. 818-824, 1988.
187. "Supervisory control of discrete event processes with partial observations," (with R. Cieslak, C. Desclaux and A. Fawaz), *IEEE Trans. on Automatic Control*, Vol. AC-33, No. 3, pp. 249-260, 1988.
188. "Finitely recursive process models for discrete event systems," (with K. Inan), *IEEE Trans. on Automatic Control*, Vol. AC-33, No. 7, pp. 626-639, 1988.
189. "Foundations of direct methods for power system transient stability analysis," (with H-D. Chiang and F.F. Wu), *IEEE Trans. on Circuits and Systems*, Vol. CAS-34, No. 2, pp. 160-173, 1987.
190. "Asymptotically efficient allocation rules for the multiarmed bandit problem with multiple plays, Part I: IID rewards," (with V. Anantharam and J. Walrand), *IEEE Trans. on Automatic Control*, Vol. AC-32, No. 1, pp. 968-976, 1987.
191. "Asymptotically efficient allocation rules for the multiarmed bandit problem with multiple plays, Part II: Markovian rewards," (with V. Anantharam and J. Walrand), *IEEE Trans. on Automatic Control*, Vol. AC-32, No. 1, pp. 977-982, 1987.
192. "Consensus in distributed estimation," (with D. Teneketzis), in H.V. Poor, Ed., *Advances in Statistical Signal Processing*, Vol. 1, JAI Press, 1987.

193. "Innovation and changes in regional structure," (with E.J. Malecki), in P. Nijkamp, Ed., *Handbook of Regional and Urban Economics*, Elsevier Science Publishers, pp. 629-645, 1986.
194. "Scheduling jobs with stochastically ordered processing times on parallel machines to minimize expected flowtimes," (with R.R. Weber and J. Walrand), *J. Appl. Prob.*, Vol. 23, 1986, 841-847.
195. "An optimal strategy for a conflict resolution problem," (with V. Anantharam), *Systems and Control Letters* Vol. 7, pp. 329-332, 1986.
196. "Direct methods for transient stability analysis of power systems: recent results" (with F.F. Wu and R.-L. Chen), *Proc. of the IEEE*, Vol. 73, No. 12, pp. 1703-1715, December 1985.
197. "Unstable queues with arrival rate less than service rate," (with V. Anantharam and S. Parekh), *Proc. IEEE Conference on Decision and Control, Fort Lauderdale*, pp. 1347-1348, December 1985.
198. "Theory of the potential energy boundary surface," (with H-D. Chiang, F.F. Wu and C-W. Tan), *Proc. IEEE Conference on Decision and Control, Fort Lauderdale*, pp. 49-51, December 1985.
199. "A structure preserving energy function for power system transient stability analysis," (with N. Tsoias and A. Arapostathis), *IEEE Trans. on Circuits and Systems*, Vol. CAS-32, No. 10, pp. 1041-1049, October 1985.
200. "Consensus in distributed estimation with inconsistent beliefs," (with D. Teneketzis), *Systems & Control Letters* Vol. 4, pp. 217-221, 1984.
201. "Consensus in distributed estimation," in A. Bagchi and H.Th. Jongen, Eds., *Lecture Notes in Control and Information Sciences*, Vol. 66, Springer-Verlag, pp. 182-191, 1985.
202. "Optimal resource allocation for two processes," (with C. Courcoubetis), *AT&T Technical Journal* Vol. 64, No. 1, pp. 1-14, January 1985.
203. "A structure preserving energy function for power system transient stability analysis," (with N. Tsoias and A. Arapostathis), *IEEE Trans. on Circuits and Systems*, Vol. CAS-32, No. 10, pp. 1041-1049, October 1985.
204. "The $c\mu$ rule revisited," (with C. Buyukkoc and J. Walrand), *Advances in Applied Probability*, Vol. 17, No. 1, pp. 237-238, March 1985.
205. "Extensions of the multi-armed bandit problem," (with J. Walrand and C. Buyukkoc), *IEEE Trans. Automatic Control*, Vol. AC-30, No. 5, pp. 426-439, May 1985.
206. "Bifurcation models of urban development," (with M. Wiseman), in Ake E. Andersson, Walter Isard, Tonu Puu, Eds., *Regional and Industrial Development Theories, Models and Empirical Evidence*, Amsterdam: Elsevier Science Publishers B.V. (North-Holland), pp. 61-88, 1984.
207. "Arnold diffusion in the swing equations of a power system," (with F.M.A. Salam and J.E. Marsden), *IEEE Trans. Circuits and Systems*, Vol. CAS-31, No. 7, pp. 673-688, August 1984.

208. "Multi-armed bandit problems and resource sharing systems," (with J. Walrand), in G. Iazeolla, P.J. Courtois, and A. Hordijk, Eds., *Mathematical Computer Performance and Reliability*, Amsterdam: North-Holland, pp. 181-196, 1984.
209. "Blocking probability in a switching center with arbitrary routing policy," (with B. Gopinath, J.-M. Garcia), *AT&T Bell Laboratories Technical Journal*, Vol. 63, No. 5, May-June 1984, pp. 709-720.
210. "Nonlinear oscillations in power systems," (with E.H. Abed), *Electrical Power and Energy Systems*, Vol. 6, No. 1, pp. 37-43, January 1984.
211. "The decentralized quickest detection problem," (with D. Teneketzis), *IEEE Trans. Automatic Control*, Vol. AC-29, No. 7, pp. 641-644, July 1984.
212. "Invariance in resource sharing problems," (with C. Courcoubetis and J. Walrand), *Journal of Applied Probability*, Vol. 21, pp. 777-785, 1984.
213. "The behavior of three node power networks," (with A. Arapostathis), *Electrical Power and Energy Systems*, Vol. 5, No. 1, pp. 22-30, January 1983.
214. "Reindustrialization and the outlook for declining cities," (with M. Wiseman), in J. V. Henderson (Ed.), *Research in Urban Economics*, Vol. 3, JAI Press, Greenwich CT and London, pp. 167-190, 1983.
215. "A game-theoretic view of two processes using a single resource," (with C. Courcoubetis), *IEEE Trans. Automatic Control*, Vol. AC-28, No. 11, pp. 1059-1061, November 1983.
216. "Serving process with least thinking time maximizes resource utilization," (with C. Courcoubetis), *IEEE Trans. Automatic Control*, Vol. AC-29, No. 11, pp. 1005-1008, November 1984.
217. "Invariance in resource sharing problems," (with C. Courcoubetis and J. Walrand), *Proc. 21st IEEE Conf. on Decision and Control*, Orlando, pp. 861-863, December 1982.
218. "Optimal causal coding-decoding problems," (with J. Walrand), *IEEE Trans. Information Theory*, Vol. IT-29, No. 6, pp. 814-820, November 1983.
219. "Causal coding and control of Markov chains," (with J. Walrand), *Systems and Control Letters*, Vol. 3, pp. 189-192, September 1983.
220. "Study of nonlinear oscillations due to exciter control using Hopf bifurcation," (with E. Abed and N. Tsolas), *Proc. 1983 IEEE Internat. Symposium on Circuits and Systems*, Newport Beach, pp. 1410-1413, May 1983.
221. "Study of nonlinear oscillations due to exciter control," (with E. Abed and N. Tsolas), *Proc. 1983 American Control Conference*, San Francisco, pp. 674-678, June 1983.
222. "Chaos and Arnold diffusion in dynamical systems," (with F.M.A. Salam and J. Marsden), *IEEE Trans. Circuits and Systems*, Vol. CAS-30, No. 9, pp. 697-708, September 1983.
223. "Analytic expressions for the unstable manifold at equilibrium points in dynamical systems of differential equations," (with F.M.A. Salam and A. Arapostathis), *Proc. 22nd IEEE Conf. on Decision and Control*, San Antonio, TX, Dec. 14-16, pp. 1389-1392, 1983.

224. "Optimal control of service in tandem queues," (with Z. Rosberg and J.C. Walrand), *IEEE Trans. Automatic Control*, Vol. AC-27, No. 3, pp. 600-610, June 1982.
225. "Asymptotic agreement in distributed estimation," (with V. Borkar), *IEEE Trans. Automatic Control*, Vol. AC-27, No. 3, pp. 650-656, June 1982.
226. "Analysis of the power flow equation," (with A. Arapostathis and S. Sastry), *Electrical Power and Energy Systems*, Vol. 3, No. 3, pp. 115-126, July 1981.
227. "Jump behavior of circuits and systems," (with S. Sastry and C. Desoer), *Proc. 20th IEEE Conf. on Decision & Control*, San Diego, pp. 1043-1047, December 1982.
228. "Routing traffic in telephone networks," (with J-C. Garcia and B. Gopinath), *Proc. 20th IEEE Conf. on Decision & Control*, San Diego, pp. 386-389, December 1982.
229. "Oscillations in power systems via Hopf bifurcation," (with E. Abed), *Proc. 20th IEEE Conf. on Decision & Control*, San Diego, pp. 962-992, December 1982.
230. "Global analysis of swing dynamics," (with A. Arapostathis and S. Sastry), *IEEE Trans. Circuits and Systems*, Vol. CAS-29, No. 10, pp. 673-679, October 1982.
231. "Identification and adaptive control of Markov chains," (with V. Borkar), *SIAM J. Control and Optimization*, Vol. 20, No. 4, pp. 470-489, July 1982.
232. "Hierarchical stability and alert state steering control of interconnected power systems," (with S. Sastry), *IEEE Trans. on Circuits and Systems*, Vol. CAS-27, No. 11, pp. 1102-1112, November 1980.
233. "Flows in queuing networks: A martingale approach," (with J. Walrand), *Mathematics of Operations Research*, Vol. 6, No. 3, pp. 387-404, August 1981.
234. "Coherency for interconnected power systems," (with S. Sastry), *IEEE Trans. on Automatic Control*, Vol. AC-26, No. 1, pp. 218-226, February 1981.
235. "Finite chain approximation to a continuous stochastic control problem," (with V. Borkar), *IEEE Trans. on Automatic Control*, Vol. AC-26, No. 2, pp. 466-470, April 1981.
236. "Investment and employment in manufacturing in US metropolitan areas 1960-1976," *Regional Science and Urban Economics*, Vol. 11, No. 4, pp. 431-469, November 1981.
237. "A simple dynamic routing problem," (with A. Ephremides and J. Walrand), *IEEE Trans. on Automatic Control*, Vol. AC-25, No. 4, pp. 690-693, August 1980.
238. "Interconnections of Markov chains and quasi-reversible queuing networks," (with J. Walrand), *Stochastic Processes and their Applications*, Vol. 10, pp. 209-219, 1980.
239. "Sojourn times and the overtaking condition in Jacksonian networks," (with J. Walrand), *Advances in Applied Probability*, Vol. 12, pp. 1000-1018, 1980.
240. "A minimum principle for decentralized stochastic control problems," (with J. Walrand), in *Dynamic Optimization and Mathematical Economics*, P.T. Liu, Ed., Plenum Press, pp. 253-266, 1980.

241. "Division of labor and the distribution of income," (with R. Artle and C. Humes), *Regional Science and Urban Economics*, Vol. 9, pp. 71-82, 1979.
242. "Decentralized control in packet switched satellite communication," (with J. Walrand), in *IEEE Trans. Automatic Control*, Vol. AC-24, No. 5, pp. 794-796, 1979.
243. "Adaptive control of Markov chains," (with V. Borkar), in M. Kohlmann and W. Vogel, Eds., *Stochastic Control Theory and Stochastic Differential Systems*, Lecture Notes in Control and Information Sciences, No. 16, Springer-Verlag, Berlin, 1979.
244. "Adaptive control of Markov chains, I: Finite parameter set," (with V. Borkar), *IEEE Trans. Automatic Control*, Vol. AC-24, No. 6, pp. 953-957, 1979.
245. "Multilayer control of large Markov chains" (with J. P. Forestier), *IEEE Trans. Automatic Control*, Vol. AC-23, No. 2, pp. 298-305, 1978.
246. "The effects of discounted cost on the uncertainty threshold principle" (with R. Ku and M. Athans), *Ann. Econ. and Soc. Measurement*, Vol. 6, No. 5, pp. 485-492, 1978.
247. "Optimal and suboptimal stationary controls for Markov chains," *IEEE Trans. Automatic Control*, Vol. AC-23, No. 3, pp. 388-394, 1978.
248. "On delayed sharing patterns" (with J. Walrand), *IEEE Trans. Automatic Control*, Vol. AC-23, No. 3, pp. 443-445, 1978.
249. "Stochastic control of large Markov chains," (with J. P. Forestier), *Control and Management of Integrated Industrial Complexes*, M. Singh and A. Titli, Eds., Pergamon Press, Oxford, 1978.
250. "Decentralized stochastic control," (with J. Walrand), *Control and Management of Integrated Industrial Complexes*, M. Singh and A. Titli, Eds., Pergamon Press, Oxford, 1978.
251. "The age of cities and movement of manufacturing employment in the U.S.," (with M. Wiseman), *Papers of Regional Science Assoc.*, Vol. 41, pp. 127-140, 1978.
252. "Life cycle consumption and homeownership," (with R. Artle), *J. Economic Theory*, Vol. 18, No. 9, pp. 38-58, 1978.
253. "Survey of decentralized control methods for large scale systems" (with N. Sandell, M. Athans and M. Safanov), *IEEE Trans. Automatic Control*, Vol. AC-23, No. 2, pp. 108-128, 1978.
254. "The spatial structure of production with a Leontief technology," (with U. Schweizer), *Regl. Science and Urban Econ.*, Vol. 6, pp. 231-251, 1976.
255. "Optimal control of jump processes," (with R. Boel), *SIAM J. Control and Opt.*, Vol. 15, No. 1, pp. 92-119, 1977.
256. "The spatial structure of production with a Leontief technology, II: Substitute techniques," (with U. Schweizer), *Regional Science and Urban Econ.*, Vol. 7, pp. 293-320, 1977.
257. "Division of labor—Simon revisited," (with R. Artle and C. Humes), *Regional Science and Urban Econ.*, Vol. 7, pp. 185-196, 1977.

258. "A class of Markovian problems related to the districting problem for urban emergency services," (with U. Schweizer and J. Hartwick), *Ricerche de Automatica*, Vol. 8, No. 1, pp. 1-19, 1977.
259. "Economics of information: Examples in location and land-use theory," (with K. Stahl), *Regional Science and Urban Econ.*, Vol. 8, pp. 43-56, 1977.
260. "N-Player stochastic differential games," *SIAM J. Control and Optimization*, Vol. 14, No. 3, pp. 538-545, May 1976.
261. "General equilibrium and location theory," (with J. Hartwick and U. Schweizer), *J. Urban Economics*, Vol. 3, pp. 285-303, 1976.
262. "Public goods and consumption indivisibility," (with Urban Systems Group), *Regional Science and Urban Econ.*, Vol. 6, pp. 45-50, 1976.
263. "On the design of rent control," *IEEE Trans. Automatic Control*, Vol. AC-21, No. 3, pp. 316-319, 1976.
264. "Stochastic models of price adjustment" (with S. Barta), *Annals of Economic and Social Measurement*, Vol. 5, No. 3, pp. 267-281, 1976.
265. "Comparative statics of a residential economy with several classes," (with J. Hartwick and U. Schweizer), *J. Econ. Theory*, Vol. 13, No. 3, pp. 396-413, 1976.
266. "On the solutions of a stochastic control system, II" (with T.E. Duncan), *SIAM J. Control*, Vol. 13, No. 5, pp. 1077-1092, 1975.
267. "Martingales on jump processes, Part I: Representation results," (with R. Boel and E. Wong), *SIAM J. Control*, Vol. 13, No. 5, pp. 992-1021, 1975.
268. "Martingales on jump processes, Part II: Applications," (with R. Boel and E. Wong), *SIAM J. Control*, Vol. 13, No. 5, pp. 1022-1061, 1975.
269. "The martingale theory of jump processes," *IEEE Trans. Automatic Control*, Vol. AC-20, No. 1, pp. 34-42, 1975.
270. "Economic theories and empirical models of location choice and land use: A survey," (with R. Artle), *Proc. of the IEEE*, Vol. 63, No. 3, pp. 421-430, 1975.
271. "N-Person stochastic differential games," in *The Theory and Application of Differential Games*, J.D. Grote and D. Reidel, Eds., Dordrecht and Boston, pp. 97-106, 1975.
272. "Filtering and control of jump processes," in *Control Theory, Numerical Methods and Computer Systems Modeling*, A. Bensoussan and J.L. Lions, Eds., Lecture Notes in Economics and Mathematical Systems, Vol. 107, Springer-Verlag, Berlin, pp. 509-518, 1975.
273. "An optimizing model of urban development," (with M. Ripper), *Environment and Planning A*, Vol. 6, pp. 149-168, 1974.
274. "On the multiplicity of an increasing family of sigma-fields," (with M.H.A. Davis), *Annals of Probability*, Vol. 2, No. 5, pp. 958-963, 1974.

275. "Effects of congestion on the shape of a city," (with L. Legey and M. Ripper), *Journal of Economic Theory*, Vol. 6, No. 2, pp. 162-179, April 1973.
276. "Dynamic programming conditions for partially observed stochastic systems," (with M.H.A. Davis), *SIAM J. Control*, Vol. 11, No. 2, pp. 226-261, May 1973.
277. "Optimal control of a partially observed stochastic system," *Stochastic Differential Equations*, SIAM-AMS Proceedings Vol. VI, Amer. Math. Society, J.B. Keller and H.P. McKean, Eds.: pp. 173-187, 1973.
278. "Information states for linear stochastic systems," (with M.H.A. Davis), *J. Math. Anal. Appl.*, Vol. 37, No. 2, pp. 384-402, February 1972.
279. "A critique of Forrester's model of an urban area," (with J.N. Gray and D. Pessel), *IEEE Trans. on Systems, Man and Cybernetics*, Vol. SMC-2, No. 2, pp. 139-144, April 1972.
280. "Decentralized information and control: A network flow example," (with R. Lau and R.C.M. Persiano), *IEEE Trans. on Automatic Control*, Vol. AC-17, No. 4, pp. 466-473, August 1972.
281. "Locational implications of transaction costs," (with R. Artle), *Swedish J. Economics*, Vol. 74, pp. 174-183, 1972.
282. "Trends in the theory of control of large systems," *Annals of Economic and Social Measurement*, Vol. 1, No. 4, pp. 493-500, 1972.
283. "Equivalent nonlinear reciprocal networks," (with J.P. Verma), *IEEE Trans. on Circuit Theory*, Vol. CT-18, No. 2, pp. 214-217, March 1971.
284. "On the solutions of a stochastic control system," (with T.E. Duncan), *SIAM J. Control*, Vol. 9, No. 3, pp. 354-371, August 1971.
285. "Target Function approach to linear pursuit problems," (with W. Borgest), *IEEE Trans. on Automatic Control*, Vol. AC-16, No. 5, pp. 449-459, October 1971.
286. "Complexity problems in real time languages," (with W. A. Burkhard), *Information Sciences*, No. 3, pp. 87-199, 1971.
287. "Differential games with dynamical systems," in *Differential Games* H.W. Kuhn and G.P. Szego, Eds., North-Holland, Amsterdam and London, pp. 129-146, 1971.
288. "Differential games," *Proc. Sixth Berkeley Symposium on Mathematical Statistics and Probability*, Vol. III: Probability Theory, UC Press, pp. 687-697, 1971.
289. "N-Person, nonzero sum differential games with linear dynamics," *SIAM J. Control*, Vol. 8, No. 4, pp. 441-449, November 1970.
290. "Existence of saddle points in differential games," (with J. Lin), *SIAM J. Control*, Vol. 7, No. 1, pp. 141-157, February 1969.
291. "E-Capacity of classes of unknown channels," (with L. Forys), *Information and Control*, Vol. 14, No. 4, pp. 376-406, November 1969.

292. "Decomposition of large-scale systems," *System Theory*, L. Zadeh and E. Polak, Eds., McGraw-Hill, pp. 467-488, 1969.
293. "Representation of a differential system," (with D. Eggert), *J. Differential Equations*, Vol. 4, No. 2, pp. 280-299, April 1968.
294. "Difference between number of capacitors and inductors in a lossless n-port," (with L. Silverman), *IEEE Trans. on Circuit Theory*, Vol. CT-15, No. 2, pp. 147-148, June 1968.
295. "Capacity of classes of Gaussian channels," (with W.L. Root), *SIAM J. Applied Math.*, Vol. 16, No. 6, pp. 1350-1393, November 1968.
296. "On the existence of solutions to a differential game," *SIAM J. Control*, Vol. 5, No. 1, pp. 153-162, February 1967.
297. "Nonlinear programming in Banach space," *SIAM J. Applied Math.*, Vol. 15, No. 2, pp. 284-293, March 1967.
298. "Determinable classes of signals and linear channels," *SIAM J. Applied Math.*, Vol. 15, No. 2, pp. 440-449, March 1967.
299. "Minimal realization of a non-anticipative impulse-response matrix," (with C.A. Desoer), *SIAM J. Applied Math.*, Vol. 15, No. 3, pp. 754-764, May 1967.
300. "B.I./B.O. Stability of discrete time systems," (with J. Lin), *IEEE Trans. on Automatic Control*, Vol. AC-12, No. 4, pp. 423-427, August 1967.
301. "Affine dynamical systems," (with D. Eggert), *J. Computer and System Sciences*, Vol. 1, No. 4, pp. 330-348, December 1967.
302. "Controllability of a class of nonlinear systems," (with L. Silverman and E. Davidson), *IEEE Trans. on Automatic Control*, Vol. AC-12, No. 6, pp. 791-792, December 1967.
303. "On the trajectories of a differential system," *Math. Theory of Control*, L.W. Neustadt and A.V. Balakrishnan, Eds., Academic Press, pp. 115-128, 1967.
304. "Decomposition of large-scale system," *SIAM J. Control*, Vol. 4, No. 1, pp. 173-178, February 1966.
305. "B.I./B.O. Stability of the Lure problem," (with R. Liu), *IEEE Trans. on Automatic Control*, Vol. AC-11, No. 4, pp. 745-746, October 1966.
306. "B.I./B.O. Stability of nonlinear, time-varying system," (with R. Liu), *SIAM J. Control*, Vol. 4, No. 4, pp. 698-704, November 1966.
307. "Normal form and stability of a class of coupled nonlinear networks," (with R. Liu), *IEEE Trans. on Circuit Theory*, Vol. CT-13, No. 4, pp. 413-418, December 1966.
308. "A decomposition technique for nonlinear programming," *I.B.M. Research, Report RJ-345*, July 1965.