MIHALIS   YANNAKAKIS

Address:

Department of Computer Science
Columbia University
1214 Amsterdam Avenue, Mail Code 0401
New York, NY 10027
e-mail: mihalis@cs.columbia.edu

Education:

January 1979: Ph.D., Dept. of Electrical Engineering and Computer Science
Princeton University

July 1975: Diploma in Electrical Engineering
National Technical University of Athens, Greece

Experience:

January 2004 - present: Columbia University
Percy K. and Vida L. W. Hudson Professor of Computer Science

October 2002 - December 2003: Stanford University
Professor of Computer Science

August 2001 - September 2002: Avaya Laboratories, Basking Ridge, NJ
Head, Computing Principles Research Department

September 1978 - July 2001: Bell Laboratories, Murray Hill, NJ
Head, Computing Principles Research Department, (1991 - 2001)

Research Interests:

Algorithms and Complexity

Combinatorial Optimization

Algorithmic Game Theory

Databases

Testing and Verification

Awards/Distinctions:

National Academy of Science, 2018

Academia Europaea, 2013

National Academy of Engineering, 2011

Knuth Prize, 2005

Fellow, Association for Computing Machinery (ACM), 1998

Fellow, Bell Laboratories, 1997

ISI Highly Cited Researcher, 2002

Bell Labs President's Gold Award, 2000

Bell Labs Distinguished Member of Technical Staff Award, 1985

H-index: 93 (Google scholar)

Professional Activities:

Editorial Boards:

SIAM Journal on Computing (1992 - 2003); Editor-in chief (1998 - 2003)

Journal of ACM (1986 - 2000)

Journal of Computer and System Sciences (1990 - present)

Journal of Combinatorial Optimization (1997 - present)

Journal of Complexity (2004 - 2015)

ACM Transactions on Computation Theory (2009 – 2018)

Discrete Applied Mathematics (1988 -97)

Operations Research (1983 - 86)

Conference Committee Chairs:

Program Chair, 33rd ACM Symposium on Theory of Computing, 2001

Conference Chair, 13th, 14th and 15th ACM Symp. on Principles of Database Systems, 1994, '95, '96

Program Chair, 31st IEEE Symp. on Foundations of Computer Science, 1990

Program Chair, 7th ACM Symp. on Principles of Database Systems, 1988

Program Committee Member:

6th, 10th Conf. on Innovations in Theoretical Computer Science, 2015, 2019

2nd, 6th, 18th, 22nd, 24th, 26th ACM Symp. on Principles of Database Systems, 1983, '87, '99, 2003, '05, '07

23rd, 25th, 27th, 30th, 35th, 46th IEEE Symp. on Foundations of Computer Science, 1982, '84, '86, '89, '94, 2005

12th, 35th Intl. Colloquium on Automata, Languages and Programming, 1985, 2008

16th Intl. Symposium on Algorithms and Computation, 2005

7th Intl. Workshop on Approximation Algorithms for Combinatorial Optimization Problems, 2004

3rd and 7th Annual Intl. Computing and Combinatorics Conf., 1997, 2001

2nd International Conference on Network Protocols, 1994

3rd ACM-SIAM Symposium on Discrete Algorithms, 1992

4th International Conference on Database Theory, 1992

ACM-SIGMOD Intl. Conference on Management of Data, 1981, 1985

Intl. Symp. on Mathematical Foundations of Computer Science, 1984

Executive Committees:

Simons Institute for Theoretical Computer Science, Berkeley
  - Advisory Board Co-chair (2014-2017)

DIMACS, the NSF STC Center for Discrete Mathematics and Theoretical Computer Science, Rutgers-Princeton-Bell Labs-AT&T Labs-Bellcore
  - Executive Committee (1991 - 2001)
  - Co-chair of DIMACS Special Years on Networks 1996-2000
  - Advisory Board (2005 - present)

IMA - Institute for Mathematics and its Applications, Board of Governors, (2003 - 2006)

ACM Symp. on Principles of Database Systems, Executive Committee 1988-90, 1994-2000

Publications

Journal Articles:

1. "The Node-Deletion Problem for Hereditary Properties is NP-Complete", (with J. Lewis), *Journal of Computer and System Sciences* (special issue for 10th ACM Symp. on Theory of Computing), 20(2), pp. 219-230, 1980.

2. "The Effect of a Connectivity Requirement on the Complexity of Maximum Subgraph Problems", *Journal of ACM*, 26(4), pp. 618-630, 1979.

3. "Scheduling Interval Ordered Tasks", (with C. H. Papadimitriou), *SIAM Journal on Computing*, 8(3), pp. 405-409, 1979.

4. "Topological Characterizations of Families of Graphs Generated by Certain Types of Graph Grammars", (with T. Pavlidis), *Information and Control*, 42(1), pp. 72-86, 1979.

5. "Equivalences among Relational Expressions with the Union and Difference Operators", (with Y. Sagiv), *Journal of ACM*, 27(4), pp. 633-655, 1980.

6. "Edge-Dominating Sets in Graphs", (with F. Gavril), *SIAM Journal on Applied Mathematics*, 38(3), pp. 364-372, 1980.

7. "Testing the Universal Instance Assumption", (with P. Honeyman and R. E. Ladner), *Information Processing Letters*, 10(1), pp. 14-19, 1980.

8. "Node-Deletion Problems on Bipartite Graphs", *SIAM Journal on Computing*, 10(2), pp. 310-327, 1981.

9. "Edge-Deletion Problems", *SIAM Journal on Computing*, 10(2), pp. 297-309, 1981.

10. "On the Complexity of Testing Implications of Functional and Join Dependencies", (with D. Maier and Y. Sagiv), *Journal of ACM*, 28(4), pp. 680-695, 1981.

11. "Computing the Minimum Fill-In is NP-Complete", *SIAM Journal on Algebraic and Discrete Methods*, 2(1), pp. 77-79, 1981.

12. "A Theory of Safe Locking Policies in Database Systems", *Journal of ACM*, 29(3), pp. 718-740, 1982.

13. "Freedom from Deadlock of Safe Locking Policies", *SIAM Journal on Computing*, 11(2), pp. 391-408, 1982.

14. "On Minimal Eulerian Graphs", (with C. H. Papadimitriou), *Information Processing Letters*, 12(4), pp. 203-205, 1981.

15. "The Clique Problem for Planar Graphs", (with C. H. Papadimitriou), *Information Processing Letters*, 13(4,5), pp. 131-133, 1981.

16. "The Complexity of Restricted Spanning Tree Problems", (with C. H. Papadimitriou), *Journal of ACM*, 29(2), pp. 285-309, 1982.

17. "The Complexity of the Partial Order Dimension Problem", *SIAM Journal on Algebraic and Discrete Methods*, 3(3), pp. 351-358, 1982.

18. "Algebraic Dependencies", (with C. H. Papadimitriou), *Journal of Computer and System Science* (special issue for 21st IEEE Symp. on Foundations of Computer Science), 25(1), pp. 2-41, 1982.

19. "Bounds on the Size and Transmission Rate of Communication Protocols", (with A. V. Aho, J. D. Ullman, A. Wyner), *Computers and Mathematics with Applications*, 8(3), pp. 205-214, 1982.

20. "The Complexity of Testing whether a Graph is a Superconcentrator", (with M. Blum, R. M. Karp, O. Vornberger, C. H. Papadimitriou), *Information Processing Letters*, 13(4,5), pp. 164-167, 1981.

21. "Tools for Template Dependencies", (with R. Fagin, D. Maier, J. D. Ullman), *SIAM Journal on Computing*, 12(1), pp. 36-59, 1983.

22. "Scheduling Opposing Forests", (with M. R. Garey, D. S. Johnson, R. E. Tarjan), *SIAM J. on Algebraic and Discrete Methods*, 4(1), pp. 72-93, 1983.

23. "On the Desirability of Acyclic Database Schemes", (with C. Beeri, R. Fagin, D. Maier), *Journal of ACM*, 30(3), pp. 479-513, 1983.

24. "Simple Linear-Time Algorithms to Test Chordality of Graphs, Test Acyclicity of Hypergraphs, and Selectively Reduce Acyclic Hypergraphs", (with R. E. Tarjan), *SIAM J. on Computing*, 13(3), pp. 566-579, 1984.

25. "The Complexity of Facets (and Some Facets of Complexity)", (with C. H. Papadimitriou), *J. of Computer and System Sciences* (special issue for 14th ACM Symp. on Theory of Computing), 28(2), pp. 244-259, 1984.

26. "Independent Database Schemas", (with M. Graham), *J. of Computer and System Sciences* (special issue for 1st ACM Symp. on Principles of Database Systems), 28(1), pp. 121-141, 1984.

27. "Permuting Elements within Columns of a Matrix in Order to Minimize Maximum Row Sum", (with E. G. Coffman), *Mathematics of Operations Research*, 9(3), pp. 384-390, 1984.

28. "Serializability by Locking", *Journal of ACM*, 31(2), pp. 227-244, 1984.

29. "On a Class of Totally Unimodular Matrices", *Mathematics of Operations Research*, 10(2), pp. 280-304, 1985.

30. "A Polynomial Algorithm for the Min Cut Linear Arrangement of Trees", *Journal of ACM*, 32(4), pp. 950-988, 1985.

31. "Querying Weak Instances", in *Advances in Computing Research*, vol. 3, (F. Preparata, P. Kanellakis eds.), pp. 185-211, JAI Press, 1986.

32. "A Note on Succinct Representations of Graphs", (with C. H. Papadimitriou), *Information and Control*, 71(3), pp. 181-185, 1986.

33. "Deadlock-Freedom and Safety of Transactions in a Distributed Database", (with O. Wolfson), *J. of Computer and System Sciences* (special issue for 4th ACM Symp. on Principles of Database Systems), 33(2), pp. 161-178, 1986.

34. "The Maximum k-Colorable Subgraph Problem for Chordal Graphs", (with F. Gavril), *Information Processing Letters*, 24, pp. 133-137, 1987.

35. "The Complexity of Reliable Concurrency Control", (with C. H. Papadimitriou), *SIAM J. on Computing*, 16(3), pp. 538-553, 1987.

36. "How Easy is Local Search?", (with D. S. Johnson, C. H. Papadimitriou), *J. of Computer and System Sciences* (special issue for 26th IEEE Symp. on Foundations of Computer Science), 37(1), pp. 79-100, 1988.

37. "Embedding Planar Graphs in Four Pages", *J. of Computer and System Sciences* (special issue for 18th ACM Symp. on Theory of Computing), 38(1), pp. 36-67, 1989.

38. "On Generating All Maximal Independent Sets", (with D. S. Johnson, C. H. Papadimitriou), *Information Processing Letters*, 27(3), pp. 119-123, 1988.

39. "Optimal Scheduling of Products with Two Subassemblies on a Single Machine", (with E. G. Coffman, A. Nozari), *Operations Research*, 37(3), pp. 426-436, 1989.

40. "On Recognizing Integer Polyhedra", (with C. H. Papadimitriou), *Combinatorica*, 10(1), pp. 107-109, 1990.

41. "Deleting Completed Transactions", (with T. Hadzilacos), *J. Computer and System Sciences* (special issue for 5th ACM Symp. on Principles of Database Systems), 38(2), pp. 360-379, 1989.

42. "Pfaffian Orientations, 0/1 Permanents, and Even Cycles in Directed Graphs", (with V. Vazirani), *Discrete Applied Mathematics*, 25(1-2), pp. 179-190, 1989.

43. "Towards an Architecture-Independent Analysis of Parallel Algorithms", (with C. H. Papadimitriou), *SIAM J. on Computing*, 19(2), pp. 322-328, 1990.

44. "Simple Local Search Problems that are Hard to Solve", (with A. Schaffer), *SIAM J. on Computing*, 20(1), pp. 56-87, 1991.

45. "Shortest Paths without a Map", (with C. H. Papadimitriou), *Theoretical Computer Science* (special issue for 16th Intl. Coll. on Automata, Languages and Programming), 84(1), pp. 127-150, 1991.

46. "Optimization, Approximation and Complexity Classes", (with C. H. Papadimitriou), *J. Computer and System Sciences* (special issue for 20th ACM Symp. on Theory of Computing), 43(3), pp. 425-440, 1991.

47. "Expressing Combinatorial Optimization Problems by Linear Programs", *J. Computer and System Sciences* (special issue for 20th ACM Symp. on Theory of Computing), 43(3), pp. 441-466, 1991.

48. "Modularity of Cycles and Paths in Graphs", (with E. M. Arkin, C. H. Papadimitriou), *Journal of ACM*, 38(2), pp. 255-274, 1991.

49. "Batch Sizing and Job Sequencing on a Single Machine", (with E. G. Coffman Jr., M. J. Magazine, C. Santos), *Annals of Operations Research*, 26, pp. 135-147, 1990.

50 "High-Probability Parallel Transitive Closure Algorithms", (with J. D. Ullman), *SIAM J. on Computing*, 20(1), pp. 100-125, 1991.

51. "The Traveling Salesman Problem with Distances One and Two", (with C. H. Papadimitriou), *Mathematics of Operations Research*, 18(1), pp. 1-11, 1993.

52. "The Input-Output Complexity of Transitive Closure", (with J. D. Ullman), *Annals of Mathematics and Artificial Intelligence*, 3, pp. 331-360, 1991.

53. "Memory Efficient Algorithms for the Verification of Temporal Properties", (with C. Courcoubetis, M. Vardi, P. Wolper), *Formal Methods in System Design* (special issue for 2nd Conf. on Computer Aided Verification), 1, pp. 275-288, 1992.

54. "Minimum and Maximum Delay Problems in Real Time Systems", (with C. Courcoubetis), *Formal Methods in System Design* (special issue for 3rd Conf. on Computer Aided Verification), 1(4), pp. 385-415, 1992.

55. "Testing Finite State Machines: State Identification and Verification", (with D. Lee), *IEEE Trans. on Computers*, 43(3), pp. 306-320, 1994.

56. "Computing the Throughput of a Network with Dedicated Lines", (with C. H. Papadimitriou, P. Serafini), *Discrete Applied Mathematics*, 42(2-3), pp. 271-278, 1993.

57. "Testing Finite State Machines: Fault Detection", (with D. Lee), *J. Computer and System Sciences* (special issue for 23rd ACM Symp. on Theory of Computing), 50 (2), pp. 209-227, 1995.

58. "On the Approximation of Maximum Satisfiability", *Journal of Algorithms* (special issue for 3rd ACM-SIAM Symp. on Discrete Algorithms), 17, pp. 475-502, 1994.

59. "The Complexity of Multiterminal Cuts", (with E. Dalhaus, D. S. Johnson, C. H. Papadimitriou, P. D. Seymour), *SIAM J. on Computing*, 23(4), pp. 864-894, 1994.

60. "On Datalog vs. Polynomial Time", (with F. Afrati, S. Cosmadakis), *J. Computer and System Sciences* (special issue for 10th ACM Symp. on Principles of Database Systems), 51(2), pp. 177-196, 1995.

61. "The Complexity of Probabilistic Verification", (with C. Courcoubetis), *Journal of ACM*, 42(4), pp. 857-907, 1995.

62 "Linear Approximation of Shortest Superstrings", (with A. Blum, T. Jiang, M. Li, J. Tromp), *Journal of ACM*, 41(4), pp. 630-647, 1994.

63. "On the Hardness of Approximating Minimization Problems", (with C. Lund), *Journal of ACM*, 41(5), pp. 960-981, 1994.

64. "Approximate Max-Flow Min-(Multi)cut Theorems and Their Applications", (with N. Garg, V. V. Vazirani), *SIAM J. on Computing*, 25 (2), pp. 235-251, 1996.

65. "Timing Verification by Successive Approximation" (with R. Alur, A. Itai, R. P. Kurshan), *Information and Computation*, 118 (1), pp. 142-157, 1995.

66. "Tie-Breaking Semantics and Structural Totality", (with C. H. Papadimitriou), *J. Computer and System Sciences* (special issue for 11th ACM Symp. on Principles of Database Systems), 54 (1), pp. 48-60, 1997.

67. "On Limited Nondeterminism and the Complexity of the V-C Dimension", (with C. H. Papadimitriou), *J. Computer and System Sciences* (special issue for 8th IEEE Structures Conf.), 53 (2), pp. 161-170, 1996.

68. "Primal-Dual Approximation Algorithms for Integral Flow and Multicut in Trees", (with N. Garg, V. V. Vazirani), *Algorithmica*, 18, pp. 3-20, 1997.

69. "Computational Complexity of Local Search", chapter in book *Local Search in Combinatorial Optimiza*tion, E.H.L. Aarts, J.K. Lenstra eds., John Wiley, 1997.

70. "Principles and Methods of Testing Finite State Machines - A Survey", (with D. Lee), invited paper, *Proceedings of the IEEE*, 84 (8), pp. 1090-1126, 1996.

71. "An Efficient Algorithm for Minimizing Real-Time Transition Systems", (with D. Lee), *Formal Methods in System Design* (special issue for 5th Conf. on Computer Aided Verification), 11, pp. 113-136, 1997.

72. "Conformance Testing", (with D. Lee), *Encyclopedia of Electrical and Electronics Engineering*, J. Webster ed., John Wiley, 1998.

73. "Markov Decision Processes and Regular Events", (with C. Courcoubetis), *IEEE Trans. on Automatic Control*, 43(10), pp. 1399-1418, 1998.

74. "On the Complexity of Protein Folding", (with P. Crescenzi, D. Goldman, C. Papadimitriou, A. Piccolboni), *J. Computational Biology* 5(3), pp. 423-466, 1999.

75. "On the Complexity of Database Queries", (with C. H. Papadimitriou), *J. Computer and System Sc.*, (special issue for 16th ACM Symp. on Principles of Database Systems), 58(3), pp. 407-427, 1999.

76. "Bin Packing with Discrete Item Sizes, Part I: Perfect Packing Theorems and the Average Case Behavior of Optimal Packings", (with E. G. Coffman Jr., C. Courcoubetis, M. R. Garey, D. S. Johnson, P. W. Shor, R. R. Weber), *SIAM J. on Discrete Math.*, 13(3), pp. 384-402, 2000.

77. "Model Checking of Hierarchical State Machines", (with R. Alur), *ACM Trans. on Programming Languages and Systems*, 23(3), pp. 273-303 2001.

78. "On Complexity as Bounded Rationality" (with C. H. Papadimitriou), submitted to *Mathematics of Operations Research*.

79. "Closed Partition Lattice and Machine Decomposition", (with D. Lee), *IEEE Trans. on Computers*, 51(2), pp. 216-228 2002.

80. "Black Box Checking", (with D. Peled, M. Vardi), *Journal of Automata, Languages and Combinatorics*, 7(2), pp. 225-246, 2002.

81. "Perfect Packing Theorems and the Average Case Behavior of Optimal and On-line Packings" (with E. G. Coffman Jr., C. Courcoubetis, M. R. Garey, D. S. Johnson, P. W. Shor, R. R. Weber), *SIAM Review*, 44, pp. 384-402, 2002.

82. "Inference of Message Sequence Charts", (with R. Alur, K, Etessami), *IEEE Trans. on Software Engineering*, 29(7), pp. 623--633, 2003.

83. "Near-Optimal Hardness Results and Approximation Algorithms for Edge-Disjoint Paths and Related Problems", (with V. Guruswami, S. Khanna, R. Rajaraman, B. Shepherd), *J. of Computer and System Sc.*, 67(3), pp. 473-496, 2003.

84. "Multiway Cuts in Node Weighted Graphs", (with N. Garg, V. Vazirani), *J. of Algorithms*, 50(1), pp. 49-61, 2004.

85. "Realizability and Verification of MSC Graphs", (with R. Alur, K. Etessami), *Theoretical Computer Science* (special issue from ICALP'01), 331, pp. 97-114, 2005.

86. "Analysis of Recursive State Machines", (with R. Alur, M. Benedikt, K. Etessami, P. Godefroid, T. Reps), *ACM Trans. on Programming Languages and Systems*, 27(4), pp. 786-818, 2005.

87. "Efficiently Computing Succinct Trade-off Curves", (with S. Vassilvitskii), *Theoretical Computer Science* (special issue from ICALP'04), 348, pp. 334-356, 2005.

88. "Adaptive Model Checking", (with A. Groce, D. Peled), *Logic Journal of the IGPL*, Oxford Univ. Press, 14(5), pp. 729-744, 2006.

89. "Recursive Concurrent Stochastic Games", (with K. Etessami), *Logical Methods in Computer Science* (special issue for ICALP 2006), 4(4:7), pp. 1-21, 2008.

90. "Multi-objective Model Checking of Markov Decision Processes", (with. K. Etessami, M. Kwiatowska, M. Vardi), *Logical Methods in Computer Science* (special issue for TACAS 2007), 4(4:8), pp. 1-21, 2008.

91. "Recursive Markov Chains, Stochastic Grammars, and Monotone Systems of Nonlinear Equations", (with K. Etessami), *Journal of ACM,* 56(1), pp. 1-66, 2009.

92. "Equilibria, Fixed Points, and Complexity Classes", *Computer Science Review*, 3(2), pp. 71-85, 2009.

93. "Small Approximate Pareto Sets for Bi-objective Shortest Paths and Other Problems", (with I. Diakonikolas), *SIAM J. on Computing,* 39(4), pp. 1340-1371, 2009.

94. "An Impossibility Theorem for Price Adjustment Mechanisms", (with C. H. Papadimitriou), *Proc. Nat. Acad. Sci.,* 107(5), pp. 1854-1859, 2010.

95. "On the Complexity of Nash Equilibria and Other Fixed Points", (with K. Etessami), *SIAM J. on Computing,* special issue for 48th FOCS, 39(6), pp. 2531-2597, 2010.

96. "Quasi-Birth-Death Processes, Tree-Like QBDs, Probabilistic 1-Counter Automata, and Pushdown Systems", (with K. Etessami, D. Wojtzak), *Performance Evaluation,* special issue for 5th QEST, 67(9), pp. 837-857, 2010.

97. "Market Equilibrium under Separable Piecewise-Linear Concave Utilities", (with V. Vazirani), *Journal of ACM*, 58(3), 2011.

98. "Model Checking of Recursive Probabilistic Systems" (with K. Etessami), *ACM Trans. on Computational Logic*, 13(2): 12, 2012.

99. "A Note on the Complexity of Comparing Succinctly Represented Integers, with an Application to Maximum Probability Parsing" (with K. Etessami, A. Stewart), *ACM Trans. on Computation Theory*, 6(2):9, 2014.

100. "Recursive Markov Decision Processes and Recursive Stochastic Games" (with K. Etessami), *Journal of ACM*, 62(2):11, 2015.

101. "Upper Bounds for Newton's Method on Monotone Polynomial Systems, and P-time Model Checking of Probabilistic One-Counter Automata" (with K. Etessami, A. Stewart), *Journal of ACM*, 62(4):30, 2015.

102. "How Good is the Chord Algorithm?" (with C. Daskalakis, I. Diakonikolas), *SIAM J. on Computing*, 45(3), pp. 811-858, 2016.

103. "The Complexity of Non-monotone Markets" (with X. Chen, D. Paparas), *Journal of ACM*, 64(3), 20:1-20:56, 2017.

104. "A Polynomial-time Algorithm for Computing Extinction Probabilities of Multi-type Branching Processes" (with K. Etessami, A. Stewart), *SIAM J. on Computing,* 46(5), 1515-1553, 2017.

105. "Greatest Fixed Points of Probabilistic Min/Max Polynomial Equations, and Reachability for Branching Markov Decision Processes" (with K. Etessami, A. Stewart), *Information and Computation* (special issue for ICALP '15), 261, pp. 355-382, 2018.

106. "Power Grid State Estimation Following a Joint Cyber and Physical Attack" (with S. Soltan, G. Zussman), *IEEE Transactions on Control of Network Systems*, 5(1), 499-512, 2018.

107. "The Complexity of Optimal Multidimensional Pricing for a Unit-demand Buyer" (with X. Chen, I. Diakonikolas, D. Paparas, X. Sun), *Games and Economic Behavior*, 110, pp. 139-164, 2018.

108. "Polynomial-time Algorithms for Branching Markov Decision Processes and Probabilistic Min (Max) Polynomial Bellman Equations" (with K. Etessami, A. Stewart), *Mathematics of Operations Research*, to appear.

109. "REACT to Cyber Attacks on Power Grids" (with S. Soltan, G. Zussman), *IEEE Transactions on Network Science and Engineering,* to appear.

110. "Recursive Stochastic Games with Positive Rewards" (with K. Etessami, D. Wojtczak), *Theoretical Computer Science*, to appear.

Conference papers

1. "Node- and Edge-Deletion NP-Complete Problems", *Proc. 10th Annual ACM Symposium on Theory of Computing*, pp. 253-264, San Diego, California, 1978.

2. "Topological Characterizations of Families of Graphs Generated by Certain Types of Graph Grammars", (with T. Pavlidis), *Proc. IEEE Conference on Pattern Recognition and Image Processing*, pp. 269-274, Chicago, Illinois, 1978.

3. "Equivalence among Relational Expressions with the Union and Difference Operators", (with Y. Sagiv), *Proc. 4th Intl. Conf. on Very Large Data Bases*, pp. 535-548, Berlin, Germany, 1978.

4. "The Complexity of Restricted Minimum Spanning Tree Problems", (with C. H. Papadimitriou), *Proc. 6th Intl. Coll. on Automata, Languages and Programming*, pp. 460-470, Austria, 1979.

5. "Locking Policies: Safety and Freedom from Deadlock", (with H. T. Kung and C. H. Papadimitriou), *Proc. 20th Annual Symposium on Foundations of Computer Science*, pp. 286-297, San Juan, Puerto Rico, 1979.

6. "Modeling Communications Protocols by Automata", (with A. V. Aho and J. D. Ullman), *Proc. 20th Annual Symposium on Foundations of Computer Science*, pp. 267-273, 1979.

7. "Sorting the Cartesian Product", (with A. V. Aho and T. G. Szymanski), *Proc. Conference on Information Sciences and Systems*, pp. 557-558, Princeton, New Jersey, 1980.

8. "Algebraic Dependencies", (with C. H. Papadimitriou), *Proc. 21th Annual Symposium on Foundations of Computer Science*, pp. 328-332, Syracuse, New York, 1980.

9. "On a Class of Totally Unimodular Matrices", *Proc. 21th Annual Symposium on Foundations of Computer Science*, pp. 10-16, Syracuse, New York, 1980.

10. "Properties of Acyclic Database Schemes", (with C. Beeri, R. Fagin, D. Maier, A. Mendelzon, J. D. Ullman), *Proc. 13th Annual ACM Symposium on Theory of Computing*, pp. 355-362, Milwaukee, Wisconsin, 1981.

11. "Issues of Correctness in Database Concurrency Control by Locking", *Proc. 13th Annual ACM Symposium on Theory of Computing*, pp. 363-367, Milwaukee, Wisconsin, 1981.

12. "Bounds for Planar Independent Sets", (with C. H. Papadimitriou), *CORS-TIMS-ORSA 1981 Joint National Meeting*, Toronto, Canada, 1981.

13. "Algorithms for Acyclic Database Schemes", *Proc. 7th Intl. Conf. on Very Large Data Bases*, pp. 82-94, Cannes, France, 1981.

14. "Worst-Case Ratios in Planar Graphs and the Method of Induction on Faces", (with C. H. Papadimitriou), *Proc. 22nd Annual Symp. on Foundations of Computer Science*, pp. 358-363, Nashville, Tennessee, 1981.

15. "Independent Database Schemas", (with M. H. Graham), *Proc. 1st ACM Symp. on Principles of Database Systems*, pp. 199-204, Los Angeles, California, 1982.

16. "The Complexity of Facets (and Some Facets of Complexity)", (with C. H. Papadimitriou), *Proc. 14th ACM Symp. on Theory of Computing*, pp. 255-260, San Fransisco, California, 1982.

17. "On Notions of Information Transfer in VLSI Circuits", (with A. V. Aho, J. D. Ullman), *Proc. 15th ACM Symp. on Theory of Computing*, pp. 133-139, Boston, Massachusetts, 1983.

18. "Cutting and Partitioning a Graph after a Fixed Pattern", (with P. C. Kanellakis, S. C. Cosmadakis, C. H. Papadimitriou), *Proc. 10th Intl. Coll. on Automata, Languages and Program*ming, pp. 712-722, Barcelona, Spain, 1983.

19. "A Polynomial Algorithm for the Min Cut Linear Arrangement of Trees", *Proc. 24th Annual Symp. on Foundations of Computer Science*, pp. 274-281, Tucson, Arizona, 1983.

20. "Querying Weak Instances", *Proc. 3rd ACM Symp. on Principles of Database Systems*, pp. 275-280, 1984.

21. "On Monotone Formulae with Restricted Depth", (with M. Klawe, W. Paul, N. Pippenger), *Proc. 16th Annual ACM Symp. on Theory of Computing*, pp. 480-487, 1984.

22. "Deadlock-Freedom (and Safety) of Transactions in a Distributed Database", (with O. Wolfson), *Proc. 4th ACM Symp. on Principles of Database Systems*, pp. 105-112, 1985.

23. "The Complexity of Reliable Concurrency Control", (with C. H. Papadimitriou), *Proc. 4th ACM Symp. on Principles of Database Syste*ms, pp. 230-234, 1985.

24. "How Easy is Local Search?", (with D. S. Johnson, C. H. Papadimitriou), *Proc. 26th Annual Symp. on Foundations of Computer Science*, pp. 39-42, 1985.

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26. "Four Pages are Necessary and Sufficient for Planar Graphs", *Proc. 18th Annual ACM Symp. on Theory of Computing*, pp. 104-108, 1986.

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37. "The Input/Output Complexity of Transitive Closure", (with J. D. Ullman), *Proc. 1990 ACM SIGMOD Intl. Conf. on Management of Data*, pp. 44-53, 1990.

38. "Markov Decision Processes and Regular Events", (with C. Courcoubetis), *Proc. 17th Intl. Coll. Automata, Languages and Programming*, pp. 336-349, 1990.

39. "High Probability Parallel Transitive Closure Algorithms", (with J. D. Ullman), *Proc. 2nd ACM Symp. on Parallel Algorithms and Architectures*, pp. 200-209, 1990.

40. "Memory Efficient Algorithms for the Verification of Temporal Properties", (with C. Courcoubetis, M. Vardi, P. Wolper), *Proc. 2nd Conf. on Computer-Aided Verification*, AMS, pp. 207-218, 1990.

41. "Fundamental Discrepancies Between Average Case Analyses Under Discrete and Continuous Distributions: A Bin Packing Case Study", (with E. G. Coffman Jr., C. Courcoubetis, M. R. Garey, D. S. Johnson, L. A. McGeogh, P. Shor, R. Weber), *Proc. 23rd Annual ACM Symp. on Theory of Computing*, pp. 230-240, 1991.

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43. "Testing Finite State Machines", (with D. Lee), *Proc. 23rd Annual ACM Symp. on Theory of Computing*, pp. 476-485, 1991.

44. "On Datalog vs. Polynomial Time", (with F. Afrati, S. Cosmadakis), *Proc. 10th ACM Symp. on Principles of Database Systems*, pp. 13-25, 1991.

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93. "Efficiently Computing Succinct Trade-off Curves", (with S. Vassilvitskii), *Proc. 31st Intl. Coll. on Automata, Languages, and Programming*, pp. 1201-1213, 2004.

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101. "Probability and Recursion" (invited), (with K. Etessami), *Proc. 16th Intl. Symp. on Algorithms and Computation*, pp. 2-4, Springer-Verlag LNCS 3827, 2005.

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111. "Succinct Approximate Convex Pareto Curves", (with I. Diakonikolas), *Proc. 19th ACM-SIAM Symp. on Discrete Algorithms*, pp. 74-83, 2008.

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113. "Recursive Stochastic Games with Positive Rewards", (with K. Etessami, D. Wojtzak), *Proc. 35th Intl. Coll. on Automata, Languages, and Programming,* pp. 711-723, 2008.

114. "Automata, Probability, and Recursion" (invited), *Proc.13th Intl. Conf. on Implementation and Applications of Automata ,* pp. 23-32, 2008.

115. "Quasi-Birth-Death Processes, Tree-Like QBDs, Probabilistic 1-Counter Automata, and Pushdown Systems", (with K. Etessami, D. Wojtzak), *Proc. 5th Intl. Conf. on the Quantitative Evaluation of Systems,* pp. 243-253, 2008.

116. "Computational Aspects of Equilibria", (invited), *Proc. Symp. Algorithmic Game Theory,* pp. 2-13, 2009.

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118. "How good is the Chord Algorithm?", (with C. Daskalakis and I. Diakonikolas), *Proc.* 21st *ACM-SIAM Symp. on Discrete Alg.,* pp. 978-991, 2010.

119. "Computation of Equilibria and Stable Solutions" (Invited), *Proc. 12th Intl. Symp. on Stabilization, Safety and Security of Distributed Systems*, 2010.

120. "Temporal Synthesis for Bounded Systems and Environments" (with O. Kupferman, Y. Lustig, M. Y. Vardi), *Proc. 28th Intl. Symp. on Theoretical Aspects of Computer Science*, pp. 615-626, 2011.

121. "Polynomial-time Algorithms for Multi-type Branching Processes and Stochastic Context-free Grammars" (with K. Etessami, A. Stewart), *Proc. 44th ACM Symp. on Theory of Computing,* pp. 579-588, 2012.

122. "Polynomial-time Algorithms for Branching Markov Decision Processes and Probabilistic Min(Max) Polynomial Bellman Equations" (with K. Etessami, A. Stewart), *Proc. 39th Intl. Coll. on Automata, Languages, and Programming,* pp. 314-326, 2012.

123. "Computation of Least Fixed Points", (invited), *Proc. 37th Intl Symp. On Math. Foundations of Computer Science,* 2012.

124. "Analysis of Boolean Programs" (with P. Godefroid), *Proc. 19th Intl. Conf. on Tools and Alg. for Analysis and Constr. of Systems,* pp. 214-229, 2013.

125. "The Complexity of Non-Monotone Markets" (with X. Chen, D. Paparas), *Proc. 45th ACM Symp. on Theory of Computing*, pp. 181-190, 2013.

126. "Upper bounds for Newton's method on monotone polynomial systems, and P-time model checking of probabilistic one-counter automata" (with K. Etessami, A. Stewart), *Proc. 25th Intl. Conf. on Computer-Aided Verification",* pp. 495-510, 2013.

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128. "The Complexity of Optimal Multidimensional Pricing" (with X. Chen, I. Diakonikolas, D. Paparas, X. Sun), *Proc. 25th ACM-SIAM Symp.on Discrete Algorithms,* pp. 1319-1328, 2014.

129. "Joint Cyber and Physical Attacks on Power Grids: Graph Theoretical Approaches for Information Recovery" (with S. Soltan, G. Zussman), *Proc. SIGMETRICS,* pp. 361-374, 2015.

130. "Greatest Fixed Points of Probabilistic Min/Max Polynomial Equations, and Reachability for Branching Markov Decision Processes" (with K. Etessami, A. Stewart), *Proc. 42nd Intl. Coll. on Automata, Languages, and Programming,* pp.184-196, 2015.

131. "On the Complexity of Optimal Lottery Pricing and Randomized Mechanisms" (with X. Chen, I. Diakonikolas, A. Orfanou, D. Paparas, X. Sun), *Proc. 56th Symp. on Foundations of Computer Science*, pp. 1464-1479, 2015.

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133. "On the Complexity of Simple and Optimal Deterministic Mechanisms for an Additive Buyer" (with X. Chen, G. Matikas, D. Paparas), *Proc. ACM-SIAM Symp. On Discrete Algorithms,* pp. 2036-2049, 2018.

134. "Passive Static Equilibrium with Frictional Contacts and Application to Grasp Stability Analysis", (with M. Ciocarlie, M. Haas-Heger, G. Iyengar, C. Papadimitriou), *Robotics: Science and Systems,* 2018.

135. "REACT to Cyber-Physical Attacks on Power Grids (Extended abstract)", (with S. Soltan, G. Zussman), *SIGMETRICS Performance Evaluation Review* (special issue on CISN'18), 46(2), pp. 50-51, 2018.

136. "Alembic: Automated Model Inference for Stateful Network Functions", (with S. Moon, J. Helt, Y. Yuan, Y. Bieri, S. Banerjee, V. Sekar, W. Wu, Y. Zhang), *Proc. 16th Usenix Symp. on Networked Systems Design and Implementation (NSDI),* pp. 699-718, 2019.

Patents

1. "Timing Verification by Successive Approximation", (with R. Alur, A. Itai, R. Kurshan), US patent no. 5,483,470 (1996).

2. "Methods And Apparatus For Generating Passive Testers From Properties", (with G. J. Holzmann), U.S. patent no. 6,061,812 (2000).

3. "Model Checking of Hierarchical State Machines", (with R. Alur), U.S. patent no. 6,324,496 (2001).

4. "Model Checking of Message Flow Diagrams", (with R. Alur), US patent no. 6,516,306 (2003).

5. "Directly verifying a black box system", (with D. Peled, M. Y. Vardi), U.S. patent no. 6,526,544, (2003).

6. "Implied Message Sequence Charts", (with R. Alur, K. Etessami), U.S. patent no. 6,681,264 (2004).

7. "Automatic Generation and Regeneration of a Covering Test Case Set from a Model", (with G. J. Holzmann, M. H. Holzmann, J. J. Striegel), U.S. patent no. 6,804,634 (2004).

8. "Incremental update of a shape graph", (with Z. Shen, Q. Lin, J. Xie, P. Xie, Y. Tang, S. Yang, D. Lee), U.S. patent no. 10,021,026 (2018).

Invited Keynote and Distinguished Lectures (selected)

Distinguished Lecture, Rutgers University, 2016

Strachey Distinguished Lecture, Oxford University, 2014

Invited Talk, 37th Intl. Conf. on Math. Foundations of Computer Science, Slovakia, 2012.

Distinguished Lecture, SUNY at Stony Brook, 2012

Invited Keynote, NY Computer Science and Economics Day, 2010

Invited Talk, 12th Intl. Symp. on Stabilization, Safety and Security of Distributed Systems, 2010.

Invited Keynote, 50th Anniversary celebration of IEEE Symp. on Found. of Comp. Sci., 2009

Invited Plenary Talk, 2nd Intl. Symp. on Algorithmic Game Theory, Cyprus, 2009

Distinguished Lecture, University of Illinois at Chicago, 2009

Distinguished Lecture, Toyota Technological Institute, 2009

Distinguished Lecture, University of Illinois at Urbana-Champaign, 2008

Invited Talk, 13th Intl. Conf. on Implementation and Application of Automata, 2008

Invited Plenary Talk, 25th Ann. Symp. on Theor. Aspects of Computer Science, France, 2008

Distinguished Lecture, Simon Fraser University, Canada, 2007

4th Intl. Symp. on Automated Technology for Verification and Analysis, Beijing, China, 2006

2nd Workshop on Internet and Network Economics, Patras, Greece, 2006

4th IFIP Intl. Conf. on Theoretical Computer Science, Santiago, Chile, 2006

Knuth Prize Lecture, 46th IEEE Symp. On Foundations of Computer Science, 2005

Invited Plenary Talk, 16th Intl. Symp. on Algorithms and Computation, China, 2005

Distinguished Lecture, University of Toronto, 2005

Invited Joint Plenary Talk, 31st Intl. Coll. on Aut., Lang. and Progr., and 19th Ann. IEEE Symp. on Logic in Computer Science, Finland, 2004

Annual Milner Distinguished Lecture, University of Edinburgh, 2004

Distinguished Lecture, University of California at Riverside, 2003

Invited Plenary Talk, 5th LATIN American Conf. on Theoretical Informatics, Mexico, 2002

Invited Plenary Talk, 7th Intl. Workshop on Algorithms and Data Structures, 2001

First Kannelakis Memorial Lecture, Brown University, 2001

Distinguished Lecture, University of Pennsylvania, 2001

Distinguished Lecture, University of Texas at Austin, 2001

Invited Talk, IBM-NYU-Columbia Theory Day, 2001

Invited Talk, 1st IFIP Theoretical Computer Science Conf., Japan, 2000

Invited Talk, 3rd International Conf. on Metaheuristics, Brasil, 1999

Distinguished Lecture, University of California, Santa Barbara, 1999

Invited Plenary Talk, Joint Computer Science Logic & Math. Found. of CS Conf, 1998

Distinguished Lecture, Brown University, 1996

Invited Plenary Talk, 36th IEEE Symp. on Foundations of Computer Science, 1995

Distinguished Lecture, University of Maryland, 1995

Invited Plenary Talk, 7th SIAM Conf. on Discrete Mathematics, Albuquerque, 1994

Invited Talk, 2nd Italian Conf. on Algorithms and Complexity, Rome, 1994

Invited Tutorial Talk, 21st Intl. Coll. on Automata, Languages and Programming, Jerusalem, 1994

Invited Talk, 4th Intl. Symp. on Algorithms and Computation, Hong Kong, 1993

Distinguished Lecture, University of Texas at Austin, 1993

Invited Talk, 7th Maryland Theoretical Computer Science Day, 1992

Invited Talk, Symp. on 20th Anniversary of NP-completeness, Italy, 1991

Invited Talk, Columbia Theory Day, 1991

Invited Talk, 7th Symp. on Theoretical Aspects of Computer Science, France, 1990

Invited Talk, 9th ACM Symp. on Principles of Database Systems, Nashville, 1990

Distinguished Cray Lecture, University of Minnesota, 1989

Many other invited talks at universities and workshops.