John E. Savage

Curriculum Vitae
January 2018

1. Personal

An Wang Professor
Department of Computer Science
Brown University
Providence, RI 02912

Date of Birth: September 19, 1939

2. Home Address

65 Humboldt Avenue
Providence, RI 02906

3. Education

Sc.B. and Sc.M. (joint degree), Electrical Engineering, M.I.T., 1962 (Class of 1961)

Ph.D., Electrical Engineering, M.I.T., 1965

Ph.D. Thesis: *The Computation Problem with Sequential Decodin*g

4. Academic Honors, Fellowships, and Honorary Societies

2014	Professorial Fellow, EastWest Institute, New York
2011	An Wang Professor of Computer Science
2009-2010	Jefferson Science Fellowship, US State Department
2009	President's Award for Excellence in Faculty Governance, Brown University
2004	Life Fellow, IEEE
1997	Fellow, AAAS
1996	IEEE Golden Core Member
1996	Fellow, ACM
1992	Fellow, IEEE
1991	Senior Member, IEEE
1973-1974	Guggenheim Fellowship
1973-1974	Fulbright-Hays Research Award
1961-1962	N.S.F. Cooperative Graduate Fellow
1961	Sigma Xi
1960	Eta Kappa Nu
1960	Tau Beta Pi
1958-1961	M.B.E.A. Scholarship
1958-1961	M.I.T. Melvin Scholarship
1957-1961	Fond Scolaire, Jean-Baptiste Parent

5. Awards

2012	Zachariah Allen Award for outstanding contributions to the Brown Faculty Club.

6. Professional Appointments

2017-	Member of the Board of Directors of the Michael Dukakis Institute and Cybersecurity Director
2017	Cyber Rhode Island Advisory Committee to Congressman Langevin
2014-	Professorial Fellow, EastWest Institute, New York
2010-	Member, IC Associates Program, National Intelligence Council
1985-1991	Chair, Department of Computer Science, Brown University
1979-2011	Professor of Computer Science, Brown University
1976-1979	Professor of Computer Science and Engineering, Brown University
1974-1976	Professor of Engineering, Brown University
1970-1974	Associate Professor of Engineering, Brown University
1967-1970	Assistant Professor of Engineering, Brown University
1967	Lecturer in Electrical Engineering, Columbia University, teaching Information Theory
1965	Instructor, Introductory Scientific French, Bell Telephone Laboratories' Out of Hours Program
1965-1967	Member of Technical Staff, Bell Telephone Laboratories, Holmdel, NJ
1964	Graduate Instructor, Modulation Theory and Systems, M.I.T. Electrical Engineering Department, Cambridge, MA
1964	Graduate Instructor, Signals and Systems, M.I.T. Electrical Engineering Department, Cambridge, MA
1962-1965	Research Assistant, Research Laboratory of Electronics, M.I.T., Cambridge, MA
1963	Summer Employee, M.I.T. Lincoln Laboratory, Lexington, MA
1962	Summer Employee, Sylvania Applied Research Laboratory, Waltham, MA
1961	Bell Telephone Laboratories, M.I.T. Cooperative Program: North Andover, MA
1960	Bell Telephone Laboratories, M.I.T. Cooperative Program: Whippany, NJ
1959-1960	Bell Telephone Laboratories, M.I.T. Cooperative Program: Murray Hill, NJ

7. Sabbatical and Other Leaves

2014	Brown University
2008	Brown University
2004-2005	Ecole Polytechnique, France and Brown University
1994-1995	Brown University
1991-1992	University of Warwick, Coventry, England
1980-1981	Université Paris-Sud, Orsay, France, and INRIA, Institut National de Recherche en Informatique et en Automatique, Rocquencourt, France
1973-1974	Department of Mathematics, Technical University of Eindhoven, Netherlands

Consultancies

2010-	Member, IC Associates Program
2004	Testa, Hurwitz & Thibeault on intellectual property
1995	Greenberg & Mamorstein on intellectual property
1987-1988	Morgan & Finnegan on patent law
1986	Fish & Richardson on Telecommunications
1982-1985	Davis, Hoxie, Faithful and Hapgood on Computer Technology
1977-1979	US Army BMDATC (Batelle) on Distributed Computing, Software Methodology
1976-1977	UC Riverside on Concrete Complexity Theory

1972	MIT Lincoln Lab., Cambridge, MA on Communications for Air Traffic Control
1971	Sanders Associates on Coding for Error Control
1969-1974	Jet Propulsion Laboratory on Coding and Complexity
1968-1969	IBM Federal System Division on Sequential Decoding
1967-1968	Codex Corporation on High-Speed Data Communications

8. Congressional Testimony

2011   "The Technology/Policy Intersection," in the Hearing of the Senate Judiciary Committee, Subcommittee on Crime and Terrorism entitled **Cyber Security: Responding to the Threat of Cyber Crime and Terrorism**, April 12, 2011.

9. Publications

Books

The Complexity of Computing, Wiley-Interscience, 1976; reissued by Krieger, 1987.; Russian translation by Factorial, Moscow, 1998.

The Mystical Machine (with S. Magidson and A. Stein), Addison-Wesley, 1986.

Advanced Research in VLSI and Parallel Systems (edited with T. Knight), MIT Press, 1992.

Models of Computation: Exploring the Power of Computing, Addison Wesley, 1998.

Articles or Chapters in Books

"History and Contributions of Theoretical Computer Science," (with A. Selman and C. Smith), *Advances in Computers*, M. Zelkowitz, Editor, Academic Press, Volume 55 (2001).

``Extending the Hong-Kung Model to Memory Hierarchies,'' in *Computing and Combinatorics*, e.d. Ding-Zhu Du and Ming Li, pp. 270-281, Lecture Notes in Computer Science, Springer Verlag, vol. 959 (1995).

"On Parallelizing Graph Partitioning Heuristics" (with M.G. Wloka), *Proceedings of the 17th International Colloquium on Automata, Languages, and Programming*, ed. M.S. Paterson, Warwick, England (July 1990), pp. 476-489, Lecture Notes in Computer Science, vol. 443 Springer- Verlag, Coventry (1990).

"A Parallel Algorithm for Channel Routing" (with M.G. Wloka), in *Graph-Theoretic Concepts in Computer Science*, ed. J. van Leeuwen, pp. 288-303, Lecture Notes in Computer Science, vol. 344, Springer-Verlag, Amsterdam (1988).

"Three VLSI Compilation Techniques: PLA's, Weinberger Arrays, and SLAP, A New Silicon Layout Program," in *Algorithmically Specialized Parallel Computers*, ed. L. Snyder, L. H. Jamieson, D. B. Gannon, and H. J. Siegel, Academic Press, pp. 17-26 (1985).

"Planar Circuit Complexity and the Performance of VLSI Algorithms," in *VLSI Systems and Computations*, ed. Kung, Sproull and Steele, Computer Science Press, pp. 61-68 (1981).

"Space-Time Tradeoffs for Oblivious Integer Multiplication" (with S. Swamy), in *Lecture Notes in Computer Science*, **71** ed. H.A. Maurer, pp. 498-504, Springer-Verlag, Berlin, Heidelberg, New York (July 1979).

"Computational Work and Time," *Courant Computer Science Symposium 7: Computational Complexity*, Randall Rustin (Ed.), pp. 42-49, Algorithmics Press (1972).

"Progress in Sequential Decoding," in Vol. III of *Advances in Communication Systems*, Academic Press, edited by A. V. Balakrishnan, pp. 149-204 (June 1968).

Journal Articles

"Upper and Lower I/O Bounds for Pebbling *r*-Pyramids," (with D. Ranjan and M. Zubair), *Journal of Discrete Algorithms*, Vol. 14, pp. 2-12, 2012.

"Cache-Optimal Algorithms for Option Pricing," (with M. Zubair), *ACM Transactions on Mathematical Software*, Vol. 17, No. 1, pp. 1-30 (2010).

"Evaluating Multicore Algorithms on the Unified Memory Model," (with M. Zubair), *Scientific Programming*, Vol. 17 Issue 4, pp. 295-308 (2009).

"Nanowire Addressing with Randomized-Contact Decoders" (with E. Rachlin), *Theoretical Computer Science*, Vol. 408, Issues 2-3, pp. 241-261 (October 2008).

"Analysis of a Mask-Based Decoder," (with Eric Rachlin), *IEEE Transactions on Computers*, Vol. 57, No. 2, pp. 175-187, February 2008.

"Radial Addressing of Nanowires," (with Eric Rachlin, André DeHon, Charles M. Lieber, and Yue Wu), *ACM J. on Emerging Technologies in Computing Systems*, Vol. 2, No. 2, pp. 129-154, April 2006.

"Evaluation of Design Strategies for Stochastically Assembled Nanoarray Memories," (with Benjamin Gojman and Eric Rachlin), *ACM J. on Emerging Technologies in Computing Systems*, Vol. 1, No. 2, pp. 73-108 (2005).

"Efficient Data Storage in Large Nanoarrays," (with Lee-Ad Gottlieb and Arkady Yerukhimovich), *Theory of Computing Systems*, Vol 38, pp. 503-536 (2005).

"Stochastic Assembly of Sublithographic Nanoscale Interfaces," (with André DeHon and Patrick Lincoln), *IEEE Transactions in Nanotechnology*, Vol 2, No. 3, pp. 165-174 (September 2003).

"Generalized Scans and Tri-Diagonal Systems," (with P.F. Fischer and F.P. Preparata), *Theoretical Computer Science 255*, pp. 423-436 (2001).

"Parallelism in Graph-Partitioning" (with M.G. Wloka), *Journal of Parallel and Distributed Computing*, **13**, pp. 257-272 (November 1991).

"Parallelism in Space-Time Trade-Offs" (with J.S. Vitter), in *Advances in Computing Research*, **4**, pp. 117-146, JAI Press Inc., Greenwich, CT (1987).

"The Performance of Multilective VLSI Algorithms," in *Journal of Computer and Systems Sciences*, **29** (2), pp. 243-273 (October 1984).

"Space-Time Tradeoffs for Banded Matrix Problems," *Journal of the ACM*, **31** (2), pp. 422-437 (April 1984).

"Size-Space Tradeoffs for Oblivious Computations" (with D. Carlson), in *Journal of Computer and Systems Science*, **26** (1), pp. 65-81 (February 1983).

"Design Synthesis in VLSI and Software Engineering" (with R. Cuykendall, A. Domic, W.H. Joyner, S. Johnson, S. Kelem, D. McBride, J. Mostow, and G. Saucier) in *Journal of Systems and Software*, **4** (1), pp. 7-12 (April 1984).

"Space-Time Tradeoffs for Linear Recursion" (with S. Swamy), in *Mathematical Systems Theory Journal*, **16**, pp. 9-27 (1983).

"Extreme Time-Space Tradeoffs for Graphs with Small Space Requirements" (with D. Carlson), in *Information Processing Letters*, **14** (5), pp. 223-227 (July 1982).

"Area-Time Tradeoffs for Matrix Multiplication and Related Problems in VLSI Models," in *Journal of Computer and Systems Sciences*, **22** (2), pp. 230-242 (April 1981).

"Lower Bounds on Synchronous Combinational Complexity" (with L.H. Harper), in *SIAM Journal on Computing*, **8**(2), pp. 115-119 (May 1979).

"Space-Time Tradeoffs on the FFT Algorithms" (with S. Swamy), in *IEEE Transactions on Information Theory*, **IT-24**, pp. 563-568 (September 1978).

"Processing Power and Delay – Limits on Human Performance" (with G.R. Kiss), *Journal of Mathematical Psychology*, **16** (1), pp. 68-90 (August 1977).

"A Class of Boolean Functions with Linear Combinational Complexity" (with L.H. Harper and W.N. Hsieh), in *Theoretical Computer Science* **1** (2) (1976).

"Sorting X + Y" (with L.H. Harper, T.H. Payne and E. Strauss), *Communications of the ACM*, **18** (6), pp. 347-349 (June 1975).

"An Algorithm for the Computation of Linear Forms," *SIAM Journal of Computing*, **3** (2), pp. 150-158 (June 1974).

"Signal Detection in the Presence of Multiple-Access Noise," *IEEE Transactions on Information Theory*, **IT-20** (1), pp. 42-49, (January 1974).

"On the Complexity of the Marriage Problem" (with L.H. Harper), *Advances in Mathematics*, **9** (3), pp. 299-312 (December 1972).

"Computational Work and Time on Finite Machines," *Journal of the Association for Computing Machinery*, **19** (4), pp. 660-674, (October 1972).

"The Complexity of Decoders – Part II: Computational Work and Decoding Time," *IEEE Transactions on Information Theory*, **IT-17** (1), pp. 77-85 (January 1971).

"A Note on the Performance of Concatenated Coding," *IEEE Transactions on Information Theory*, **IT-16** (4), pp. 512-513 (July 1970).

"Three Measures of Decoder Complexity," *IBM Journal of Research and Development*, **14** (4), pp. 417-425, (July 1970).

"The Complexity of Decoders – Part I: Decoder Classes," *IEEE Transactions on Information Theory*, **IT-15** (6), pp. 689-694 (November 1969).

"Minimum Distance Estimates of the Performance of Sequential Decoding," *IEEE Transactions on Information Theory*, **IT-15** (l), pp. 128-140 (January 1969).

"Some Simple Self-Synchronizing Digital Data Scramblers," *Bell System Technical Journal*, **XLVI** (2), pp. 449-487 (February 1967).

"The Distribution of the Sequential Decoding Computation Time," *IEEE Transactions on Information Theory*, **IT-12** (2), pp. 143-148 (April 1966).

"A Bound on the Reliability of Block Coding with Feedback," *Bell System Technical Journal*, **XLV** (6), pp. 967-978 (July-August 1966).

"Sequential Decoding – The Computation Problem," *Bell System Technical Journal*, **XLV**, pp. 149-175 (January 1966).

Papers in Refereed Conference Proceedings

"Strong I/O Lower Bounds for Binomial and FFT Computation Graphs," (with Desh Ranjan and Mohammad Zubair), Procs. COCOON, August 2011 (Dallas).

"Upper and Lower I/O Bounds for Pebbling *r*-Pyramids," (with Desh Ranjan and Mohammad Zubair), Procs. IWOCA 2010, Combinatorial Algorithms, Lecture Notes in Computer Science, Volume 6460. ISBN 978-3-642-19221-0. Springer Berlin Heidelberg, 2011, p. 107.

"Stochastic Nanoscale Addressing for Logic," (with Eric Rachlin), *Proceedings of NANOARCH 2010,* June 2010 (Anaheim, CA).

"A Unified Model for Multicore Architectures," (with Mohammad Zubair), Procs. 1st Int. Forum on Next-Generation Multicore/Manycore Techns., Nov. 24-25, 2008. (Cairo, Egypt).

"A Framework for Coded Computation," (with Eric Rachlin), Procs. IEEE Intl. Symp. On Information Theory, pp. 2342-2346, July 6-11, 2008.

"Nanowire Addressing with Randomized Contact Decoders," (with Eric Rachlin), Proceedings of the IEEE/ACM Int. Conf. on Computer-Aided Design (ICCAD), pp. 735-742, (Oct. 2006).

"Addressing in the Face of Uncertainty," (with Eric Rachlin), *Proceedings of the International Symposium on VLSI*, pp. 225-230 (March 2006).

"Analysis of a Mask-Based Decoder," (with Eric Rachlin and Benjamin Gojman), *Proceedings of the 2005 Int. Symp. on VLSI*, pp. 6-13, (May 11-12, 2005).

"Crossbar Addressing Using Core-Shell Nanowires," (with Eric Rachlin), *Proceedings of TECHCON 2005,* Semiconductor Research Corporation (October 24-26, 2005).

"Realizing Stochastically Assembled Nanoarrays," Procs. 2004 Asilomar Conf. on Signals, Systems and Computers (Nov. 2004).

"Decoding of Stochastically Assembled Nanoarrays," (with Benjamin Gojman and Eric Rachlin), *Proceedings of the 2004 Int. Symp. on VLSI*, , pp. 11-18 (February 19-20, 2004).

"Sub-lithographic Semiconductor Computing Systems," (with André DeHon, Charles M. Lieber, and Patrick Lincoln), *Proceedings of HotChips*, Vol. 15 (2003).

"Repartitioning Unstructured Adaptive Meshes," (with Jose Castaños) Procs. 2000 Int. Symp. Parallel and Distributed Proc., Cancun, Mexico (May 1-5, 2000).

"Parallel Refinement of Unstructured Meshes," (with Jose Castaños) Procs. IASTED Conference on Parallel and Distributed Computing and Systems (PDCS'99), (Nov. 3-6, 1999).

"PARED: A Framework for the Adaptive Solution of PDEs," Procs. Eighth IEEE Int. Symp. High Performance Distributed Computing (HPDC'99) (August 3-6, 1999).

"Challenges for Theory of Computing: Report of an NSF-Sponsored Workshop on Research in Theoretical Computer Science," (with A. Condon, H. Edelsbrunner, E. A. Emerson, L. Fortnow, S. Haber, R. Karp, D. Leivant, R. Lipton, N. Lynch, I. Parberry, C. Papadimitriou, M. Rabin, A. Rosenberg, J. Royer, J. Savage, A. Selman, C. Smith, E. Tardos, J. Vitter), SIGACT News, June 1999.

"The Dynamic Adaptation of Parallel Mesh-Based Computation," (with Jose Castaños), Procs. Eighth SIAM Conference on Parallel Processing for Scientific Computing (March 1997).

"Strategic Directions for Research in Theory of Computing," (with A. Condon, F. Fich, G. N. Frederickson, A. V. Goldberg, D. S. Johnson, S. Mahaney, P. Raghavan, A. Selman, D. B. Shmoys) Computing Surveys, vol. 28, no. 4, December, 1996.

"Generalized Scans and Tri-Diagonal Systems," (with P.F. Fischer and F.P. Preparata), in *Procs. 12th Ann. Symp. on Theoretical Aspects of Computer Science (STACS'95),* Munich, pp.168-180 (March 2- 4, 1995)).

"A Model for Multi-Grained Parallelism," *Procs. 6th Annl. ACM Symp. on Parallel Algorithms and Architectures*, pp. 330-335, Cape May, NJ (June 27-29, 1994).

"The Parallel Complexity of a Minimizing Column Conflicts" (with M.G. Wloka), *Proceedings of the Second Great Lakes Symposium on VLSI*, pp. 30-34 (February 28-29,1992).

"Parallel Graph-Embedding Heuristics" (with M.G. Wloka), *Proceedings of the 5th SIAM Con-*

ference on Parallel Processing for Scientific Computing (1991).

"Parallelizing SA For Graph Embedding Is Hard" (with M.G. Wloka), *Proceedings of the IMACS World Congress on Computation and Applied Mathematics, Special Session on Simulated Annealing*, vol. 2, pp. 818-823, Dublin (July 22-26, 1991).

"DECO – A Device Compilation System" (with B.A. Dalio), in *Proc. International Workshop on Logic and Architecture Synthesis for Silicon Compilation*, (1989).

"The Crossing Number for Neural Networks" (abstract only) (with D.A. Durfee), in *Proc. Int. Joint Conf. on Neural Networks*, San Diego, CA (June 1989).

"Parallel Constraint Graph Generation" (with M.G. Wloka), in *Proc. Decennial Caltech Conf. on VLSI*, MIT Press, Cambridge, MA, pp. 241-259 (March 1989).

"Parallelism in Space-Time Tradeoffs" (with J. S. Vitter), in *VLSI: Algorithms and Architectures*, Proc. International Workshop on Parallel Computing and VLSI, Amalfi, Italy, May 23-25, 1984, ed. P. Bertolazzi and F. Luccio, Elsevier Science Publishers, pp. 49-58 (1985).

"Heuristics for Graph Embeddings Using Level Graphs," in *Proceedings of the WG'83 International Workshop on Graphtheoretic Concepts in Computer Science*, ed. M. Nagl, J. Perl, pp. 307- 318 (June 16-18, 1983).

"Heuristics in the SLAP Layout System," in *Proceedings of the IEEE International Conference on Computer Design: VLSI in Computers*, pp. 637-640 (October 1983).

"Multilective Planar Circuit Size," in *Procs. 20th Annual Allerton Conf. on Communication, Control, and Computing*, pp. 665-671 (October 6-8, 1982).

"SLAP – A Methodology for Silicon Layout" (with S. P. Reiss), in *Procs. Int. Conf. on Circuits and Computers*, IEEE, pp. 281-285 (September 28 - October 1, 1982).

"Design Synthesis and Measurement" (with R. Cuykendall, A. Domic, W.H. Joyner, S. Kelem, D. McBride, J. Mostow, and G. Saucier), in IEEE 1982 Workshop Report on VLSI and Software Engineering Workshop, Port Chester, NY, pp. 6-9 (October 4-6, 1982).

"Space-Time Tradeoffs – A Survey," in *Proceedings Third Hungarian Conference on Computer Science*, Budapest (January 1981).

"Graph Pebbling with Many Free Pebbles Can Be Difficult" (with D. Carlson), in *Proceedings 12th Annual ACM Symposium on Theory of Computing*, pp. 326-332, Los Angeles, CA (April 28- 30, 1980).

"Area-Time Tradeoffs for Matrix Multiplication and Related Problems in VLSI Models," in *Procs. 17th Annual Allerton Conf. on Communication, Control, and Computing*, pp. 670-676 (October 10-12, 1979).

"Space-Time Tradeoffs for Linear Recursion" (with S. Swamy), in *Proceedings 6th Annual ACM Symposium on Principles of Programming Languages*, pp. 135-142, San Antonio, TX (January 1979).

"A Computational Inequality and Storage-Time Tradeoffs," in *Theorie des Algorithmes des Langages et de la Programmation*, Seminaires INRIA, pp. 59-84, (October 1976).

"The Complexity of Decoders," in *Coding and Complexity*, Lecture Notes of the Centre International des Sciences Mecaniques, Udine, Italy (1976).

"Combinational Complexity of Some Monotone Functions" (with E.A. Lamagna), *Proceedings, 15th Annual Symposium on Switching and Automata Theory* , pp. 140-144, (October 1974).

"Complexity Made Simple" (with L. H. Harper), *Proceedings of the International Symposium on Combinatorial Theory*, Rome, Italy (September 2-15, 1973).

"Bounds on the Performance of Computing Systems," *Proceedings of the Seventh Annual Symposium on Computer Science and Statistics* (October 18-19, 1973).

"Some Thoughts About Locality in Program Behavior" (with P. Denning and J. Spirn), *Proceedings of Symposium on Computer-Communications Networks and Traffic*, pp. 101-112, (April 1972).

"Decision Rules for a Two-Channel Deep Space Telemetry System" (with S. Butman and U. Timor), *Proceedings of the International Conference on Communication* (June 15, 1971).

"Some Remarks on the Complexity of Source Encoders," *Proceedings Fourth Annual Princeton Conference on Information Sciences and Systems*, summary only (March 1970).

"Some Comments on the Computation Time and Complexity of Algorithms," *Proceedings of 1969 Princeton Conference on Information Sciences and Systems*, summary only.

Articles Published Online

"Principles for a Cyber Defense Strategy," by Derek S. Reveron, Jacquelyn Schneider, Michael Miner, John Savage, Allan Cytryn, and Tuan Ahn Nguyen, the Boston Global Forum, December 12, 2017.

"Action Plan to Block Cyberattacks in Vietnam," a report produced by the Boston Global Forum for the Government of Vietnam by Allan Cytryn and John E. Savage, August 2016.

"Promoting International Cyber Norms: A New Advocacy Forum," A Report from the EastWest Institute Breakthrough Group on **Promoting Measures of Restraint in Cyber Armaments,** by Greg Austin, Bruce McConnell, and Jan Neutze with contributions from Shen Yi and John Savage, December 2015.

"Exploring Multi-Stakeholder Internet Governance," (with Bruce McConnell) EastWest Institute, January 20, 2015.

Contributed to "Frank Communication and Sensible Cooperation to Stem Harmful Hacking," by Karl Frederick Rauscher and Zhu Yonglin, published by the EastWest Institute (December 6, 2013).

"Stewardship of Cyberspace: Duties for Internet Service Providers," (with Melissa Hathaway), **CyberDialogue2012 Conference**, Canada Centre for Global Security Studies, Munk School of Global Affairs, University of Toronto (March 2012).

"On Cyber Peace," (with Les Bloom), Issue Brief of the Cyber Statecraft Initiative, Atlantic Council, (August 8, 2011).

Poster Presentation

"Modeling and Analysis of a Membrane-Based Randomized-Contact Decoder," (with J. Long), Procs. NSTI-Nanotech 2008, Vol.3, pp. 80-83 (June 1-5, 2008).

Book Reviews

Cohabiting with Computers, edited by J.F. Traub, William Kaufman, Inc., 1985, in *Spectrum* (December 1985), also in *McClure Center Magazine* (Fall/Winter 1985).

Probabilistic Information Theory - Discrete and Memoryless Models, by Frederick Jelenik, McGraw-Hill (1968) 609 + vii pages, in *Information and Control*, Academic Press, New York (December 1968).

Opinion Pieces

"Revisions in Faculty Governance," Faculty Bulletin, Brown University, 2003.

"A Time of Renewal for Faculty Governance," Faculty Bulletin, Brown University, May, 2002.

"Budgetary Priorities for Brown," Faculty Bulletin, Brown University (April, 1999).

"A New Approach to the First Theory Course," SIGACT News, vol. 29, no. 4, December, 1998.

"Will Computer Science Become Irrelevant?," ACM Computing Surveys, pp. 35-37 (March, 1995).

"Brown's Financial Condition: Crisis Ahead?," (with W. Poole), Faculty Bulletin, Brown University (January, 1995).

"Why NSF should Not Change its Approach to HPCCC/NII Research," *Developing a Computer Science Agenda for High-Performance Computing*, ACM Press (1994).

"We Need the 'Goose' of Basic Research to Get the 'Golden Egg' Payoff," George Street Journal, Vol 18, No. 22 (May 27, 1994).

"In science, to be too practical may be perilously impractical," The Providence Sunday Journal, (May 8, 1994).

Published Interview

"Silver Bullet talks with John Savage," IEEE Privacy and Security Magazine, July/August 2011

Invited Presentations and Meetings

Discussant for the session on *Promoting Norms of Responsible Behavior in Cyberspace*, EastWest Roundtable, September 6-7, 2017.

Cyberspace Policy and Technology, Sarah and John Graves Distinguished Cybersecurity Lecture, University of Tulsa, Tulsa, OK, October 14, 2016.

Participant, Munich Security Conference's Cyber Security Summit, Stanford, CA, September 19-20, 2016.

The Ethics Code of Conduct for Cyber Peace and Security (ECCC), Global Citizenship Education in Cyber Civil Defense, Joint BGF-Unesco-at-UCLA Conference, September 23, 2016.

A G7 Cybersecurity Agenda, Boston Global Forum, February 22, 2016.

Member, The McCain-Whitehouse US Congressional Delegation, Munich Security Conference, Munich, Germany, February 12-14, 2016.

Panelist, *Cyberspace Governance Forum*, 2nd World Internet Conference (Wuzhen Summit), Wuzhen, Zhejiang, China, December 16-18, 2015.

Panelist, Mechanics of Cyber Deterrence, "Cyber Deterrence: What is Really Required?", an exchange organized by the Department of State and the National Intelligence Council, Washington, DC, November 5, 2015.

Panelist, Internet Governance, CyFy, the India Conference on Cyber Security and Internet Governance, New Delhi, India, October 14-16, 2015.

Chair, Breakthrough Group on Governing and Managing the Internet, Cyberspace Cooperation Summit, EastWest Institute, New York, September 9 and 10, 2015.

Participant, Munich Security Conference Roundtable, New York, September 8, 2015

Panelist, Report of the Breakthrough Group on Governing and Managing the Internet, Global Cooperation in Cyberspace Roundtable, EastWest Institute, Hewlett Foundation, Menlo Park, May 28, 2015.

Panelist, Report of the Breakout Group on Multi-Stakeholder Governance, 2015 IEEE Experts in Technology and Policy Forum (ETAP), San Jose CS, May 18, 2015.

Exploring Multi-Stakeholder Internet Governance, presented at the Ninth International Forum organized by the International Information Security Research Consortium at Lomonosov Moscow State University held in Garmisch-Partenkirchen, Germany, April 20-23, 2015.

The Cyberspace Challenge, presented at the AAAS 2015 Annual Meeting Panel on the Future of Computing entitled *Engineering Information: Adapting to Risk and Resilience Frameworkds to Cybersecurity*, San Jose CA, February 13, 2015.

Exploring Multi-Stakeholder Internet Governance, presented at the EastWest Institute's Cyberspace Cooperation Summit V, Berlin, December 3-6, 2014.

A New Course on Cybersecurity and International Relations, Panel Discussant: Changes on Campus!, Jefferson Science Fellows Program 10 Year Event, July 15, 2014.

Exploring the Limits of Multi-Stakeholder Governance, Bureau of Intelligence and Research, Department of State and the National Intelligence Council, July 10, 2014.

Discussion Leader on two panels, a) Enhancing Global Access to Secure Products and Services and b) Governing and Managing the Internet, on the EastWest Institute's working roundtable on *Pathways to Improve Global Cooperation in Cyberspace*, June 16-17, 2014.

Cyber Norms Workshop 2014, Panelist on Governance and New Institutions for Cyberspace and Panelist on Norms and Practices to Balance Data Protection and Security Needs, MIT, Cambridge, MA, April 7-8, 2014.

A Personal Odyssey Through Cyberspace, Ivy Chief Information Security Officers Meeting, Brown University, November 14, 2013.

Policy for Secure Cloud Enablement joint with Royal Hansen, Goldman Sachs, presented at the EastWest Institute's World Cyberspace Cooperation Summit IV, Stanford, November 4-6, 2013

Are Privacy and Security Possible in Cyberspace?, Brown Faculty Club, September 12, 2013.

Cyberspace Technologies and Policy, Roger Williams Law School Summer Institute, June 7, 2013.

Cybersecurity: The Intersection of Policy and Technology, Keynote Luncheon Address, Second Annual Conference, Advanced Cyber Security Center, Boston, MA, November 15, 2012.

Cyber Norms Workshop 2012, Panelist on Evolution of Western Internet Governance, MIT, Cambridge, MA, September 12-14, 2012.

Cyber Doctrine Workshop, Member, Core Group, Battelle Institute, Virginia Beach, VA, June 7-10, 2012.

Cybersecurity and the Law, Panel Presentation, USENIX Hot Topics in Cyber Law, Boston, MA, June 12, 2012.

Cyber Norms Workshop 2011, Panelist on Cybercrime, MIT, Cambridge, MA, October 20 and 21, 2011.

The Cyberspace Threat, NATO TIDE Sprint Workshop on Cyber Defense, Virginia Breach, VA, October 26, 2011.

The Cyberspace Threat, NATO Allied Command Transformation, Norfolk, VA, October 12, 2011.

Cyber Theft of Intellectual Property, Cyber Theft of Intellectual Property Conference, CENTRA, Arlington, VA, September 9, 2011.

The Intersection of Technology and Policy in Cyberspace, National Intelligence Council, March 31, 2011.

Cyberspace – Taming the Wild West, Department of Statistics and Computer Science, University of Rhode Island, March 30, 2011.

Challenges for Cyber Security, National Intelligence Council workshop entitled "Geopolitical Implications of Global Advances in Information and Communication Technologies through 2020," October 5, 2010.

Is the Internet a Commons: A Technological Perspective, US State Department Conference entitled "Is Cyberspace Different? Traditional Frameworks in a New International Space," Meridian International Center, September 22, 2010.

Cyberspace – Taming the Wild West, Distinguished Lecture, National Science Foundation, May 12, 2010.

A Framework for Coded Computation, Institute for Defense Analysis, May 10, 2010 (Bowie, MD).

Cyberspace – Taming the Wild West, Distinguished Lecture, Department of Computer Science, Brown University, April 29, 2010.

Cyberspace – Taming the Wild West, Jefferson Science Fellow Distinguished Lecture, US State Department, April 12, 2010.

Bounds on the Theoretical Efficiency of Multicore Cache Hierarchies, 1st Int. Forum on Next-Generation Multicore/Manycore Techns., Nov. 24-25, 2008. (Cairo, Egypt).

Probabilistic Models for Nanoscale Computation, Old Dominion University, Oct. 17, 2008.

Computing at the Nanoscale, 23rd IEEE Int. Symp. on Defect and Fault Tolerance in VLSI Systems (DFT'08), Oct. 3, 2008.

Nanotechnology – The Technology of the Ultra Small, Artemis Program, Computer Science Department, Brown University, June 27, 2008

Computing with Stochastically Assembled Nanoscale Devices, University of Connecticut, Mar. 28, 2008.

Computing with Stochastically Assembled Nanoscale Devices, University of Texas, Austin, Feb. 15, 2008.

Nanowire Decoders, Keynote Address, Workshop on NSF Nanoelectronics: Circuits, Systems, and CAD Tools, Arlington, VA October 16, 2007.

Nanotechnology: The Technology of the Ultra Small, Post and Telecommunications Institute of Technology, Ho Chi Minh City, Vietnam, August 10, 2007.

Nanotechnology – The Technology of the Ultra Small, Artemis Program, Computer Science Department, Brown University, June 29, 2007.

Addressing Self-Assembled Nanoarrays, Computer Science Seminar, Purdue University, June 18, 2007.

Specification and Analysis at the Nanoscale, presented at Dagstuhl Seminar N° 06361, **Computing Media and Languages for Space-Oriented Computation**, organized by A. DeHon (CalTech - Pasadena, US), J.-L. Giavitto (Univ. of Evry, FR), F. Gruau (Univ. Paris

Sud, FR), September 6, 2006.

Analysis of Architectures for Stochastically Assembled Arrays, Workshop entitled *Exploiting Nanoscale Devices for Future Computing*, International Conference on Computer Aided Design (ICCAD), November 6, 2005.

Computational Nanotechnologies, International University, Vietnam National University, Ho Chi Minh City, Vietnam June 10, 2005.

Computational Nanotechnologies, University of Technology, Ho Chi Minh City, Vietnam, June 10, 2005.

"Defects and Randomness in Nanotechnologies," *Information Science and Technology Workshop on the Law of Large Numbers Systems Design* (March 10, 11, 2005).

Realizing Stochastically Assembled Nanoarrays, Procs. 2004 Asilomar Conf. on Signals, Systems and Computers, Nov. 2004.

Models of Computation and *Universality*, Computing Beyond Silicon Summer School, Caltech, June 16 and 17, 2004.

Computing with Electronic Nanotechnologies, 5th Italian Conference on Algorithms and Complexity, Rome, Italy, May 28-30, 2003.

Repartitioning for Unstructured Adaptive Meshes, Sendai University, March 1, 2001.

Repartitioning for Unstructured Adaptive Meshes, Kyoto University, February 26, 2001.

The Role of Theory in Computer Science, Class of 1960's Scholar, Williams College, April 6, 1995.

Integrating Parallelism into the First Theory Course, NECUSE Forum on Parallel Computing Curricula, Wellesley College, March 31, April 1, 1995.

Will Computer Science Become Irrelevant?, Panelist on panel *Is Computer Science Obsolete*, ACM 1995 Computer Science Conference, March 1, 1995.

Heterogeneous Supercomputing, SuperTech Seminar, LCS, MIT, April 6, 1994.

Limits on Heterogeneous Supercomputing, ONR International Workshop on Models for High-Performance Computing, Warsaw, Poland, May 24-26, 1993.

VLSI Analysis, Synthesis and Theory, British Colloquium on Theoretical Computer Science, Newcastle, England, March 24, 1992.

Parallelizing Graph Embedding Heuristics, Department of Mathematics and Computer Science, The University of Wales, Swansea, February 20, 1992.

Parallelizing Graph Embedding Heuristics, Department of Computer Science, The University College of Wales, Aberystwyth, February 17, 1992.

Parallelizing Graph Embedding Heuristics, Department of Computer Science, Christian-Albrecht University, Kiel, Germany, November 29, 1991.

Parallelizing Graph Embedding Heuristics, Department of Computer Science, University of Warwick, Coventry, October 29, 1991.

Living in the Computer Age, The Brown and Pembroke Clubs of Rhode Island, April 18, 1990.

Parallel VLSI Synthesis, Department of Computer Science, University of North Carolina at Charlotte, Charlotte, NC, March 27, 1989.

The Challenge of International Competition, Member, Panel on ''Computer Science and Industry: Are We Meeting Each Other's Needs?'' Tektronix Academic Forum, Tektronix Inc., Beaverton, OR, January 20, 1989.

Panelist on ''New Modes of Computing for Instruction,'' 1988 Snowbird Meeting for Chairpersons of PhD-Granting Departments of Computer Science and Engineering, July 10-12, 1988.

DeCo – A Hierarchical Device Compilation System, Massachusetts Microelectronics Center, May 19, 1988.

DeCo – A Hierarchical Device Compilation System, Computer Sciences Department, University of Texas at Austin, Austin, TX, March 11, 1988.

The Electronic Exploratorium, Department of Computer Science, Cornell University, August 4, 1987.

Computers in Education, Department of Computer Science, Cornell University, August 4, 1987.

DeCo – A Device Compilation System, Tektronix, Inc., Beaverton, OR, June 26, 1987.

The Experimenter's Assistant, Sun Microsystems Higher Education Conference, Mountain View, CA, June 24, 1987.

Device Compilation, IEEE VLSI Workshop, Clearwater Beach, FL, February 23, 1987

DeCo – A Device Compilation System, VLSI Seminar, IBM T. J. Watson Research Center, Yorktown Heights, NY, February 20, 1987.

DeCo – A Device Compilation System, Computer Science and Engineering Department, University of Connecticut, December 12, 1986.

DeCo – A Hierarchical Device Compiler, College of Computer Science, Northeastern University, November 13, 1986.

Parallelism in Space-Time Tradeoffs, Computer Engineering Seminar, Department of Electrical Engineering and Computer Science, University of Massachusetts, May 14, 1985.

Parallelism in Space-Time Tradeoffs, Procs. Intern. Workshop on Parallel Computing and VLSI, Amalfi, Italy (jointly with J. S. Vitter) May 23-25, 1984.

Experiments with Semi-Automatic Layout Tools, CAT '84, Computer and Technology Meeting, West Point, NY, April 26, 1984

Hierarchical and Functional VLSI Layout Systems, Department of Computer Science, Carnegie- Mellon University (jointly with G. Baudet), April 9, 1984.

Experiments with Interactive Functional and Geometric Layout Systems ONR Workshop on VLSI, Santa Catalina, March 16, 1984.

Heuristics in the SLAP Layout System, Workshop on Mathematical Methods for VLSI, Mathematisches Forschungs-institut, Oberwolfach, December 1983.

VLSI Layout with Level Graphs, Dept. of Computer Science and Statistics, University of Rhode Island, October 1983.

Heuristics for Graph Embeddings Using Level Graphs, Workshop on Graphtheoretic Concepts in Computer Science, Osnabuck, West Germany, June 1983.

SLAP – A Silicon Layout Method for IC Design, RCA Research Laboratories, Princeton, NJ, March 1983.

PLA's, 1-D Arrays, and a New 2-D Layout Methodology, Department of Computer Science, SUNY at Stony Brook, December 6, 1982.

SLAP – A Methodology for Silicon Layout, Department of Computer Science, University of Maryland, October 25, 1982.

Three VLSI Compilation Techniques: PLA's, Weinberger Arrays, and SLAP, A New Silicon

Layout Program, Purdue Workshop on Algorithmically-specialized Computer Organizations, October 1, 1982.

VLSI Models and Analysis, 1982 IEEE International Symposium on Information Theory, Les Arcs, France, June 21, 1982.

SLAP – A Silicon Layout Program, Seminar, Institute National de Recherche en Informatique et en Automatique, Le Chesnay, France, June 18, 1982.

SLAP – A Synchronous Layout Program for VLSI, Dept. of Electrical and Computer Engineering, University of Massachusetts, April 24, 1982.

Planar Circuit Size and the Performance of VLSI Algorithms, GE Research & Development Center, Schenectady, NY, August 11, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Department d'Informatique, Universite de Strasbourg, France, June 2, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Institut de Progr., Universite de Paris–VI, France, May 19, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Department of Computer Science, University of Dortmund, West Germany, May 8, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Department of Mathematics, University of Bielefeld, West Germany, May 6, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Department of Computer Science, University of Amiens, France, April 30, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Department of Computer Science, University of Edinburgh, Edinburgh, Scotland, April 22, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Conference on Algorithms and Complexity Theory, Oberwolfach, West Germany, February 2, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Department of Mathematics, University of Pavia, Pavia, Italy, January 30, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Department of Electrical Engineering, Polytechnico di Milano, Milan, Italy, January 29, 1981.

Space-Time Tradeoffs – A Survey, Third Hungarian Symposium on Computer Science, Budapest, Hungary, January 26, 1981.

Planar Circuit Size and the Performance of VLSI Algorithms, Department of Computer Science, University of Frankfurt, Frankfurt, West Germany, December 9, 1980.

Space-Time Tradeoffs for Concrete Problems, 1979 International Symposium on Information Theory, Trieste, June 25-29, 1979.

Space-Time Tradeoffs, Lectures in Summer School on *Computational Complexity* at C.I.S.M., Udine, Italy, June 13-22, 1979.

Pebbling the FFT Graph and the Integer Multiplication Function, Conference on Algorithms and Complexity Theory, Oberwolfach, West Germany, October 16-21, 1977.

Space-Time Tradeoffs on the FFT Algorithms, 1977 Allerton Conference on Communication, Control and Computing, Allerton, Illinois, September 28-30, 1977.

Modeling the Mind: A Computational Approach to Limits on Human Performance, seminar, Department of Electrical Engineering and Computer Science, University of Connecticut, March 4, 1977.

Modeling the Mind: Limits on Human Performance, Dean's Convocation, Brown University,

November 18, 1976.

Processing Work and Power: Limits on Human Performance, Psychology Department, Brown University, January 19, 1976.

Storage-Time Tradeoffs and the Complexity of Functions, Computer Science Colloquium, Yale University, April 9, 1975.

Storage-Time Tradeoffs and the Complexity of Functions, Department of Computer Science, SUNY at Stony Brook, March 18, 1975.

The Complexity of Computing, Electrical Sciences Seminar, Brown University, March 17, 1975.

Panel discussant on *Software Physics*, ACM 74 Conference, San Diego, November 11, 1974

Storage-Time Tradeoffs and the Complexity of Functions, seminar, Department of Applied Mathematics, M.I.T., November 4, 1974.

The Complexity of Decoders, presented at Conference on Coding and Complexity, Summer School, Centre International des Sciences Mecanique, Udine, Italy, July 1974.

Storage-Time Tradeoffs and the Complexity of Functions, seminar, Department of Mathematics, Goethe University, Frankfurt, June 28, 1974.

Storage-Time Tradeoffs and the Complexity of Functions, seminar, Department of Electrical Engineering, ETH, Eindhoven, Netherlands, June 18, 1974.

Outline for An Applied Theory of Computation, Seminar on Mathematical Foundations of Computer Science, Banach Center, Warsaw, Poland, June 11, 1974.

Outline for An Applied Theory of Computation, Department of Computer Science, University of Trondheim, Norway, May 20, 1974.

Outline for An Applied Theory of Computation, Mathematics Institute, University of Oslo, Norway, May 15-16, 1974.

Outline for An Applied Theory of Computation, Information Science, University of Bergen, Norway, May 14, 1974.

Storage-Time Tradeoffs and the Complexity of Functions, seminar at GMD, Bonn, April 30, 1974.

Methods for Bounding the Combinational Complexity of Functions, Conference on 'Automatentheorie und Formale Sprachen,' Universitat Dortmund, March 29, 1974.

Outline for An Applied Theory of Computation, Department of Computation Science, University of St. Andrews, of St. Andrews, Scotland, March 8, 1974.

Outline for An Applied Theory of Computation, seminar, Department of Computer Science, Warwick University, England, March 6, 1974.

Outline for An Applied Theory of Computation, seminar, Department of Computing, Brighton Polytechnic, England, March 5, 1974.

Outline for An Applied Theory of Computation, Mathematics Institute, Rijksuniversiteit de Groningen, Netherlands, February 19, 1974.

Outline for An Applied Theory of Computation, Conference on Automata Theory and Formal Language, Mathematisches Forschungsinstitut, Oberwolfach, West Germany, November 25-December 1, 1973.

On the Complexity of the Marriage Problem, seminar, Department of Mathematics, THE, Netherlands, November 12, 1973.

The Efficiency of Algorithms and Machines – A Survey of the Complexity Theoretic Approach, National Computer Conference, New York, June 8, 1973.

Computational Work, Computer Science Seminar, Department of Computer Science, State University of North Carolina-Raleigh, March 15, 1973.

An Extension of the Kolmogorov-Chaitin Measure to Functions, Computer Science Seminar, Department of Applied Electro-Physics, University of California, San Diego, March 15, 1973.

Matrix Multiplication with Fixed Matrices and Polynomial Evaluation with Fixed Polynomials, seminar, Department of Computer Science, U.C.L.A., January 11, 1973.

The Cost of Coding – Complex Decoders, Washington, D.C., Chapter of Information Theory Group of IEEE, March 23, 1972.

Computational Work and Time, Electrical Engineering Seminar, City College of New York, February 18, 1972.

Functional and Algorithmic Complexity, 1972 International Symposium on Information Theory, Pacific Grove, February 1972.

Computational Work and Time on Finite Machines, Symposium on Computational Complexity, Courant Institute, New York University, October 24-25, 1971.

Algebraic Coding, Mathematics Department, Hunter College, May 17, 1971.

Computational Work, Information Theory and the Traveling Salesman Problem, Computer Science Colloquium, Brown University, March 12, 1971.

The Cost of Coding – Complex Decoders, Electrical Engineering Seminar, Rice University, February 9, 1971.

Computational Work on Finite Machines, Computer Science Seminar, U.C.L.A., February 5, 1971.

Computation on Finite Machines, Computer Science Seminar, University of California at Santa Cruz, February 3, 1971.

The Cost of Coding – Complex Decoders, Communication Seminar, Bell Telephone Laboratories, Murray Hill, New Jersey, January 29, 1971.

The Cost of Coding – Complex Decoders, Electrical Engineering Graduate Communication and Computer Seminar, Polytechnic Institute of Brooklyn, December 17, 1970.

Computation on Finite Machines, Electrical Engineering Seminar, Princeton University, November 5, 1970.

Computation on Finite Machines, Electrical Engineering Seminar, Princeton University, November 5, 1970.

Computation on Finite Machines, Information Systems Seminar, Stanford University, October 26, 1970.

Computation on Finite Machines, Computer Sciences Colloquium, Electrical Engineering Department, University of Connecticut, October 9, 1970.

The Complexity of Decoders: Computational Work and Decoding Time, IEEE, Los Angeles Section on Information Theory, April 2, 1970.

The Complexity of Source Encoders, 4th Annual Princeton Conference on Information Sciences and Systems, March 26, 1970.

Three Measures of Decoder Complexity, NASA Coded Communications Conference, Pasadena, California, February 25, 1970.

The Cost of Coding - Complex Decoders, seminar, Center for Computer and Information Sciences, Brown University, February 23, 1970.

The Cost of Coding – Complex Decoders, Information Processing Seminar, University of California, San Diego, November 7, 1969.

The Cost of Coding – Complex Decoders, seminar, Jet Propulsion Laboratory, November 6, 1969.

The Cost of Coding – Complex Decoders, Electrical Engineering Seminar, U.R.I., Kingston, Rhode Island, October 1, 1969.

Some New Results on the Complexity of Decoding Machines, seminar at T.J. Watson Research Center, IBM, Yorktown Heights, March 20, 1969.

Complexity of Decoders, Electrical Engineering Seminar, University of California, Berkeley, October 28, 1968.

Complexity of Finite State Decoders, Electrical Engineering Seminar, Stanford University, October 28, 1968.

Asynchronous Data Scramblers, Department of Electrical Engineering, Cornell University, April 20, 1967.

Recent Progress in Sequential Decoding, Engineering Seminar Department of Engineering, U.C.L.A., October 25, 1966.

10. Research in Progress

Cybersecurity Policy

Internet Governance

11. Research Grants

2007-2010	National Science Foundation, "Collaborative Research: Nanoscale Coded Computation and Storage," $199,999.
2005	National Science Foundation, Supplement of $19,995 to grant below.
2004-2009	National Science Foundation, "NIRT: Technologies, Architectures and Performance Analysis for Nanoelectronics," (Co-Principal Investigator with André DeHon and Charles M. Lieber) $1,300,000.
2002-2003	National Science Foundation, "NER: Exploring the Computational Limits Imposed by Nanotechnologies," $97,828.
1994-96	National Science Foundation, ''Acquisition of a Parallel Supercomputer'' (Co-Principal Investigator with D. Gottlieb, G. Karniadakis, M. Maxey, D. McClure, M. Ortiz, F. Preparata), $300,000.
1991-1995	National Science Foundation, ''Investigations in programmable systolic architectures'' (Replaced D. Lopresti as Principal Investigator 7/91), $180,882.
1991-1996	DARPA/ONR, ''High-Performance Design Environments'' (Co-Principal Investigator with E. Charniak, A. van Dam, T.L. Dean, T.W. Doeppner, P.C. Kanellakis, D.P. Lopresti, F.P. Preparata, S.P. Reiss, J.S. Vitter, P. Wegner, F.K. Zadeck, S.B. Zdonik), $2,580,000.
1988-1993	National Science Foundation, ''Multiparadigm Design Environments'' (Co-Principal Investigator with E. Charniak, A. van Dam, T.L. Dean, T.W. Doeppner, P.C. Kanellakis, D.P. Lopresti, L. Morgenstern, S.P. Reiss, J.S. Vitter, P. Wegner, F.K. Zadeck, S.B. Zdonik), $3,480,999.
1987-1990	DARPA/ONR, ''Multiparadigm Design Environments'' (Co-Principal Investi-

	gator with Paris Kanellakis and Steven Reiss), $1,776,120.
1986-1988	Semiconductor Research Corporation, ''Hierarchical Silicon Compilation'' (with G.M. Baudet), $158,733.
1983-1986	Semiconductor Research Corporation, ''Hierarchical Silicon Compilation'' (with G.M. Baudet and S.P. Reiss), $306,997.
1983-1988	National Science Foundation, ''VLSI (Very Large Scale Integrated) Algorithms and Analysis,'' November 1983 to October 1988, $238,932.
1983-1987	DARPA/ONR, ''Ideographics'' (Principal investigator with A. van Dam, Co-principal investigator with G.M. Baudet, E. Charniak, B.M. Chazelle, T.W. Doeppner, P.C. Kanellakis, S.P. Reiss, R. Sedgewick, J.S. Vitter and P. Wegner), $1,700,000.
1982-1987	National Science Foundation, ''An Integrated Experimental Environment for Research in Computer Science'' (Co-principal investigator with A. van Dam, P. Wegner, R. Sedgewick, E. Charniak, T.W. Doeppner, S.P. Reiss, J.S. Vitter and P.C. Kanellakis) $2,771,311.
1981-1983	National Science Foundation, ''Applied Computational Complexity,'' $106,021, June 1, 1981 to December 31, 1983.
1976-1981	National Science Foundation, ''Analysis of Algorithms and Data Structures,'' $133,552, September 1976 for four and one-half years.
1975-1980	National Science Foundation, ''Analysis of Decoder Complexity,'' $71,757, November 1975 for four and one-half years.
1974-1976	National Science Foundation, ''A Study of Algorithms and Data Structures,'' $74,000 (with R. G. Frey as Co-Principal Investigator), September 1, 1974 for for two years.
1972-1975	National Science Foundation, ''The Performance of Computing Systems and Compiler Analysis,'' $57,700, March 1, 1972 for two and one-half years.
1972-1975	ARPA, ''Analysis of Algorithms and Machines,'' $50,000, October 24, 1972 for two and one-half years.
1970	NASA, ''Code Parameters and Decoder Complexity,'' $24,900, June 1, 1970 for one year.
1969-1971	National Science Foundation, ''Decoders for Error Correction,'' $34,500, September 1, 1969 for two years.
1969-1971	NASA, ''A Study of Decoders for Error Correction,'' $28,000, June 1, 1969 for one year.
1968-1969	National Science Foundation, ''A Study of the Power and Complexity of Decoding Machines,'' $15,000, April 1, 1968 for 18 months.

12. Service

To the University

2017	Coach for the Brown team in the Cyber 9/12 Student Competition, Atlantic Council, March 2017. They advanced to the second of three rounds.
2016	Coach for the Brown team in the Cyber 9/12 Student Competition, Atlantic Council, March 2016. They advanced to the second of three rounds.
2015-2016	Secretary of the Faculty, Semester I
2015	Coach for first place Brown team in the Cyber 9/12 Student Competition, Atlantic Council, March 2015. It was the only undergraduate team among the four finalists.
2014-2016	Secretary of the Faculty Forum
2014-2015	Member, Computer Science Faculty Search Committee

2014-2015	Member, Presidential Graduate Fellowship Selection Committee, Graduate School
2014	Coach for undergraduate first place and ninth place Brown teams for the Capture the Flag Competition at the Cybersecurity, Education, and Diversity Challenge Week (CyberSEED) at the University of Connecticut, October 2014
2014	Coach for undergraduate student team, winner of the Best Teamwork prize of the Cyber 9/12 Student Competition, Atlantic Countil, March 2014
2013-2014	Chair, Computer Science Vision Committee
2012-2013	Organized six talks in a **Cybersecurity Colloquium Series**, Watson Institute
2012	Organized Cybersecurity and International Relations Conference, May 3, 2012
2011-2013	Faculty Affiliate, Watson Institute for International Studies to lead a Cybersecurity Policy and Technology Initiative
2011-2013	Member, Computer Science Executive Committee
2011-2012	Chair, Nominations Committee
2010-2013	Member, Nominations Committee
2009-	Illumina GAIIX Internal Advisory Committee, Biomed, Brown University
2008-2009	Diversity Committee, Computer Science
2008-2009	PhD Programming Examination Committee, Computer Science
2008-2009	Graduate Exams Committee, Computer Science
2007-2009	Co-Chair, NEASC Accreditation Subcommittee on Organization and Governance
2007-2008	Member, Committee on Nominations
2007	Member, Search Comm. for Computer Science Academic Department Manager
2006-2007	Working Group on Global Science and Technology
2005-2008	Faculty Campaign Committee, Chair for 2007-2008
2005-2006	Chair, Search Committee for Computer Science Academic Department Manager
2005-2008	Chair, Computer Science Curriculum Committee
2003-2004	Chair, Search Committee for Vice President for Public Affairs and University Relations
2003-2004	Chair, Computer Science 25th Anniversary Committee
2002-2004	Co-Director, Industrial Partners Program, Department of Computer Science
2002-2003	Member, Academic Priorities Committee
2002-2003	Chair, Task Force on Faculty Governance
2001	Member, President's Senior Staff, Brown University
2001	Chair, Inaugural Faculty Forum Committee and Member, Inaugural Planning Committee for Inauguration of President Ruth Simmons
2001-2003	President-Elect, Brown Faculty Club Board of Managers
2000-2001	FACC Subcommittee on Instructional Technology
2001	Ad Hoc Committee to Draft a Conflict of Interest Policy
2000-03	Vice Chair, Chair, and Past Chair of the Faculty Executive Committee
1999-00	Randall Counselor
1999	Co-Chair, Committee on Electronically Mediated Instruction
1998-00	Co-Chair, Brown University Charities Drive
1998-01	President, Brown Faculty Club Board of Managers
1996-98	President-Elect, Brown Faculty Club Board of Managers
1996-1999	Vice Chair, Advisory Committee on University Planning (ACUP)
1995-2001	Director, Industrial Partners Program, Department of Computer Science
1995-97	Chair, Faculty Search Committee, Department of Computer Science
1995-96	UTRA Advisor
1989-1991	Director, Industrial Partners Program, Department of Computer Science
1993-96	CAP Advisor
1985	Search Committee for Vice-Provost for Computing, Brown University

1985-1987	Funding Computers in Higher Education Committee, Brown University
1983-1985	Member, EPC Subcommittee on Computers in Education
1983-1991	Chair, Departmental Tenure Committee
1982-1983	Chair, Faculty Search Committee, Department of Computer Science
1982	Chair, Sub-committee on Academic Regulations of the EPC
1980-1983	Member and Vice-Chair of the Educational Policy Committee
1978-1979	Departmental Supervisor for Renovation of Departmental Building
1978-1979	Acting Chair, Program in Computer Science
1978-1979	Faculty Policy Group: Chair, Semester I; Vice Chair, Semester II
1977-1980	Graduate Committee, Program in Computer Science
1977-1980	Center for Cognitive Science, Executive Committee
1977-1979	Faculty Policy Group
1977-1978	Vice Chair, Faculty Policy Group, Semester II
1977-1978	Chair, Faculty Policy Group Committee on the Academic Calendar
1977-1978	Faculty Policy Group Committee on Teaching Evaluation
1976-1979	Program Committee, Program in Computer Science
1976-1978	Chair, Computer Science Faculty Search Committee
1976-1977	Graduate Student Advisor, Program in Computer Science
1976	Faculty Participant in Writing To Learn Project, Brown University, October
1975-1976	Computer Science Faculty Search Committee
1974-1978	Engineering Concentration Committee
1974-1976	Counseling Program
1974-1975	Chair, Computer Science Faculty Search Committee
1972-1973	Division of Engineering Colloquium Committee
1971-1973	Campus Planning Committee
1971-1973	Chair, Industrial Liaison Committee, Division of Engineering
1970-1980	Liaison with Foxboro Corporation
1970-1973	Engineering Concentration Committee
1969-1971	Secretary of the Faculty Forum
1969-1971	Counselor to IEEE Student Branch
1968-1971	Committee to Receive Subfreshmen
1968-1971	Board of Counselors
1968-1970	Secretary, Electrical Sciences Seminar
1967-1970	Division of Engineering Colloquium Committee
1967-1976	Secretary, Advisory Committee of the Center for Computer and Information Sciences

To the Profession

2017	
2015-2018	Reviewer of MURI Proposals, Office of Naval Research.
2014	Program Committee, EastWest Institute 5th Cyberspace Cooperation Summit.
2014	NEASC Accreditation Committee for the University of Bridgeport, November.
2014	Site visit review committee for an NSF Engineering Research Center nanotechnology proposal by Stanford University, October.
2012	Organized conference **Cybersecurity and International Relations**, Brown University, May 3, 2012 sponsored by Department of Computer Science and the Watson Institute for International Studies
2011-	Organized the RI Cybersecurity Policy and Technology Collaboration
2010	Panelist, Global Futures Forum, Singapore
2010	Member, US Delegation to ITU representing the U. S. State Department

2009-2010	Member, Scientific and Technical Intelligence Committee
2009-2010	Member, Cyber Security and Information Assurance Interagency Working Group, NITRD
2009-2010	Member, SCORE Committee, Office of the Director of National Intelligence
2009-2010	Jefferson Science Fellow, U.S. State Department
2009	Organizer, U.S. State Department Conference "Identity Management in an Open Society"
2009-2010	Member, Architecture R&D Sub-IPC, White House
2009	Participant, ODNI Workshop on Cyber Deterrence, Harvard University
2009-2010	Member, CCC Cross-Layer Reliability Visioning Team
2008	Member, NEASC Accreditation Team for Northeastern University
2008	Member, National Research Council panel for the Ford Foundation Fellowship Program
2008	Member, NSF Site Visiting Committee, Network for Computational Nanotechnology, Purdue University
2008	Program Committee, IEEE/ACM Int. Symp. On Nanoscale Architectures
2007	Member, NSF Site Visiting Committee, Network for Computational Nanotechnology, Purdue University
2007	Member, Vietnam Education Foundation Fellowship Panel
2007	Member, NSF Review Panel – Emerging Technologies
2006	Member, Steering and Program Committees of HPC Nano '06 Workshop at Supercomputing 2006
2006	Member, NSF Site Visiting Committee, Network for Computational Nanotechnology, Purdue University
2005	Member, Steering Committee and Program Committee of HPC Nano '05 Workshop at Supercomputing 2005
2005	Member, Vietnam Education Foundation Fellowship Panel
2005	Member, NSF Site Visiting Committee, Network for Computational Nanotechnology, Purdue University
2005	Member, NSF Review Panel – International Programs
2005	Member, NSF Review Panel – Emerging Technologies
2002-2005	AAAS Electorate Nominating Committee, Section T, Info., Comp., Comm.
2004	NSF Nanotechnology Review Panel
2000	Member, NSF Committee of Visitors, Computer-Communications Research Division
1999	Member, NSF-sponsored workshop committee to advise NSF on theoretical computer science
1998	NSF Computer Science Proposal Review Panel
1997-98	Review Panel, Department of Computer Science, Williams College
1993-97	ACM SIGACT Long Range Planning Committee
1993	Review Panel Chair, Texas Higher Education Coordinating Board
1993-	Editorial Board, Journal of Computer and Systems Sciences
1991-2002	MIT Corporation Visiting Committee for the Electrical Engineering and Computer Science Department
1991-1992	Program Committee Co-Chair (with Tom Knight of MIT), Brown-MIT VLSI Conference on ''Advanced Research in VLSI and Parallel Systems''
1991	Presidential Tenure Review Committee, Division of Engineering and Applied Physics, Harvard University
1990	Local Arrangements Chair, First DARPA Software Community Meeting, Warwick, RI (February 7 – March 1, 1991)
1990-1995	Chair, Publications Committee, Computing Research Association

1990-1996	Member, Board of Directors of the Computing Research Association
1990-1995	Chair, Editorial Board of Computing Research News
1989	Session Organizer on Computer-Aided Design for the 1989 IEEE Computer Society Workshop on VLSI (February 19–22, 1989)
1988	Session Organizer on Computer-Aided Design for the 1988 IEEE Computer Society Workshop on VLSI (February 28 – March 2, 1988)
1988	Session Coordinator on VLSI for the 1988 Hawaii International Conference on System Sciences
1987	Member, Task Force on Accreditation of Computer Science Programs: The Goals and Challenges
1987	External Examiner for Proposed Ph.D. Program in Computer Science at Northeastern University
1986	Member, NSF Equipment Grant Review Panel
1986	Member, Panel on Robotics, Vision and Graphics at the 1986 Annual CER Meeting (March 1986)
1985	Member, Program Committee for STACS 85, 2nd Annual Symposium on Theoretical Computer Science, Saarbrucken, Germany (January 1985)
1983	Member, External Graduate Review Committee for the Department of Computer Science, State University at Stony Brook (April 1983)
1982-1983	Wheaton College, Technology Resource Network
1982-1983	Member, Panel on Research Initiation and Equipment Proposals, Computer Engineering, NSF
1982	Organizer, Invited Session on Algorithms and Complexity at the 1982 IEEE International Symposium on Information Theory, Les Arcs, France
1978	IEEE Computer Society, Publications Evaluation and Survey Committee
1977	18th Annual Symposium on Foundations of Computer Science (FOCS), Local Arrangements Chair
1976-1978	Editorial Board, *IEEE Transactions on Computers,* Associate Editor for Applied Theory of Computation
1976-1977	Program Committee, 1977 International Symposium on Information Theory
1976-1977	Subcommittee on Special Issues of the Publication Committee of the IEEE Computer Society
1975-1976	Technical Program Committee, National Computer Conference 1976
1974-	IEEE Technical Committee on Foundations of Computer Science

To the Community

2000-2003	At-Large Board Member, Fund for Community Progress, Providence, RI

13. Teaching

2017-2018	Independent Study (CSCI 1970)
2017-2018	The Future of Cybersecurity: Technology and Policy (EMCS 2600)
2017-2018	Theory of Computation (CSCI 1010)
2016-2017	Cybersecurity and International Relations (CSCI 1800)
2015-2016	Cybersecurity and International Relations (CSCI 1800)
2014-2015	Cybersecurity and International Relations (CSCI 1800)
	Computer Systems Security: Principles and Practice (CSCI 1951-E)
2013-2014	Models of Computation (CSCI 0510)
	Cybersecurity and International Relations (CSCI 1800)
2012-2013	Models of Computation (CSCI 0510)

	Cybersecurity and International Relations (CSCI 1800)
2011-2012	Models of Computation (CSCI 0510)
	Cybersecurity and International Relations (CSCI 1800)
2010-2011	Models of Computation (CSCI 0510)
	Cybersecurity and International Relations (CS 195)
2009-2010	Models of Computation (CS51)
2008-2009	Sabbatical, first semester
	Introduction to Computational Complexity (CS159)
2007-2008	Introduction to Nanocomputing (CS257)
	Introduction to Computational Complexity (CS159)
2006-2007	Introduction to Nanocomputing (CS257)
	Applied Theory of Computation (CS256)
2005-2006	Introduction to Nanocomputing (CS295-6)
	Introduction to Computational Complexity (CS159)
2004-2005	Sabbatical Leave
2003-2004	Models of Computation (CS51)
	Applied Theory of Computation (CS256)
2002-2003	Models of Computation (CS51)
	Introduction to Computational Complexity (CS159)
2001-2002	Models of Computation (CS51)
	Introduction to Computational Complexity (CS159)
2000-2001	Models of Computation (CS51)
	Introduction to Computational Complexity (CS159)
1999-2000	Models of Computation (CS51)
	Introduction to Scientific Computing (CS4)
1998-99	Models of Computation (CS51)
	Introduction to Scientific Computing (CS4)
1997-98	Models of Computation (CS51)
	Introduction to Scientific Computing (CS4)
1996-97	Models of Computation (CS51)
	Introduction to Scientific Computing (CS4)
1995-1996	Introduction to Computational Complexity (CS159)
	Introduction to Scientific Computing (CS4)
1994-1995	Sabbatical Leave
	Introduction to Scientific Computing (CS4)
1993-1994	Introduction to Computational Complexity (CS159)
	Introduction to Scientific Computing (CS4)
1992-1993	Analysis of Algorithms (CS253)
	Applied Theory of Computation (CS256)
1991-1992	On sabbatical leave of absence
1990-1991	Analysis of Algorithms (CS253)
	Computers and Society (CS1)
1989-1990	Analysis of Algorithms (CS253)
1988-1989	Analysis of Algorithms (CS253)
	Parallel Algorithms and Complexity (CS296)
1987-1988	Analysis of Algorithms (CS253)
	Applied Theory of Computation (CS256)
1986-1987	Computers and Society (CS1)
	Analysis of Algorithms (CS253)
1985-1986	Computers and Society (CS1)
	Analysis of Algorithms (CS253)

	Applied Theory of Computation (CS256)
1984-1985	Computers and Society (CS1)
	Analysis of Algorithms (CS253)
	Applied Theory of Computation (CS256)
1983-1984	Computers and Society (CS1)
	Analysis of Algorithms (CS253)
1982-1983	Computers and Society (CS1)
	Introduction to Computer Science Research (CS201)
	Analysis of Algorithms (CS253)
1981-1982	Analysis of Algorithms (CS253)
	Applied Theory of Computation (CS256)
1980-1981	On sabbatical leave of absence
1979-1980	Computing Systems (CS106)
	Complexity of Computing (CS277)
	Human Information Processing (PY180)
1978-1979	Computing Systems (CS106)
	Complexity of Computing (CS277)
	Human Information Processing (PY180)
1977-1978	Computing Systems (CS106)
	Complexity of Computing (CS277)
	Human Information Processing (PY180)
1976-1977	Computing Systems (CS106)
	Human Information Processing (PY180)
	Complexity of Computing (CS277)
1975-1976	Operating Systems (CS104)
	Computing Systems (CS106)
	Complexity of Computing (CS277)

14. Master's Theses Directed

1969-2007   17 Master's theses

15. Ph.D. Dissertations Directed

Eric Rachlin, "Reliable Computing at the Nanoscale, Department of Computer Science, 2010.

Jose Castaños, "Parallel Adaptive Unstructured Computation," Department of Computer Science, 2000.

Robert A. Ravenscroft, Jr., ''Generating Function Algorithms for Symbolic Computation,'' Department of Computer Science, 1991.

Markus Wloka, ''Parallel VLSI Synthesis,'' Department of Computer Science, 1991.

Brian A. Dalio, ''DeCo – A Hierarchical Device Compilation System,'' Department of Computer Science, 1987.

David A. Carlson, ''Time-Space and Size-Space Tradeoffs for Oblivious Computations,'' Department of Computer Science, 1980.

Sowmitri Swamy, ''On Space-Time Tradeoffs,'' Division of Engineering, 1978.

Yehoshua Imber, ''Analysis of Decoder Complexity,'' Division of Engineering, 1978.

Edmund A. Lamagna, ''The Complexity of Monotone Functions,'' Division of Applied Mathematics, 1975.

Charles M. Fiduccia, ''On the Algebraic Complexity of Matrix Multiplication,'' Division of Engineering, 1973.

16. Patents and Applications

2016	Apparatus, Method and Computer Program Product Providing Radial Addressing of Nanowires, (A. DeHon, C.M. Lieber, J. E. Savage, E. Rachlin) Patent **9,252,214**, Issued February 2, 2016.
2014	Method Providing Radial Addressing of Nanowires, (A. DeHon, C.M. Lieber, J. E. Savage, E. Rachlin) Patent **8,883,568**, Issued November 11, 2014.
2011	Apparatus, Method and Computer Program Product Providing Radial Addressing of Nanowires, (J.E. Savage, E. Rachlin, A. DeHon, C.M. Lieber), Patent **8,072,005**, Issued December 6, 2011.
2007	Sublithographic Nanoscale Memory Architecture, European Patent EP 1 525 586 B1, A. DeHon, C.M. Lieber, P.D. Lincoln, J. Savage
2005	Nanoscale Wire Coding for Stochastic Assembly, US Pat. 6,963,077 B2 with A. DeHon, C.M. Lieber and P. Lincoln, Nov. 8, 2005.
2005	Stochastic Assembly of Sublithographic Nanoscale Interfaces, US Pat. No. 6,900,479 B2 with A. DeHon, C.M. Lieber and P. Lincoln, May 31, 2005.
1977	Means and Methods for Generating Permutations of a Square, US Pat. No. 4,032,764
1970	Data Rate Converter, US Pat. No. 3,548,309, with B.R. Saltzberg
1970	Data Scrambler, US Pat. No. 3,515,805, with R.D. Fricassi