

# Randal E. Bryant

## Education

- 1974–1981 Massachusetts Institute of Technology, Department of Electrical Engineering and Computer Science, S.M. (1977), E.E. (1978), PhD (1981). Thesis Supervisor: Prof. Jack B. Dennis. PhD Thesis Title: “A Switch-Level Simulation Model of Integrated Logic Circuits.”
- 1970–1973 University of Michigan, College of Engineering (Applied Math), B.S. (1973).

## Employment

- 2004–Present Dean, School of Computer Science, Carnegie Mellon University.
- 2004–Present University Professor of Computer Science, Carnegie Mellon University.
- 1999–2004 Head, Computer Science Department, Carnegie Mellon University.
- 1997–2004 Robert Mehrabian Professor of Computer Science, Carnegie Mellon University.
- 1992–1997 Professor of Computer Science, Carnegie Mellon University. Research areas: VLSI circuit verification, symbolic manipulation, and parallel computation. Teaching subjects: computer architecture
- 1987–1992 Associate Professor of Computer Science, Carnegie Mellon University. (Tenure granted Sept., 1990.) Research areas: VLSI simulation, VLSI circuit verification, symbolic manipulation, and parallel computation. Teaching subjects: introductory computer science, computer architecture, advanced VLSI design.
- 1990–1991 Visiting Research Fellow, Fujitsu Laboratories, Ltd., Kawasaki, Japan.
- 1984–1987 Assistant Professor of Computer Science, Carnegie Mellon University.
- 1984–present Courtesy appointment in Electrical and Computer Engineering, Carnegie Mellon University.
- 1981–1984 Assistant Professor of Computer Science, California Institute of Technology. Research areas: VLSI circuit models, logic simulation, and circuit testing. Teaching subjects: computer architecture, digital systems theory, and computer algorithms.

## Professional Activities

### Affiliations

- 1977–present IEEE. Elected Fellow, 1990, citation: “for contributions to switch-level simulation of very large scale integrated circuits”.
- 1978–present ACM. Elected Fellow, 1999.
- 2003–present National Academy of Engineering. Elected 2003. Section 5 (computer science and engineering) Peer Committee 2008–2009, Nominating Committee, 2010. Search committee executive 2010.

- 2010 Review Committee for federal Networking and Information Technology Research and Development (NITRD) program on behalf of President’s Council of Advisors on Science and Technology (PCAST).
- 2010–present Council member, Computing Community Consortium.
- 2006–present Academic Research Council, Singapore Ministry of Education.
- 2005–present Information Technology Advisory Board, Federal Bureau of Investigation.
- 2006–2009 Computer and Information Science and Engineering (CISE) Advisory Board, National Science Foundation.
- 2000–2006 Board of Directors, Computing Research Association.
- 1999–2003 Technical Advisory Board, Innologic Systems (acquired by Synopsys in 2003).
- 1998–2000 Technical Advisory Board, Simplex Solutions (acquired by Cadence in 2002).
- 1993–2005 Technical Advisory Boards Fujitsu Labs of America, San Jose, CA.
- 1981–present Consultant: Hewlett Packard, Litton Data Systems, Digital Equipment Corporation, IBM, and other companies.

## Awards

- 2010 Elected to American Academy of Arts and Sciences.
- 2010 ACM/IEEE A. Richard Newton Technical Impact Award in Electronic Design Automation. Recognizing the impact of the 1986 paper “Graph-based algorithms for Boolean function manipulation.”
- 2009 Phil Kaufman Award, Electronic Design Automation Consortium (EDAC) and IEEE Council for Electronic Design Automation. Citation: “for his seminal breakthroughs in the area of formal verification.”
- 2008 University of Michigan Distinguished Engineering Alumni Award.
- 2007 IEEE Emanuel R. Piore Award. Citation: “For seminal contributions to the field of computer-aided circuit design and verification, including the development and promulgation of ordered binary decision diagrams.”
- 2003 IEEE CAD Transactions Best Paper Award. For paper coauthored with Ph.D. student Yirng-An Chen.
- 2003 Elected to National Academy of Engineering. Citation: “For contributions to symbolic simulation and logic verification.”
- 2003 Paper selected for inclusion in *The Best of ICCAD, 20 Years of Excellence in Computer-Aided Design*, a collection of 42 out of over 2,200 papers that have been presented at the International Conference on Computer-Aided Design between 1983 and 2002.
- 2000 Golden Jubilee Medal. Awarded to 118 members of the IEEE Circuits and Systems Society for professional contributions.
- 1998 Allen Newell Research Excellence Medal, Computer Science Department, Carnegie Mellon University.
- 1998 ACM Kanellakis Theory and Practice Award. Shared with Ken McMillan, Edmund M. Clarke, and Allen Emerson for the development of symbolic model checking
- 1996 Technical Excellence Award, Semiconductor Research Corporation. Shared with Ken McMillan and Edmund M. Clarke for the development of symbolic model checking.
- 1995 Litton Fellow, Carnegie Mellon Computer Science Department.

- 1995 Best Paper Award, Simulation, Verification, and Test Category, 32nd Design Automation Conference, for paper coauthored with Ph.D. student Yirng-An Chen.
- 1990 Inventor Recognition Award, Semiconductor Research Corporation, for the BDD symbolic Boolean manipulation software library.
- 1989 Inventor Recognition Award, Semiconductor Research Corporation. for the COSMOS switch-level simulator.
- 1989 IEEE W. R. G. Baker Award for “The most outstanding paper reporting original work in any of the *IEEE Transactions*, *Proceedings of the IEEE*, journals, or magazines issued during the previous year.”
- 1988 Best Paper Award, Design, Simulation and Test Category, 25th Design Automation Conference. For paper coauthored with Ph.D. student Derek Beatty.
- 1988 Two papers selected for inclusion in *Twenty Five Years of Electronic Design Automation*, a collection of 77 of the over 1600 papers presented at the Design Automation Conferences for the years 1964–1987.
- 1987 IEEE CAD Transactions Best Paper Award.
- 1983, 1984 IBM Faculty Development Award (One of 100 recipients of special grant for junior faculty.)
- 1974–1978 National Science Foundation Graduate Fellow.

### **Academic Review Committees**

- 2011 University of California, San Francisco, Bioinformatics Advisory Panel.
- 2010 Washington University St. Louis, School of Engineering and Applied Science.
- 2009 University of Tokyo, Graduate School of Information Science and Technology.
- 2009 University of Utah, School of Computing.
- 2009 Princeton University, Computer Science Department.
- 2009 University of Virginia, Computer Science Department.
- 2009 Massachusetts Institute of Technology, Department of EECS.
- 2009 University of Washington Computer Science Department.
- 2007 Georgia Institute of Technology, College of Computing.
- 2007 Stanford University, Department of Computer Science.
- 2005 University of Virginia, Computer Science Department.
- 2004 Kuwait University, Graduate program in computer science.
- 2004 Information Technology University of Copenhagen, Denmark.
- 2003 University of Pittsburgh Computer Science Department.
- 2003 University of Utah School of Computing.
- 2002 University of Texas, Computer Science Department.
- 2001 Stanford University Electrical Engineering Department.
- 2000 Faculty of Computer Science, Technion, Haifa, Israel.

### **Conference Committees**

- 2008 Co-organizer, Hadoop Summit and Symposium on Data-Intensive Computing, Sunnyvale, CA.

- 2002–2004 Program Committee, Design and Test in Europe.
- 1996, 1998, 2000, 2002, 2004 Program Committee, International Conference on Formal Methods in Computer-Aided Design.
- 1990, 1994, 2000–2001, 2004, 2006 Program Committee, International Conference on Computer-Aided Verification.
- 1994–2000 Executive Committee, Design Automation Conference (tutorial chair 1994–1995, program co-chair 1998–1999).
- 1990, 1992 Program Committee, TAU International Workshop on Timing Issues in the Specification and Synthesis of Digital Systems.
- 1991, 1993 Program Committee, International Workshop on Logic Synthesis.
- 1989 Program Committee, IFIP Workshop on Applied Formal Methods for Correct VLSI Design.
- 1986–1992 Program Committee, Design Automation Conference.
- 1989–1990 Program Committee, Microelectronic System Education Conference.
- 1989 Program Committee, International Conference on Computer-Aided Design.
- 1988 Program Committee, IFIP Conference on Design Methodologies for VLSI and Computer Architecture.
- 1987 Program Committee, IEEE VLSI Workshop, Clearwater Beach, Florida.
- 1985–1991, 1997 Program Committee, Conference on Advanced Research in VLSI (held at MIT, Caltech, UNC, Brown, and Michigan).
- 1983 Chairman, Third Caltech Conference on Very Large Scale Integration.
- 1979 Organizer, MIT Workshop on Self-Timed Systems.

### Proposal Review Committees

- 2001 Texas Advanced Research/Advanced Technology Programs Reviewer.
- 2001 National Science Foundation CAREER Program Proposal Panel.
- 2001 National Science Foundation ITR Program Preproposal Panel.
- 1990 National Science Foundation Graduate Fellowship evaluation panel.

### Editorships and Reviewing

- 1995–1997 Editor-in-Chief, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*.
- 1991–present Editorial Board, *Formal Methods in System Design*
- 1989–1995 Associate Editor, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*.
- 1976–present Reviewer for papers submitted to *IEEE Transactions on Computers*, *IEEE Computer*, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, *IEEE Transactions on Software Engineering*, *IEEE Transactions on Circuits and Systems*, *ACM Transactions on Computing Systems*, *Journal of the ACM*, *International Journal of Parallel Programming*, *Communications of the ACM*, *Theoretical Computer Science*, *Information Processing Letters*, and numerous conferences.
- 1983–1988 Reviewer for ACM Distinguished Dissertation Award

## University Service

2007	Member of Search Committee for Dean of Mellon College of Science
2004	Member of Search Committee for Director of Robotics Institute.
2000	Member of Provost Search Committee
1998–1999	Co-Chair of School of Computer Science Dean Search Committee
1993–1999	In charge of faculty reappointments and promotions, Computer Science Department.
1991–1993	School of Computer of Computer Science Graduate Council. Chairman-Elect 1991–1992, Chairman 1992–1993.
1991–1993	Member, CMU Faculty Development Awards Committee
1992	School of Computer Science Dean Search Committee
1988–1989	Presidential appointee to CMU Faculty Senate.
1988–1990	Graduate Admissions Committee, CMU Computer Science (Chairman, 1989).
1985–1987	Qualifier Review Committee, CMU Computer Science Dept. (Chairman, 1986–1987).
1986–1987	University Research Council, CMU.
1986–1988	Facilities Advisory Committee, CMU Computer Science Dept.
1981–1984	Organized Computer Science Seminar series, Caltech.
1982–1984	In charge of Computer Science Library, Caltech.
1982	Computer Science Graduate Admissions Committee, Caltech.

## Summary of Publication Record and Selected Publications

- Books: 2

R. E. Bryant, and D. R. O’Hallaron, *Computer Systems: A Programmer’s Perspective*, Prentice-Hall, First edition 2003, Second edition 2011.

- Chapters in Books: 3

- Edited Volumes: 1

- Refereed Journal Articles: 25. Significant publications include:

R. E. Bryant, D. Kroening, J. Ouaknine, S. A. Seshia, O. Strichman, and B. Brady, “An Abstraction-Based Decision Procedure for Bit-Vector Arithmetic,” *International Journal of Software Tools for Technology*, Springer-Verlag Vol. 11, No. 2 (April, 2009), pp. 95–104.

R. M. Jensen, M. M. Veloso, and R. E. Bryant, “State-Set Branching: Leveraging BDDs for Heuristic Search,” *Artificial Intelligence*, Vol. 172, Issues 2–3 (February, 2008), pp. 103–139.

S. A. Seshia, and R. E. Bryant, “Deciding Quantifier-Free Presburger Formulas Using Parameterized Solution Bounds,” *Logical Methods in Computer Science*, Vol. 1, Issue 2, Paper 7, December, 2005.

Y.-A. Chen, and R. E. Bryant, “An Efficient Graph Representation for Arithmetic Circuit Verification,” *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, Vol. 20, No. 12 (December, 2001), pp. 1442–1454. Winner of 2003 IEEE CAD Transactions Best Paper Award.

C.-J. H. Seger, and R. E. Bryant, “Formal Verification by Symbolic Evaluation of Partially-Ordered Trajectories,” *Formal Methods in System Design*, Vol. 6, No. 2 (March, 1995), pp. 147–190.

R. E. Bryant, "Symbolic Boolean Manipulation with Ordered Binary Decision Diagrams," *ACM Computing Surveys*, Vol. 24, No. 3 (September, 1992), pp. 293–318.

R. E. Bryant, "Boolean Analysis of MOS Circuits," *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, Vol. CAD-6, No. 4 (July, 1987), pp. 634–649. Winner of the IEEE W. R. G. Baker Award.

R. E. Bryant, "Graph-Based Algorithms for Boolean Function Manipulation," *IEEE Transactions on Computers*, Vol. C-35, No. 8 (August, 1986), pp. 677–691.

- Refereed Conference Papers: 92
- Unrefereed and Invited Conference Papers: 20

## Community Service

2001–present Board of Directors, Steel City Rowing Club, Pittsburgh, PA. Board president 2005–present.

1998–2000, 2003–2006 Board of Session, Bellefield Presbyterian Church, Pittsburgh, PA.

1986–1990 Board of Trustees, Bellefield Presbyterian Church, Pittsburgh, PA.