

Pæan to Zohar Manna

Nachum Dershowitz

School of Computer Science
Tel Aviv University
Ramat Aviv, Tel Aviv 69978, Israel
email: nachum.dershowitz@cs.tau.ac.il

.xdf ‘l’ epipia did ‘le
[And what we shared was *zohar*.]

—Leah Goldberg

Zohar’s Origins

Zohar, whose name in Hebrew means “illumination,” was born in early 1939 C.E. and grew up in Haifa, Israel. This volume is offered in tribute to Zohar – and in celebration of his 64th birthday. Two academic symposia were held to mark this event: a one-day symposium, held in Tel Aviv, Israel on May 16, 2003, and a week-long symposium, held in Taormina, Sicily, from June 29 to July 4, which gave rise to this volume.

Zohar received his bachelor’s and master’s degrees, in Mathematics, from the Technion in Haifa (in 1962 and 1965, respectively). He also served as a scientific programmer in the Israel Defense Forces from 1962 to 1964. He continued his graduate studies in Computer Science at Carnegie-Mellon University in Pittsburgh, Pennsylvania, under the guidance of **Robert W Floyd** and **Alan J. Perlis**, where he obtained his Ph.D. in 1968. Going backwards, we find that his advisor,

Alan J. Perlis, was a student of

Philip Franklin, who was a student of

Oswald Veblen, who was a student of

Eliakim Hastings Moore, who was a student of

Hubert Anson Newton, who was a student of

Michel Chasles, who was a student of

Simeon Denis Poisson, who was a student of

Joseph Louis Lagrange, who was an unofficial student of

Leonhard Euler, who was a student of

Johann Bernoulli, who was a student of his brother,

Jacob Bernoulli, who was an autodidact.

Bob Floyd did his undergraduate work in Chicago, but did not have a doctorate.

Zohar went on to be an assistant professor at Stanford University in Palo Alto, California, from 1968 to 1972, was on the faculty of the Weizmann Institute, in Rehovot, Israel, during the years 1972–1995, and has been on the faculty of Stanford University as a full professor since 1978. Zohar and his wife, Nitza, raised four children, travelling regularly from continent to continent.

Zohar's Research

Zohar's manifold research interests cover much of the theoretical and practical aspects of the logical half of computer science, embracing: the Theory of Computation; Logics of Programs; Automated Deduction; Concurrent and Reactive Systems; Real-Time and Hybrid Systems; Verification of Hardware and Software; and Synthesis of Programs.

Zohar is universally acclaimed and deeply appreciated as a consummate teacher. The eight books bearing his authorship are models of clarity and comprehensiveness:

1. *Mathematical Theory of Computation*, McGraw-Hill, New York, NY, 1974. This classic has been translated into Bulgarian, Czech, Hungarian, Italian, Japanese, and Russian.
2. *Studies in Automatic Programming Logic*, American-Elsevier, New York, NY, 1977 (with Richard Waldinger).
3. *Lectures on the Logic of Computer Programming*, CBMS-NSF Regional Conference Series in Applied Mathematics, No. 31, SIAM, 1980.
4. *Logical Basis for Computer Programming*, Volume 1: Deductive Reasoning, Addison-Wesley, Reading, MA, 1985 (with Richard Waldinger).
5. *Logical Basis for Computer Programming*, Volume 2: Deductive Systems, Addison-Wesley, Reading, MA, 1989 (with Richard Waldinger).
6. *The Temporal Logic of Reactive and Concurrent Systems: Specification*, Springer-Verlag, New York, 1991 (with Amir Pnueli).
7. *The Deductive Foundations of Computer Programming*, Addison-Wesley, Reading, MA, 1993 (with Richard Waldinger).
8. *Temporal Verification of Reactive Systems: Safety*, Springer-Verlag, New York, 1995 (with Amir Pnueli).

At last count, Zohar has produced over 2^7 articles and papers. His research has resulted in two software packages, *Tableau Deductive System* (1990) and *STeP* (1995). His forty coauthors read like a computer-science hall of fame:¹

- | | |
|------------------------------|-----------------------------------|
| 1. Martín Abadi | 12. Luca de Alfaro |
| 2. Anuchit Anuchitanukul | 13. Nachum Dershowitz |
| 3. Edward A. Ashcroft | 14. Harish Devarajan |
| 4. Mordechai Ben-Ari | 15. <i>Bernd Finkbeiner</i> |
| 5. Nikolaj Skallerud Bjørner | 16. Joseph Y. Halpern |
| 6. I. Anca Browne | 17. Thomas A. E. Henzinger |
| 7. Ronald Leroy Burback | 18. Bengt Jonsson |
| 8. Jean-Marie Cadiou | 19. Arjun Kapur |
| 9. <i>Ashok K. Chandra</i> | 20. Shmuel Katz |
| 10. Edward Y. Chang | 21. Yonit Kesten |
| 11. Michael A. Colón | 22. Jaemin Lee |

¹ Names in **boldface** are of people who contributed papers in this volume; *italicised* names are of others who presented a paper at either the Taormina or Tel-Aviv event.

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|-----------------------------------|------------------------------------|
| 23. Uri Lerner | 32. Sriram Sankaranarayanan |
| 24. John McCarthy | 33. <i>Adi Shamir</i> |
| 25. Hugh McGuire | 34. Henny Berendien Sipma |
| 26. Yonathan Malachi | 35. Mark E. Stickel |
| 27. Oded Maler | 36. Tomás E. Uribe Restrepo |
| 28. Benjamin C. Moszkowski | 37. Jean Vuillemin |
| 29. Stephen Ness | 38. Richard J. Waldinger |
| 30. Mark C. Pichora | 39. Pierre Wolper |
| 31. Amir Pnueli | 40. Calogero G. Zarba |

In addition, he has woven a world wide web of friends and colleagues.

Zohar has received numerous awards, including: the ACM Programming Systems and Languages Award (1974); a Guggenheim Fellowship (1981); the F. L. Bauer Prize (Technical University Munich, Germany, 1992); Fellowship in the ACM (1993); *Doctor honoris causa* at École Normale Supérieure de Cachan (France, 2002); and a Fulbright Fellowship (2002). He is associate editor of *Acta Informatica* and of *Theoretical Computer Science* and a board member of the International Institute for Software Technology of the United Nations University.

Zohar's Students

Zohar's students all recount how much more than just superb academic guidance they received from Zohar. Each one of us has volumes of tales to tell of the sound advice, sage counsel, joie de vivre, and the vibrant example of both hard work and great play set by Zohar and Nitza. Zohar's devotion to his students is legendary. Just one tiny example: When I first arrived at Stanford, Zohar was out of town. His wife, Nitza, collected Schulamith and me from San Francisco airport at 3 a.m. and then hosted us at their home until we found a place for ourselves.

Zohar takes great pride in his students and their spiritual heirs. Figures 1(a–c) and Table 1, in the pages that follow, give the current genealogy of Zohar's 23 doctoral students, 44 grand-students, 37 great-grand-students, and 12 great-great-grand-students, to date.² Together with his 12 known academic ancestors, that makes for a grand total of $2^7 = 128$ names, plus Zohar's.

Coda

Expanding on the traditional Hebrew wish for longevity:³

Until 128!

² *Legend:* Unofficial student relationships are indicated by dotted lines. Names in **boldface** are of people who authored papers in this volume; *italicised* names are of others who presented a paper at either the Taormina or Tel-Aviv event.

³ As rounded up by Shmuel Katz in Taormina.

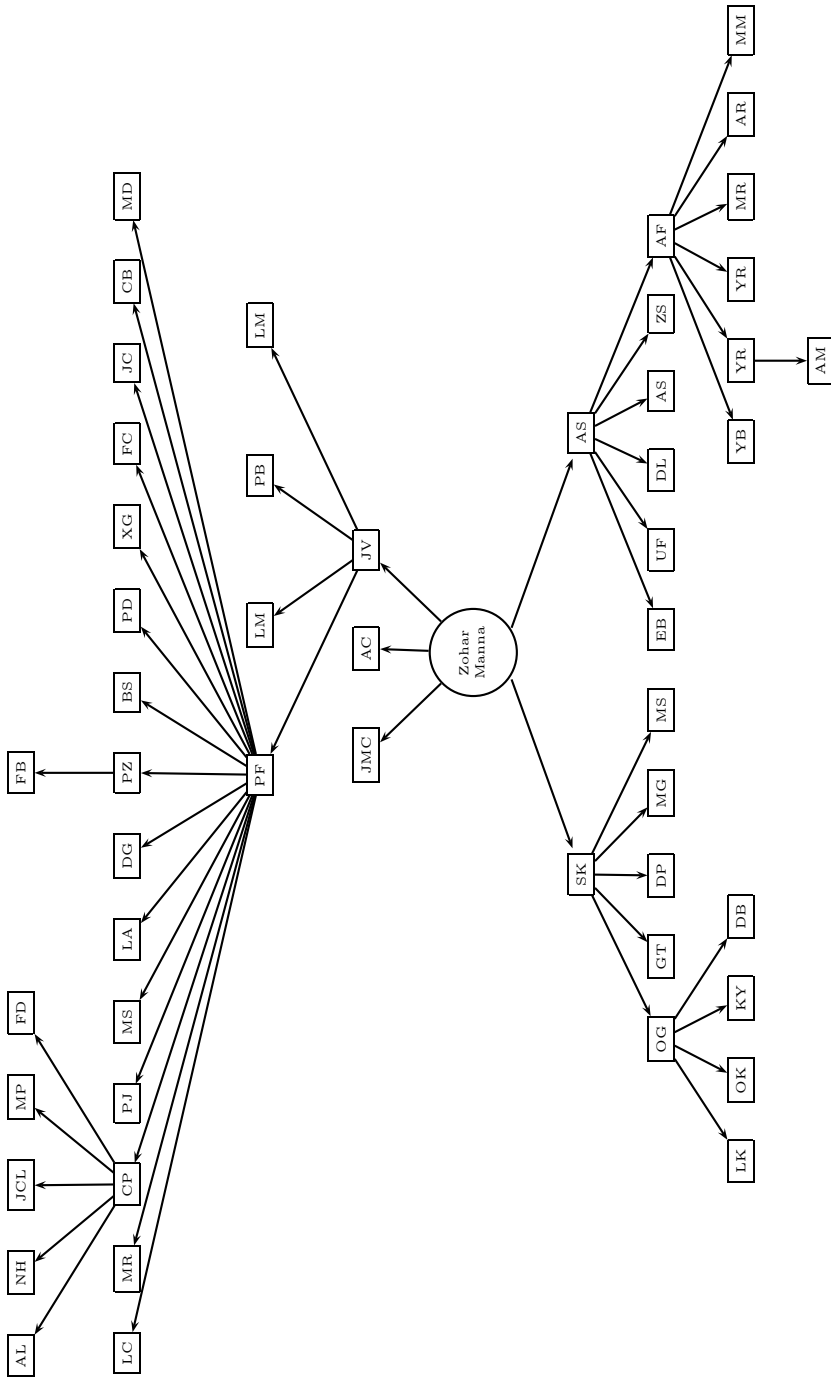


Fig. 1 (a). Zohar Mamma's doctoral descendants.

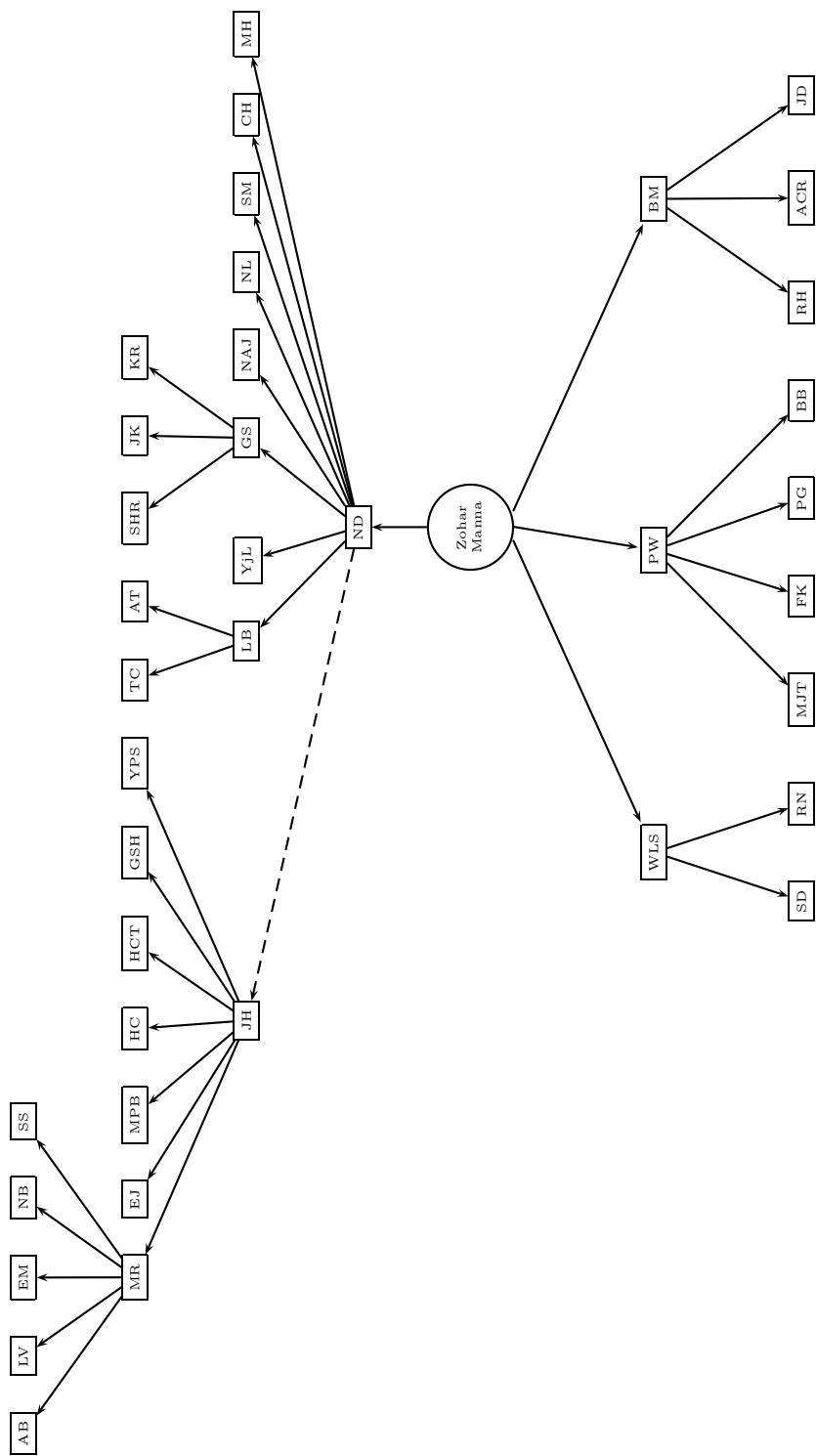


Fig. 1 (b). Zohar Manna's doctoral descendants (cont'd).

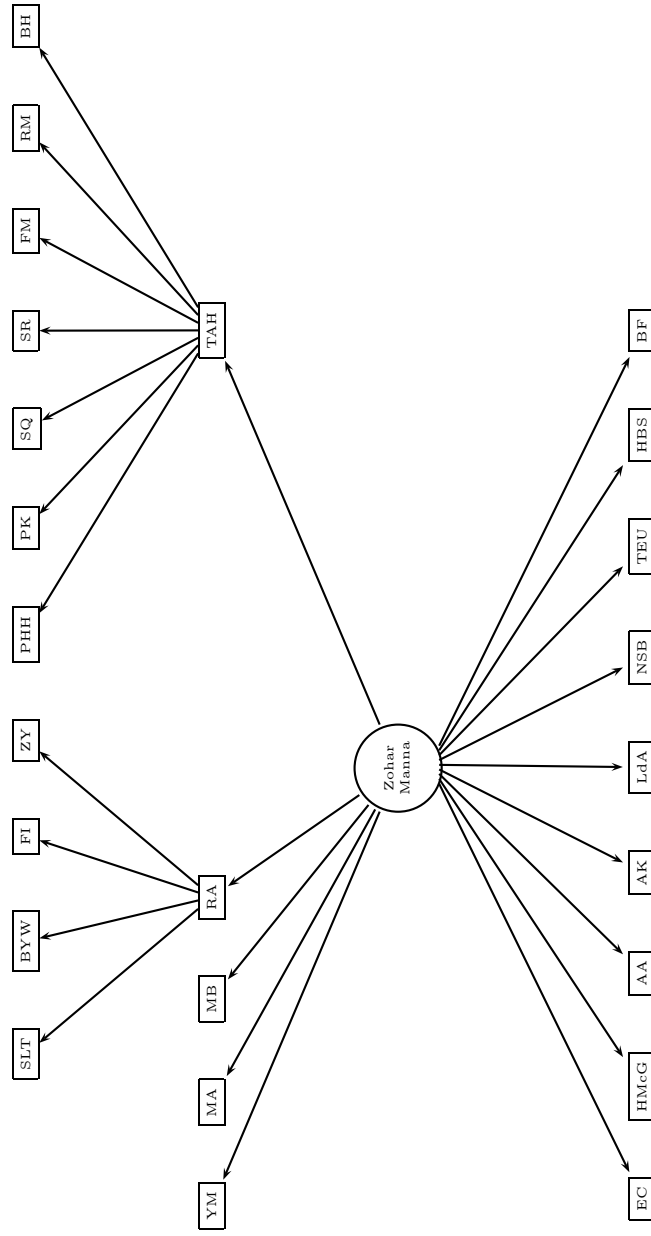


Fig. 1 (c). Zohar Manna's doctoral descendants (cont'd).

Table 1. Zohar Manna’s doctoral descendants

1. Jean-Marie Cadiou (Stanford University, 1972): *Recursive Definitions of Partial Functions and their Computations*
2. Ashok Chandra (Stanford University, 1973): *On the Properties and Applications of Program Schemas*
3. **Jean Vuillemin** (Stanford University, 1973): *Proof Techniques for Recursive Programs*
 - (a) Philippe Flajolet (Université de Paris, 1979)
 - i. Laurent Cheno (Université Paris Orsay, 1981)
 - ii. Mireille Régnier (Université Paris Orsay, 1983)
 - iii. Claude Puech (Université Paris Orsay 1984)
 - A. Alexis Lamouret (Université Joseph Fourier, 1995)
 - B. Nicolas Holzschuch (Université Joseph Fourier, 1996)
 - C. Jean-Christophe Lombardo (Université Joseph Fourier, 1996)
 - D. Michel Pocchiola (Université Paris, 1990)
 - E. Fredo Durand
 - iv. Philippe Jacquet (Université Paris Orsay, 1988)
 - v. Michelle Soria (Université Paris Orsay, 1990)
 - vi. Luc Albert (Université Paris Orsay, 1990)
 - vii. Danièle Gardy (Université Paris Orsay, 1990)
 - viii. Paul Zimmermann (École Polytechnique, 1991)
 - A. Francois Bertault (Université Henry Poincaré, Nancy, 1997)
 - ix. Bruno Salvy (Ecole Polytechnique, 1991)
 - x. Philippe Dumas (Université Bordeaux, 1993)
 - xi. Xavier Gourdon (Ecole Polytechnique, 1996)
 - xii. Frédéric Chyzak (Ecole Polytechnique, 1998)
 - xiii. Julien Clement (Université Caen, 2000)
 - xiv. Cyril Banderier (Université Paris VI, 2001)
 - xv. Marianne Durand (École Polytechnique, 2002)
 - (b) Louis Monier (Université de Paris, 1980)
 - (c) Patrice Bertin (Université Paris VII, 1993)
 - (d) Laurent Moll (École Polytechnique, 1997)
4. **Shmuel Katz** (Weizmann Institute, 1976): *Invariants and the Logical Analysis of Programs*
 - (a) **Orna Grumberg** (Technion, 1984)
 - i. Limor Fix (Technion, 1992)
 - ii. Orna Kupferman (Technion, 1995)
 - iii. Karen Yorav (Technion, 2000)
 - iv. Doron Bustan (Technion, 2002)
 - (b) Gadi Taubenfeld (Technion, 1988)
 - (c) **Doron Peled** (Technion, 1991)
 - (d) Marcelo Glusman (Technion, 2003)
 - (e) **Marcelo Sihman** (Technion, 2003)

5. *Adi Shamir* (Weizmann Institute, 1977): *Fixedpoints of Recursive Programs*
 - (a) Eli Biham (Weizmann Institute)
 - (b) Uriel Feige (Weizmann Institute)
 - (c) Dror Lapidot (Weizmann Institute)
 - (d) Avital Schrift (Weizmann Institute)
 - (e) Ziv Soferman (Weizmann Institute)
 - (f) *Amos Fiat* (Weizmann Institute)
 - i. Yair Bartal (Tel-Aviv University, 1997)
 - ii. Yuval Rabani (Tel-Aviv University, 1994)
 - A. Anna Moss (Technion, 2001)
 - iii. Yiftach Ravid (Tel-Aviv University, 1994)
 - iv. Moty Ricklin (Tel-Aviv University, 1995)
 - v. Adi Rosen (1995)
 - vi. Manor Mendel (Tel-Aviv University, 2001)
6. **Nachum Dershowitz** (Weizmann Institute, 1978): *Automatic Program Modification*
 - (a) Jieh Hsiang (University of Illinois, 1982; unofficial)
 - i. Michael Rusinowitch (Université de Nancy, 1987)
 - A. Adel Bouhoula (Université de Nancy, 1994)
 - B. Laurent Vigneron (Université de Nancy, 1994)
 - C. Eric Monfroy (Université de Nancy, 1996)
 - D. Narjes Berregeb (Université de Nancy, 1997)
 - E. Sorin Stratulat (Université de Nancy, 2000)
 - ii. Eric Johnson (SUNY Stonybrook, 1990)
 - iii. Maria Paola Bonacina (SUNY Stonybrook, 1992)
 - iv. Hong Chen (SUNY Stonybrook, 1992)
 - v. Hsieh-Chang Tu (National Taiwan University, 1999)
 - vi. Guan-Shieng Huang (National Taiwan University, 1999)
 - vii. Yuh-Pyng Shieh (National Taiwan University, 2000)
 - (b) Leo Bachmair (University of Illinois, 1986)
 - i. Ta Chen (SUNY Stony Brook, 1995)
 - ii. Ashish Tiwari (SUNY Stony Brook, 2000)
 - (c) Yuh-jeng Lee (University of Illinois, 1987)
 - (d) G. Sivakumar (University of Illinois, 1988)
 - i. S. Hanumantha Rao (IIT Bombay, 1998)
 - ii. Jyotsna Kamal (IIT Bombay, 1999)
 - iii. Krishnan Ramanathan (IIT Bombay, 1999)
 - (e) N. Alan Josephson (University of Illinois, 1989)
 - (f) Naomi Lindenstrauss (Hebrew University, 1991)
 - (g) Subrata Mitra (University of Illinois, 1994)
 - (h) Charles Hoot (University of Illinois, 1996)
 - (i) Mitch Harris (University of Illinois, 2002)

7. **William L. Scherlis** (Stanford University, 1980): *Expression Procedures and Program Derivation*
 - (a) Scott Dietzen (Carnegie-Mellon University, 1990)
 - (b) Rod Nord (Carnegie-Mellon University, 1991)
8. Pierre Wolper (Stanford University, 1982): *Synthesis of Communicating Processes from Temporal Logic Specifications*
 - (a) Marie-Jeanne Toussaint (University of Liège, 1991)
 - (b) Froduald Kabanza (University of Liège, 1992)
 - (c) Patrice Godefroid (University of Liège, 1994)
 - (d) Bernard Boigelot (University of Liège, 1998)
9. **Ben Moszkowski** (Stanford University, 1983): *Reasoning about Digital Circuits*
 - (a) Roger Hale (University of Cambridge, 1988)
 - (b) Arun Chakrapani Rao (De Montfort University, 2002)
 - (c) Jordan Dimitrov (De Montfort University, 2002)
10. Yoni Malachi (Stanford University, 1985): *Nonclausal Logic Programming*
11. **Martín Abadi** (Stanford University, 1986): *Temporal Theorem Proving*
12. Marianne Baudinet (Stanford University, 1988): *Logic Programming Semantics: Techniques and Applications*
13. **Rajeev Alur** (Stanford University, 1991): *Techniques for Automatic Verification of Real-Time Systems*
 - (a) Salvatore La Torre (University of Pennsylvania, 2001)
 - (b) Bow-Yaw Wang (University of Pennsylvania, 2001)
 - (c) Franjo Ivancic (University of Pennsylvania, 2003)
 - (d) Zijiang Yang (University of Pennsylvania, 2003)
14. **Thomas A. Henzinger** (Stanford University, 1991): *The Temporal Specification and Verification of Real-Time Systems*
 - (a) Pei-Hsin Ho (Cornell, 1995)
 - (b) Peter Kopke (Cornell, 1996)
 - (c) Shaz Qadeer (UC Berkeley, 1999)
 - (d) Sriram Rajamani (UC Berkeley, 1999)
 - (e) Freddy Mang (UC Berkeley, 2002)
 - (f) Rupak Majumdar (UC Berkeley, 2003)
 - (g) Benjamin Horowitz (UC Berkeley, 2003)
15. Eddie Chang (Stanford University, 1994): *Compositional Verification of Reactive and Real-Time Systems*
16. Hugh McGuire (Stanford University, 1995): *Two Methods for Checking Formulas of Temporal Logic*
17. Anuchit Anuchitanukul (1995): *Synthesis of Reactive Programs*
18. Arjun Kapur (Stanford University, 1997): *Interval and Point-Based Approaches to Hybrid System Verification*
19. **Luca de Alfaro** (Stanford University, 1998): *Formal Verification of Probabilistic Systems*
20. Nikolaj S. Bjørner (Stanford University, 1998): *Integrating Decision Procedures for Temporal Verification*

21. Tomás E. Uribe (Stanford University, 1998): *Abstraction-Based Deductive-Algorithmic Verification of Reactive Systems*
22. **Henny B. Sipma** (Stanford University, 1999): *Diagram-Based Verification of Discrete, Real-Time and Hybrid Systems*
23. *Bernd Finkbeiner* (Stanford University, 2002): *Verification Algorithms Based on Alternating Automata*