

Jeannette M. Wing
Computer Science Department
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, PA 15213-3891
wing@cs.cmu.edu
(412) 268-3068
<http://www.cs.cmu.edu/~wing/>

Research Interests

Software specification and verification, trustworthy computing, security, privacy, distributed and concurrent systems, programming languages, programming methodology, software analysis tools.

Education

June 1983
Massachusetts Institute of Technology Cambridge, MA
Ph.D. in Computer Science
Thesis: *A Two-Tiered Approach to Specifying Programs.*
Advisor: John Guttag.
Minor in logic and number theory.

June 1979
Massachusetts Institute of Technology Cambridge, MA
S.M. in Electrical Engineering and Computer Science.
Thesis: *Partial-Match Retrieval Using Tries, Hashing, and Superimposed Codes.*
Advisors: Ronald Rivest (MIT) and John Reiser (Bell Labs).
VI-A co-operative student in Computer Science with AT&T Bell Laboratories.

June 1979
Massachusetts Institute of Technology Cambridge, MA
S.B. in Computer Science and Engineering.
VI-A co-operative student in Computer Science with AT&T Bell Laboratories.

Employment History

2007–
National Science Foundation Arlington, VA
Assistant Director for the Computer and Information Science and Engineering (CISE) Directorate.

1985–
Carnegie Mellon University Pittsburgh, PA
President's Professor of Computer Science, 2004–.
Head, Computer Science Department, 2004–2007.
Director of Microsoft-Carnegie Mellon Center for Computational Thinking, since 2007. Currently on leave.
Professor of Electrical and Computer Engineering, courtesy, 2005–.
Associate Dean for Academic Affairs, School of Computer Science, 1999–2004.
Associate Dean for Doctoral Programs, School of Computer Science, 1998.
Associate Department Head for the Ph.D. Program, Computer Science Department, 1996–2004.
Director of Specification and Verification Center, since 2001. Currently on leave.

2002–2003

Microsoft Research Visiting Researcher.	Redmond, WA
1992 Massachusetts Institute of Technology Visiting Associate Professor of Computer Science.	Cambridge, MA
1983-1985 University of Southern California (USC) Assistant Professor, Computer Science Department.	Los Angeles, CA
1979-1983 Massachusetts Institute of Technology Research Assistant, Systematic Programming Development Group, Laboratory for Computer Science. Research Assistant, Programming Methodology Group, Laboratory for Computer Science. Teaching Assistant, Department of Electrical Engineering and Computer Science.	Cambridge, MA
1982, 1981 Xerox Palo Alto Research Centers Summer Research Intern, Computer Science Laboratory.	Palo Alto, CA
1980 USC/Information Sciences Institute Summer Research Assistant, Program Verification Group.	Marina del Rey, CA
1976-1978 AT&T Bell Laboratories Research Staff/Co-op Student, Interactive Computer Systems Research Department. Research Staff/Co-op Student, Computing Techniques Research Department. Research Staff/Co-op Student, Operator Service Department.	Murray Hill and Holmdel, NJ

Research Activities

Books, Edited Volumes

1. D. Kroening, D. Garlan, and J.M. Wing, *The Practice of Formal Methods*, in progress.
2. J.M. Wing, J.P.C. Woodcock, and J. Davies (editors), *Proceedings of FM'99: First World Congress on Formal Methods in the Development of Computing Systems*, Toulouse, France, Springer-Verlag, LNCS 1708 (Volume I) and 1709 (Volume II), 1999.
3. U. Martin and J. Wing (eds.), *Proceedings of the First International Workshop on Larch*, Springer-Verlag, Workshops in Computing Series, 1993.
4. J.V. Guttag and J.J. Horning (eds.) with S.J. Garland, K.D. Jones, A. Modet, and J.M. Wing, *Larch: Languages and Tools for Formal Specification*, Springer-Verlag, 1993.

Book Chapters (Refereed)

1. J.M. Wing, "Scenario Graphs Applied to Network Security," Chapter 9, in *Information Assurance: Survivability and Security in Networked Systems*, Yi Qian, James Joshi, David Tipper, and Prashant Krishnamurthy, editors, Morgan Kaufmann Publishers, Elsevier, Inc., 2008, pp. 247–277.
2. M. Howard, J. Pincus, and J.M. Wing, "Measuring Relative Attack Surfaces," Chapter 8, in *Computer Security in the 21st Century*, D.T. Lee, S.P. Shieh, and J.D. Tygar, editors, Springer, March 2005, pp. 109–137.
3. B.H. Liskov and J.M. Wing, "Behavioral Subtyping Using Invariants and Constraints," in *Formal Methods for Distributed Processing, an Object Oriented Approach*, Howard Bowman and John Derrick, editors, Cambridge University Press, 2001, pp. 254–280. Also available as CMU-CS-99-156, July 1999.
4. J.M. Wing and J. Ockerbloom, "Respectful Type Converters for Mutable Types," in *Foundations of Component Based Systems*, Gary Leavens and Murali Sitaraman, editors, Cambridge University Press, 2000, pages 161–186. Also available as CMU-CS-99-142, June 1999.
5. J.M. Wing, "A Symbiotic Relationship Between Formal Methods and Security," in the *Proceedings of the Workshops on Computer Security, Dependability, and Assurance: From Needs to Solution*, pp. 26-38. Also available as CMU-CS-98-188, December 1998.
6. J.M. Wing, "Hints to Specifiers," Chapter 5 in *Educational Issues of Formal Methods*, edited by M. Hinchey and N. Dean, Academic Press, London, 1996, pp. 57–77. Preliminary version available as CMU-CS-95-118R, May 1995, which supersedes "Teaching Mathematics to Software Engineers," CMU-CS-95-118, February 1995.
7. D.L. Detlefs, M.P. Herlihy and J.M. Wing, "Avalon/C++," in *Advanced Language Implementation: Recent Research at Carnegie Mellon University*, P. Lee, editor, MIT Press, 1991.
8. J.M. Wing et al., "The Avalon Language," Part IV, Chapters 19–22, in *Camelot and Avalon: A Distributed Transaction Facility*, J. Eppinger, L. Mummert and A. Spector, editors, Morgan Kaufmann Publishers, Inc., 1991.
9. M.W. Maimone, J.D. Tygar and J.M. Wing, "Formal Semantics for Visual Specification of Security," in *Visual Languages and Visual Programming*, S.-K. Chang, editor, Plenum, 1990, pp. 97–116. Also CMU-CS-88-173r.

Journal Publications

1. J.M. Wing, "Computational Thinking and Thinking about Computing," *Philosophical Transactions of the Royal Society*, vol. 366, July 2008, pp. 3717–3725.
2. J.M. Wing, "Five Deep Questions in Computing," *Communications of the ACM*, essay, vol. 51, no. 1, January 2008, pp. 58–60.
3. J.M. Wing, "Computational Thinking," *Communications of the ACM*, viewpoint, vol. 49, no. 3, March 2006, pp. 33–35. Chinese translation in *Communications of CCF*, vol. 3 no. 11, November 2007, pp. 83–85. French translation, by Pierre Lescanne, in *Bulletin of SPECIF*, December 2008.
4. K.W. Lye and J.M. Wing, "Game Strategies in Network Security," *International Journal of Information Security*, February 2005.
5. J.M. Wing, "Beyond the Horizon: A Call to Arms," *IEEE Security and Privacy*, November/December 2003, pp. 62–67.
6. D. Kindred and J.M. Wing, "Theory Generation for Security Protocols", in progress.
7. J.M. Wing and J. Ockerbloom, "Respectful Type Converters," *IEEE Transactions on Software Engineering*, vol. 26, no. 7, July 2000, pp. 579–593; also CMU-CS-98-130.
8. D. Jackson, Y. Ng, and J.M. Wing, "A Nitpick Analysis of Mobile IPv6," *Formal Aspects of Computing*, vol. 11, no. 6, 1999, pp. 591–615; also CMU-CS-98-113, March 1998.
9. H.S. Chadha, J.W. Baugh Jr., and J.M. Wing, "Formal Specification of Concurrent Systems," *Advances in Engineering Software* (read by civil and mechanical engineers), vol 30, no. 3, March 1999, pp. 211–224.
10. G. Leavens and J.M. Wing, "Protective Interface Specifications," *Formal Aspects of Computing*, vol. 10, March 1998, pp. 59–75.
11. A.M. Zaremski and J.M. Wing, "Specification Matching of Software Components," *ACM Trans. on Software Engineering and Methodology*, vol. 6, no. 4, October 1997, pp. 333-369. Shorter version published in *Proceedings of SIGSOFT Foundations of Software Engineering*, October 1995, pp. 6–17; recommended by program committee for submission to *TOSEM*; also CMU-CS-95-127, March 1995.
12. J.M. Wing and M. Vaziri-Farahani, "A Case Study in Model Checking Software Systems," *Science of Computer Programming*, vol. 28, 1997, pp. 273–299; also CMU-CS-96-124. Shorter version published as "Model Checking Software Systems: A Case Study," *Proceedings of SIGSOFT Foundations of Software Engineering*, October 1995, pp. 128–139; also CMU-CS-95-128, March 1995.
13. E.M. Clarke and J.M. Wing, "Formal Methods: State of the Art and Future Directions," *ACM Computing Surveys*, vol. 28, no. 4, December 1996, pp. 626–643. Available as CMU-CS-96-178.
14. L. Mummert, J.M. Wing and M. Satyanarayanan, "Using Belief to Reason about Cache Coherence in Distributed File Systems," submitted to *The Chicago Journal of Theoretical Computer Science*, December 1994. Shorter version published as "Using Belief to Reason about Cache Coherence," in *Proceedings of the Symposium on Principles of Distributed Computing*, August 1994, pp. 71–80. Recommended by program committee for submission to *CJTCS*; also CMU-CS-94-151R, December 1994.
15. D. Jackson and J. Wing, "Lightweight Formal Methods," *IEEE Computer*, April 1996, pp. 21–22.
16. A.M. Zaremski and J.M. Wing, "Signature Matching, a Tool for Software Libraries," *ACM Trans. on Software Engineering and Methodology*, vol. 4, no. 2, April 1995, pp. 146–170. Shorter version published as "Signature Matching: A Key to Reuse," in *Proceedings of SIGSOFT Foundations of Software Engineering*, December 1993. Recommended by program committee for submission to *TOSEM*; also CMU-CS-93-151, May 1993.
17. B.H. Liskov and J.M. Wing, "A Behavioral Notion of Subtyping," *ACM Trans. on Prog. Lang. and Systems*, vol. 16, no. 6, November 1994, pp. 1811–1841.

18. N. Haines, D. Kindred, J.G. Morrisett, S.M. Nettles and J.M. Wing, "Composing First-Class Transactions," *ACM Trans. on Prog. Lang. and Systems*, Short Communications, vol. 16, no. 6, November 1994, pp. 1719–1736.
19. J.M. Wing and C. Gong, "Testing and Verifying Concurrent Objects," *Journal of Parallel and Distributed Computing*, vol. 17, 1993, pp. 164–182.
20. M.P. Herlihy and J.M. Wing, "Specifying Graceful Degradation," *IEEE Trans. on Parallel and Distributed Computing*, vol. 2, no. 1, January 1991, pp. 93–104; preliminary version in CMU-CS-87-120 March 1988. Shorter version published as "Specifying Graceful Degradation in Distributed Systems," in *Proceedings of the 6th Symposium on Principles on Distributed Computing*, Vancouver, Canada, August 1987, pp. 167–177; also CMU-CS-87-120, May 1987.
21. A. Heydon, M. Maimone, D. Tygar, J.M. Wing and A.M. Zaremski, "Miro: Visual Specifications of Security," *IEEE Trans. on Software Engineering*, vol. 16, no. 10, October 1990, pp. 1185–1197. Also CMU-CS-89-199, November 1989.
22. J.M. Wing, "Using Larch to Specify Avalon/C++ Objects," *IEEE Trans. on Software Engineering*, vol. 16, no. 9, September 1990, pp. 1076–1088.
23. J.M. Wing, "A Specifier's Introduction to Formal Methods," *IEEE Computer*, vol. 23, no. 9, September 1990, pp. 8–24. Also CMU-CS-90-136, May 1990, superseding CMU-CS-89-200, "What is a Formal Method?," November 1989.
24. M.P. Herlihy and J.M. Wing, "Linearizability: A Correctness Condition for Concurrent Objects," *ACM Trans. on Prog. Lang. and Systems*, vol. 12, no. 3, July 1990, pp. 463–492; also CMU-CS-88-120, November 1987. Shorter version published as "Axioms for Concurrent Objects," in *Proceedings of the 14th Symposium on Principles of Programming Languages*, Munich, W. Germany, January 21–23, 1987, pp. 13–26; also CMU-CS-86-154, October 1986.
25. J.M. Wing, "Verifying Atomic Data Types," *International Journal of Parallel Programming*, vol. 18, no. 5, 1989, pp. 315–357.
26. M.R. Barbacci, D.L. Doubleday, C.B. Weinstock and J.M. Wing, "Developing Applications for Heterogeneous Machine Networks: The Durra Environment," *Computing Systems*, vol. 2, no. 1, March 1989, pp. 7–35.
27. J.M. Wing and M. Nixon, "Extending Ina Jo with Temporal Logic," *IEEE Trans. on Software Engineering*, vol. 15, no. 2, February 1989, pp. 181–197. Shorter version in *1986 IEEE Symposium on Security and Privacy*, Oakland, California, April 1986, pp. 2–13.
28. D.L. Detlefs, M.P. Herlihy and J.M. Wing, "Inheritance of Synchronization and Recovery Properties in Avalon/C++," *IEEE Computer*, vol. 21, no. 12, December 1988, pp. 57–69. Also CMU-CS-87-133, June 1987.
29. J.M. Wing, "A Study of Twelve Specifications of the Library Problem," *IEEE Software*, vol. 5, no. 4, July 1988, pp. 66–76. Runner-up for 1988 *IEEE Software Best Paper Award*. Also CMU-CS-87-142, July 1987.
30. J.M. Wing, "Writing Larch Interface Language Specifications," *ACM Trans. on Prog. Lang. and Systems*, vol. 9, no. 1, January 1987, pp. 1–24.
31. J.V. Guttag, J.J. Horning and J.M. Wing, "The Larch Family of Specification Languages," *IEEE Software*, vol. 2, no. 5, September 1985, pp. 24–36.
32. J.V. Guttag, and J.J. Horning and J.M. Wing, "Some Remarks on Putting Formal Specifications to Productive Use," *Science of Computer Programming*, vol. 2, no. 1, October 1982, pp. 53–68.

Refereed Conference and Workshop Papers

1. M.C. Tschantz and J.M. Wing, "Formal Methods for Privacy," in *Proceedings of Formal Methods 2009*, Eindhoven, The Netherlands, Lecture Notes in Computer Science, Springer-Verlag, November 2009, pp. 1–15. **Invited Paper**. Also CMU-CS-TR-09-154, August 2009.
2. P.K. Manadhata, Y. Karabulut, and J.M. Wing, "Measuring the Attack Surface of SAP Platforms and Business Applications," in *Proceedings of the International Symposium Symposium on Engineering Secure Software and Systems*, Industry Track Leuven, Belgium, February 4–6, 2009.
3. P.K. Manadhata, Y. Karabulut, and J.M. Wing, "Measuring the Attack Surfaces of SAP Software Systems," in *Proceedings of the 19th IEEE International Symposium on Software Reliability Engineering*, Industry Track (only abstract and presentation published), Redmond, WA, November 11–14, 2008.
4. M.C. Tschantz and J.M. Wing, "Extracting Conditional Confidentiality Policies," in *Proceedings of the 6th IEEE International Conference on Software Engineering and Formal Methods*, Cape Town, South Africa, November 10–14, 2008, pp. 107–116. **Best Paper Award**. Preliminary version available as CMU-CS-08-127 Technical Report, May 2008.
5. P.K. Manadhata, J.M. Wing, M.A. Flynn, and M.A. McQueen, "Measuring the Attack Surfaces of Two FTP Daemons," in *Proceedings of Quality of Protection Workshop*, Alexandria, VA, October 30, 2006.
6. V. Mehta, C. Bartzis, H. Zhu, E.M. Clarke, and J.M. Wing, "Ranking Attack Graphs," in *Proceedings of Recent Advances in Intrusion Detection 2006*, Hamburg Germany, Sept. 20–22, 2006.
7. P.K. Manadhata and J.M. Wing, "An Attack Surface Metric," *First Workshop on Security Metrics*, Vancouver, BC, August 1, 2006, position paper.
8. J.M. Wing, "Scenario Graphs Applied to Security," in *Proceedings of Verification of Infinite State Systems with Applications to Security (VISSAS) 2005*, Timisoara, Romania, March 2005, extended abstract, pp. 229–234.
9. J. Pincus and J.M. Wing, "Towards an Algebra for Security Policies," *Proceedings of 26th International Conference on Applications and Theory of Petri Nets*, Miami, FL, June 2005, extended abstract, pp. 17–25.
10. O. Sheyner and J.M. Wing, "Tools for Generating and Analyzing Attack Graphs," *Proceedings of Workshop on Formal Methods for Components and Objects*, 2004, pp. 344–371.
11. M. Howard, J. Pincus, and J.M. Wing, "Measuring Relative Attack Surfaces," *Proceedings of Workshop on Advanced Developments in Software and Systems Security*, Taipei, December 2003. Also CMU-CS-03-169 Technical Report, August 2003.
12. T.M. Wong, C. Wang, and J.M. Wing, "Verifiable Secret Redistribution for Archive Systems," *Proceedings of the First International Security in Storage Workshop*, Maryland, December 2002.
13. K.W. Lye and J.M. Wing, "Game Strategies in Network Security," in the *Proceedings of the Foundations of Computer Security Workshop 2002*, July 26, 2002, Copenhagen, Denmark. Longer version available as CMU-CS-02-136, May 2002.
14. S. Jha, O. Sheyner, and J.M. Wing, "Two Formal Analyses of Attack Graphs," *Proceedings of the 15th IEEE Computer Security Foundations Workshop*, Nova Scotia, Canada, June 2002, pp. 49–63.
15. O. Sheyner, J. Haines, S. Jha, R. Lippmann, and J.M. Wing, "Automated Generation and Analysis of Attack Graphs," *Proceedings of the IEEE Symposium on Security and Privacy*, Oakland, CA, May 2002.
16. S. Jha and J. Wing, "Survivability Analysis of Networked Systems," *Proceedings of the International Conference on Software Engineering*, Toronto, Canada, May 2001. Preliminary version available as CMU-CS-00-168, October 2000.
17. J. Wing, "Towards a Science of Survivability: A Research Agenda and a Specific Method," *Proceedings of the Third Information Survivability Workshop (ISW-2000)*, Boston, MA, October 24–26, 2000. Position paper.

18. O. Sheyner and J. Wing, "Composing Proofs of Security Protocols Using Isabelle/IOA," *Proceedings of the Theorem Proving for Higher Order Logics (TPHOLs) Workshop*, short paper, August 2000. Longer version available as CMU-CS-00-106.
19. N. Hopper, S. Seshia, and J. Wing, "A Comparison and Combination of Theory Generation and Model Checking for Security Protocol Analysis," *Proceedings of the Workshop on Formal Methods and Security*, July 2000; earlier version available as CMU-CS-00-107.
20. S. Jha, J.M. Wing, R. Linger, and T. Longstaff, "Analyzing Survivability Properties of Specifications of Networks," *Proceedings of the International Conference on Dependable Systems and Networks, Workshop on Dependability Despite Malicious Faults*, New York City, NY, June 25-28, 2000, pp. 613-622.
21. M. Vaziri, N. Lynch, and J.M. Wing, "Proving the Correctness of a Controller Algorithm for the RAID Level 5 System," *Proceedings of the International Symposium on Fault-Tolerant Computing*, June 1998; also CMU-CS-98-117, March 1998.
22. J.M. Wing, "Subtyping for Distributed Object Stores," *Proceedings of the Second IFIP International Workshop on Formal Methods for Open Object-based Distributed Systems (FMOODS)*, July 1997, pp. 305-318. **Invited Paper**. Also CMU-CS-97-121, April 1997.
23. Gary T. Leavens and J.M. Wing, "Protective Interface Specifications," *Proceedings of TAPSOFT '97 Theory and Practice of Software Development, 7th International Joint Conference CAAP/FASE*, Lecture Notes in Computer Science 1214, April 1997, pp. 520-534. Also CMU-CS-96-129R, October 1996. Earlier version appeared as "Protection from the Underspecified," CMU-CS-96-129 and Iowa State University Dept. of Computer Science TR96-04, April 1996.
24. D. Kindred and J.M. Wing, "Fast, Automatic Checking of Security Protocols," *Proc. of the USENIX 1996 Workshop on Electronic Commerce*, Oakland, CA, November 1996, pp. 41-52. Also CMU-CS-96-173, September 1996.
25. N. Heintze, J.D. Tygar, J.M. Wing, and H.-C. Wong, "Model Checking Electronic Commerce Protocols," *Proc. of the USENIX 1996 Workshop on Electronic Commerce*, Oakland, CA, November 1996, pp. 147-164.
26. J.M. Wing, "Teaching Mathematics to Software Engineers," *Proceedings of the Fourth International Conference on Algebraic Methodology and Software Technology (AMAST '95)*, Montreal, Canada, July 3, 1995, pp. 18-40. **Invited Paper**. Also CMU-CS-95-118, March 1995; superseded by CMU-CS-95-118R, May 1995.
27. J.M. Wing and D.C. Steere, "Specifying Weak Sets," *Proceedings of the 15th International Conference on Distributed Computing Systems*, Vancouver, May 30-June 2, 1995. Also CMU-CS-94-194, October 1994.
28. D. Garlan, G. Abowd, D. Jackson, J. Tomayko, and J.M. Wing, "The CMU Master of Software Engineering Core Curriculum," *Proceedings of the Eighth SEI Conference on Software Engineering Education (CSEE)*, New Orleans, Lecture Notes in Computer Science 895, Springer-Verlag, March-April 1995, pp. 65-86.
29. Harpreet S. Chadha, John W. Baugh Jr., and J.M. Wing, "Formal Specification of AEC Product Models," *Computing in Civil Engineering: Proceedings of the First Congress*, K. Khozeimeh, ed., American Society of Civil Engineers (ASCE), Washington, D.C., June pp. 571-578, 1994.
30. J.M. Wing, "Decomposing and Recomposing Transactional Concepts," *Proceedings of the Workshop on Object-based Distributed Programming*, Lecture Notes in Computer Science 791, R. Guerraoui, O. Nierstrasz, and M. Riveill (editors), Springer-Verlag, pp. 111-121, 1994.
31. B. Liskov and J.M. Wing, "Specifications and Their Use in Defining Subtypes," *Proceedings of OOP-SLA '93*, September 1993, pp. 16-28. Also reprinted by permission from ACM in *Proceedings of ZUM '95*, Lecture Notes in Computer Science, Springer-Verlag, September 1995, pp. 245-263.

32. B. Liskov and J.M. Wing, "A New Definition of the Subtype Relation," *Proceedings of ECOOP '93*, Lecture Notes in Computer Science 707, Springer-Verlag, July 1993, pp. 118–141. Also CMU-CS-93-149, April 1993; MIT LCS Programming Methodology Group Memo 76, May 1993.
33. J.M. Wing, M. Faehndrich, J.G. Morrisett, and S.M. Nettles, "Extensions to Standard ML to Support Transactions," *Proceedings of ACM SIGPLAN Workshop on ML and its Applications*, June 20-21, 1992, San Francisco, CA, pp 104-118. Also CMU-CS-92-132, April 1992.
34. J.M. Wing, "Revisiting Abstraction Functions for Reasoning About Concurrency," *Proceedings of the Fifth Refinement Workshop*, British Computer Society, Springer-Verlag, C.B. Jones, R.C. Shaw, and T. Denz, editors, 1992, pp. 298–300. Extended abstract. **Invited Paper.**
35. S.M. Nettles and J.M. Wing, "Persistence + Undoability = Transactions," *Proceedings of Hawaii International Conference on Systems Science 25*, January 1992. Also CMU-CS-91-173, August 1991.
36. J.M. Wing and A.M. Zaremski, "Unintrusive Ways to Integrate Formal Specifications in Practice," *Proceedings VDM '91*, Lecture Notes in Computer Science 551, Springer-Verlag, October 1991, Delft, The Netherlands, pp. 545–569. Also CMU-91-113, February 1991.
37. J.M. Wing and A.M. Zaremski, "A Formal Specification of a Visual Language Editor," *Proceedings of the Sixth International Workshop on Software Specification and Design*, October 1991, Como, Italy, pp. 120–129. Also CMU-91-112, February 1991.
38. E.R. Rollins and J.M. Wing, "Specifications as Search Keys for Software Libraries," *Proceedings of the Eighth International Conference on Logic Programming*, Paris, June 1991. Also CMU-90-159, September 1990.
39. J.M. Wing and C. Gong, "Experience with the Larch Prover," *Proceedings of the ACM Workshop on Formal Methods in Software Development*, Napa, CA, May 1990, pp. 140–143.
40. J.M. Wing, "Verifying Atomic Data Types," *Proceedings of the REX Workshop on Stepwise Refinement of Distributed Systems: Models, Formalism, Correctness*, May 29-June 2, 1989, Plasmolen, The Netherlands, Lecture Notes in Computer Science 430, Springer-Verlag, 1990, pp. 731–758. **Invited Paper.** Also CMU-CS-89-168, July 1989.
41. M.R. Barbacci and J.M. Wing, "A Language for Distributed Applications," *Proceedings of the 1990 International Conference on Computer Languages*, March 1990, New Orleans, pp. 59–68.
42. S.M. Clamen, L.D. Leibengood, S.M. Nettles and J.M. Wing, "Reliable Distributed Computing with Avalon/Common Lisp," *Proceedings of the 1990 International Conference on Computer Languages*, March 1990, New Orleans, pp. 169–179. Also CMU-CS-89-186, September 1989.
43. A. Heydon, M. Maimone, J.D. Tygar, J.M. Wing and A.M. Zaremski, "Miro Tools," *Proceedings of the IEEE 1989 Workshop on Visual Languages*, Rome, Italy, October 1989, pp. 86–91. Also CMU-CS-89-159, July 1989.
44. A. Heydon, M. Maimone, J.D. Tygar, J.M. Wing and A.M. Zaremski, "Constraining Pictures with Pictures," *Proceedings of IFIPS '89*, San Francisco, CA, August 1989, pp. 157–162. Also CMU-CS-88-185, November 1988.
45. M.P. Herlihy and J.M. Wing, "Specifying Security Constraints with Relaxation Lattices," *Proceedings of the Computer Security Foundations Workshop II*, Franconia, NH, June 1989, pp. 47–53.
46. J.M. Wing, "Specifying Avalon Objects in Larch," *Proceedings of the International Joint Conference on Theory and Practice of Software Development (TAPSOFT)*, Barcelona, March 13-17, 1989, Lecture Notes in Computer Science 352, Springer-Verlag, pp. 61–80. **Invited Paper.** Also CMU-CS-88-208, December 1988.
47. M.W. Maimone, J.D. Tygar and J.M. Wing, "Miro Semantics for Security," *Proceedings of the IEEE 1988 Workshop on Visual Languages*, Pittsburgh, PA, October 1988, pp. 45–51. Also CMU-CS-88-173, August 1988.

48. M.P. Herlihy and J.M. Wing, "Reasoning About Atomic Objects," *Proceedings of the Symposium on Formal Techniques in Real-time and Fault-tolerant Systems*, 22-23 September 1988, Warwick, U.K., Lecture Notes in Computer Science 331, Springer-Verlag, pp. 193–208. Preliminary version in CMU-CS-87-176, March 1988.
49. J.M. Wing, "Specifying Recoverable Objects," *Proceedings of the Sixth Annual Pacific Northwest Software Quality Conference*, Portland, OR, September 1988, pp. 317–331. Also CMU-CS-88-170, July 1988.
50. M.R. Barbacci, C.B. Weinstock and J.M. Wing, "Programming at the Processor-Memory-Switch Level," *Proceedings of the Tenth International Conference on Software Engineering*, Singapore, March 1988, pp. 19–28.
51. D.L. Detlefs, M.P. Herlihy and J.M. Wing, "Inheritance of Synchronization and Recovery Properties in Avalon/C++," *Proceedings of the Hawaii International Conference on Systems Science*, January 1988.
52. M.R. Barbacci, C.B. Weinstock and J.M. Wing, "Durra: Language Support for Large Grained Parallelism," *Proceedings of the International Conference on Parallel Processing and Applications*, L'Aquila, Italy, September 1987.
53. J.D. Tygar and J.M. Wing, "Visual Specification of Security Constraints," *Proceedings of the 1987 Workshop on Visual Languages*, August 19-21, 1987, Linkoping, Sweden. Also CMU-CS-87-122, May 1987.
54. M.R. Barbacci and J.M. Wing, "Durra: A Task-level Description Language," *Proceedings of the 16th Annual International Conference on Parallel Processing*, St. Charles, IL, August 1987, pp. 370–380.
55. M.P. Herlihy and J.M. Wing, "Avalon: Language Support for Reliable Distributed Systems," *Proceedings of the 17th International Symposium on Fault-Tolerant Computing*, Pittsburgh, PA, July 1987, pp. 89–94. Also CMU-CS-86-167, December 1986.
56. M.R. Barbacci and J.M. Wing, "Specifying Functional and Timing Behavior for Real-Time Applications," *Proceedings of the Conference on Parallel Architectures and Languages Europe (PARLE)*, vol. 2, Eindhoven, Lecture Notes in Computer Science 259, Springer-Verlag, June 1987, pp. 124–140. Also CMU-CS-86-177, CMU/SEI-86-TR-4, December 1986.
57. J.M. Wing, "A Larch Specification of the Library Problem," *Proceedings of the Fourth International Workshop on Software Specification and Design*, Monterey, CA, April 1987, pp. 34–41. Also CMU-CS-86-168, December 1986.
58. F. Arbab and J.M. Wing, "Geometric Reasoning: A New Paradigm for Processing Geometric Information," *Proceedings of the International Symposium on New Directions in Computing*, sponsored by the IEEE Computer Society, Norwegian Institute of Technology, Trondheim, Norway, August 12-14, 1985, pp. 80–89. Also in *Proceedings on IFIP Design Theory for CAD*, Tokyo, Japan, October 1985.
59. J.M. Wing, "Specification Firms: A Vision for the Future," *Proceedings of the Third International Workshop on Software Specification and Design*, London, August 26-27, 1985, pp. 241–243.
60. F. Arbab and J.M. Wing, "Geometric Reasoning for Geometric Modeling," *AIAA/AHS/ASEE Aircraft Design, Systems and Operations Conference*, AIAA, Colorado Springs, Colorado, October 14-16, 1985; abstract presented at *SIAM Conference on Geometric Modeling and Robotics*, Albany, New York, July 15-19, 1985.
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62. D. Berry and J.M. Wing, "Specifying and Prototyping: Some Thoughts on Why They Are Successful," *Proceedings of the International Joint Conference on Theory and Practice of Software Development (TAPSOFT) Volume 2*, Berlin, West Germany, Lecture Notes in Computer Science 186, Springer-Verlag, March 1985, pp. 117–128. Also USC Computer Science TR-85-329, July 1985.

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Unrefereed Abstracts, Papers, Reports, Columns, Blogs

1. J.M. Wing, "Computing and Administration Priorities," Computing Research Association, vol. 22, no. 5, November 2009.
2. J.M. Wing, "Breaking the Cycle," Blog@CACM, August 21, 2009.
3. J.M. Wing, "Windmills in the Water," Blog@CACM, June 7, 2009.
4. J.M. Wing, "When the White House Calls...," Blog@CACM, June 2, 2009.
5. J.M. Wing, "Educating Future Generations in Computing," Computing Research Association, vol. 22, no. 2, March 2009.
6. J.M. Wing, "A Simple View of the Budget Process," Blog@CACM, February 7, 2009.
7. E. Lazowska, M. Pollack, D. Reed, and J.M. Wing, "Boldly Exploring the Endless Frontier," Computing Research Association, vol. 22, no. 1, January 2009.
8. J.M. Wing, "Cyber-Physical Systems," Computing Research Association, vol. 22, no. 1, January 2009.
9. J.M. Wing, "A⁷: Anwhere Anytime Affordable Access to Anything by Anyone Authorized," Computing Research Association, vol. 21, no. 5 November 2008.
10. J.M. Wing, "Data-Intensive Computing," *Computing Research News*, Computing Research Association, vol. 20, no. 2, March 2008, p. 3.
11. J.M. Wing, "Thinking About Computing," *Computing Research News*, Computing Research Association, vol. 19, no. 5, November 2007, p. 3.
12. S. Tekinay and J.M. Wing, "Cyber-enabled Discovery and Innovation," *Computing Research News*, Computing Research Association, vol. 19, no. 5, November 2007, pp. 1 and 7.
13. J.M. Wing, "Software Security," *Proceedings of First IEEE and IFIP International Symposium on Theoretical Aspects of Software Engineering*, Shanghai, China, June 2007.
14. J.M. Wing, "FAQ on Pi-Calculus," Microsoft Internal Memo, December 2002.
15. J. M. Wing, "Platitudes and Attitudes," *Software Tools for Technology Transfer*, editorial board opinion piece, Volume 4, Number 3, May 2003, pp. 261–265.
16. J.M. Wing, "What, Who, and How of Tomorrow," Monterey Workshops: Radical Innovations of Software and Systems Engineering in the Future, Venice, Italy, October 6–10, 2002, pp. 400–403.
17. J.M. Wing, "Mathematics in Computer Science Curricula," Sixth International Conference on Mathematics of Program Construction, Dagstuhl, Germany, July 8–10, 2002. Abstract of invited talk, p. 22.
18. J.M. Wing, "Modeling Unpredictable or Random Environments," *Using Uncertainty Within Computation*, AAI 2001 Fall Symposium, Technical Report FS-01-04, AAI Press, North Falmouth, Cape Cod, MA, November 2001, pp. 144–145.
19. J.M. Wing, "Weaving Formal Methods into the Undergraduate Computer Science Curriculum," in the *Proceedings of the Eighth International Conference on Algebraic Methodology and Software 2000*, Iowa City, IA, May 2000, Lecture Notes in Computer Science 1816, Springer-Verlag, pp. 2–7. Extended abstract of invited talk.
20. D. Kindred and J.M. Wing, "Closing the Idealization Gap with Theory Generation," extended abstract, *Proceedings of the DIMACS Workshop on Cryptographic Protocol Design and Verification*, Rutgers, NJ, September 3-5, 1997.

21. J.M. Wing (editor), "Report of the Committee of Visitors for Programs in the Division of Computer and Computation Research," July 1996.
22. J.M. Wing (editor), "Report of the Committee of Visitors for the CISE Institutional Infrastructure Program," November 1995.
23. J.M. Wing, "Hints for Writing Specifications," in *Proceedings of the Z Users' Meeting '95*, September 1995. One-page abstract.
24. D.T. Steere, M. Satyanarayanan, and J.M. Wing, "Dynamic Sets for Search," in *Proceedings of the Symposium on Principles of Distributed Computing*, August 1994, Brief Announcement (one-page abstract), p. 397.
25. F. Bamberger, P. Ford, and J.M. Wing, "Interoperability," section in *R&D for the NII: Technical Challenges*, report edited by M.K. Vernon, E.D. Lazowska, and S.D. Personick, Interuniversity Communications Council, Inc. (EDUCOM), 1994.
26. J.M. Wing, "Formal Methods," *Encyclopedia of Software Engineering*, John Wiley & Sons, Inc., New York, 1994, pp. 504–517. Revision in Second Edition.
27. B. Liskov and J.M. Wing, "Corrigenda to ECOOP '93 Paper," *ACM SIGPLAN Notices*, Volume 29, Number 4, April 1994, p. 4.
28. J.M. Wing, "Composing Transactional Concepts," *ECOOP '93 Workshop on Object-based Distributed Programming*, Kaiserslautern, Germany, July 1993.
29. J.M. Wing, E.R. Rollins, and A.M. Zaremski, "Thoughts on a Larch/ML and a New Application for LP," *Proceedings of the First International Workshop on Larch*, July 13-15, 1992, Dedham, MA. Also CMU-CS-92-135, July 1992.
30. J.M. Wing, "Specifications in Software Development," *Proceedings of the Seventh Annual Symposium on Logic in Computer Science*, June, 1992. Abstract of **Invited Tutorial**.
31. J.M. Wing and A.M. Zaremski, "Two Ways to Integrate Formal Specifications in Practice," *Proceedings of Formal Methods '91*, Drymen, Scotland, September 24-27, 1991, position paper.
32. J.M. Wing, "Program Specification" and "Formal Methods," *Encyclopedia of Computer Science*, A. Ralston and E.D. Reilly (eds.), Van Nostrand Reinhold, Third Edition, 1993, pp. 564–565, 1107-1111.
33. L.D. Leibengood, J.G. Morrisett, S.M. Nettles and J.M. Wing, "ML as a Basis for Distributed Object Management," Standard ML Workshop, Princeton University, June 7-8, 1990.
34. M.R. Barbacci, D.L. Doubleday, C.B. Weinstock and J.M. Wing, "The Durra Language and Runtime Environment: Tools for PMS-Level Programming," *Proceedings of the IFIP Working Conference on Decentralized Systems*, Lyon, France, December 11-13, 1989.
35. S.M. Clamen, L.D. Leibengood, S.M. Nettles and J.M. Wing, "An Overview of Avalon/Common Lisp," *Proceedings of the Third Workshop on Large Grained Parallel Programming*, Pittsburgh, October 10-11, 1989.
36. M.R. Barbacci, D.L. Doubleday, C.B. Weinstock and J.M. Wing, "A Status Report on Durra: A Tool for PMS-Level Programming," *Proceedings of the Third Workshop on Large Grained Parallel Programming*, Pittsburgh, October 10-11, 1989.
37. M.P. Herlihy and J.M. Wing, "Linearizable Concurrent Objects," *Proceedings of the ACM SIGPLAN Workshop on Object-Based Concurrent Programming*, *SIGPLAN Notices*, Vol 24, No. 4, April 1989, pp. 133–135.
38. A. Heydon, M.W. Maimone, A.F. Moormann, J.D. Tygar and J.M. Wing, "Miro: A Visual Language for Specifying Security," *UNIX Security Workshop*, Portland, OR, August 29-30, 1988.
39. D.L. Detlefs, M.P. Herlihy and J.M. Wing, "Avalon/C++: C++ Extensions for Transaction-Based Programming," *Proceedings of the 1987 USENIX Workshop on C++*, Santa Fe, NM, November 8-10, 1987.

40. M. Barbacci and J.M. Wing, "Task-level Application Descriptions," *Workshop on Large Grained Parallelism*, Providence, RI, October 27-29, 1986.
41. J.M. Wing, "Role of Formal Specifications," NRL Invitational Workshop on Testing and Proving, *ACM SIGSOFT Software Engineering Notes*, vol. 11, no. 5, October 1986.
42. J.M. Wing, "Beyond Functional Behavior: Combining Methods to Specify Different Classes of Properties of Large Systems," Proceedings of Verification Workshop III, Watsonville, CA, February 18-21, 1985, *ACM SIGSOFT Software Engineering Notes*, vol. 10, no. 4, August 1985, pp. 102–104.
43. J.M. Wing, "Strength and Essentiality of Specifications," Workshop Notes: International Workshop on Models and Languages for Software Specification and Design, edited by Robert Babb, Department d'Informatique, Universite Laval, Quebec, DIUL-RR-8408, March 1984, pp. 178–181.

Technical Reports (not already listed above)

1. P.K. Manadhata, Y. Karabulut, and J.M. Wing, "Measuring the Attack Surfaces of SAP Business Applications," CMU-CS-08-134 Technical Report, May 2008.
2. P.K. Manadhata, K. Tan, R. Maxion, and J.M. Wing, "An Approach to Measuring A System's Attack Surface," CMU-CS-07-146 Technical Report, August 2007.
3. P.K. Manadhata, D. Kaynar, and J.M. Wing, "A Formal Model for a System's Attack Surface." CMU-CS-07-144 Technical Report, July 2007.
4. Alberts et al., "Results of SEI Independent Research and Development Projects," CMU/SEI-2007-TR-006 Technical Report, July 2007.
5. M. Tschantz and J. M. Wing, "Confidentiality Policies and Their Extraction from Source Code," CMU-CS-07-108 Technical Report, February 2007.
6. P. Manadhata and J.M. Wing, "An Attack Surface Metric," CS-TR-05-155, July 2005.
7. P. Manadhata and J.M. Wing, "Measuring a System's Attack Surface," CS-TR-04-102, January 2004.
8. G. Fairbanks, D. Garlan, B. Sarpeshkar, R. Simmons, G. Tolle, and J.M. Wing, "Reasoning About Exceptions Using Model Checking," CMU-CS-02-165. In preparation.
9. T.M. Wong, J.M. Wing, and C.X. Wang, "Verifiable Secret Redistribution for Threshold Sharing Schemes," CMU-CS-02-114, February 2002.
10. S. Jha, O. Sheyner, and J.M. Wing, "Minimization and Reliability Analyses of Attack Graphs," CMU-CS-02-109, February 2002.
11. T.M. Wong and J.M. Wing, "Verifiable Secret Redistribution," CMU-CS-01-155, October 2001. Superseded by CMU-CS-02-114.
12. O. Sheyner and J. Wing, "Toward Compositional Analysis of Security Protocols Using Theorem Proving," CMU-CS-00-106, January 2000.
13. N. Haines, D. Kindred, J.G. Morrisett, S.M. Nettles and J.M. Wing, "Tinkertoy Transactions," CMU-CS-93-202, December 1993.
14. B. Liskov and J.M. Wing, "Family Values: A Behavioral Notion of Subtyping," CMU-CS-93-187, July 1993. Supersedes "A New Definition of the Subtype Relation," CMU-CS-93-149, April 1993; and "Family Values: A Semantic Notion of Subtyping," CMU-CS-92-220, December 1992, also published as MIT-LCS-TR-562.
15. D. Garlan, A. Brown, D. Jackson, J. Tomayko and J. Wing, "The CMU Masters in Software Engineering Core Curriculum," CMU-CS-93-180, August 1993.
16. J.M. Wing, M. Faehndrich, N. Haines, K. Kietzke, D. Kindred, J.G. Morrisett and S. Nettles, "Veniari/ML Interfaces and Examples," CMU-CS-93-123, March 1993.

17. M.P. Herlihy, S.-Y. Ling and J.M. Wing, "Implementation of Commit Timestamps in Avalon," CMU-CS-91-107, January 1991.
18. C. Gong and J.M. Wing, "A Library of Concurrent Objects and Their Proofs of Correctness," CMU-CS-90-151, July 1990.
19. J.M. Wing and C. Gong, "A Simulator for Concurrent Objects," CMU-CS-90-150, July 1990.
20. C. Gong and J.M. Wing, "Raw Code, Specification, and Proof of the Avalon Queue Example," CMU-CS-89-172, August 1989.
21. J.M. Wing and C. Gong, "Machine-Assisted Proofs of Properties of Avalon Programs," CMU-CS-89-171, August 1989.
22. M. Barbacci and J.M. Wing, "Durra: A Task-level Description Language Reference Manual (Version 2)," CMU/SEI-89-TR-34, August 1989.
23. J. Wing, M. Herlihy, S. Clamen, D. Detlefs, K. Kietzke, R. Lerner and S.-Y. Ling, "The Avalon/C++ Programming Language (Version 0)," CMU-CS-88-209, December 1988.
24. M. Barbacci, M. Herlihy and J. Wing, co-editors, "Proceedings of the Second Workshop on Large-Grained Parallelism," Hidden Valley, PA, October 11-14, 1987, CMU Software Engineering Institute Special Report, CMU/SEI-87-SR-5, November 1987. Also CMU-CS-TR-88-112, February 1988.
25. M. Barbacci and J.M. Wing, "Durra: A Task-level Description Language," CMU-CS-86-176 (also CMU/SEI-86-TR-3), December 1986.
26. M. Nixon and J.M. Wing, "On Adding Concurrency to the Formal Development Methodology (FDM)," System Development Corporation, SP-4360, March 1986.
27. J.M. Wing and M. Nixon, "Adding Temporal Logic to Ina Jo," CMU-CS-85-146, July 1985.
28. J.V. Guttag, J.J. Horning and J.M. Wing, "Larch in Five Easy Pieces," DEC Systems Research Center Technical Report 5, July 1985.
29. F. Arbab and J.M. Wing, "Geometric Reasoning: A New Paradigm for Processing Geometric Information," USC Computer Science TR-85-333. Also available as CMU-CS-85-144, July 1985.
30. J.M. Wing, "A Two-Tiered Approach and Language for Formally Specifying Program Modules," USC Computer Science TR-85-331, March 1985.
31. J.M. Wing, "A Two-Tiered Approach to Specifying Programs," MIT Laboratory for Computer Science TR-299, Cambridge, MA, 1983. Also Ph.D. thesis under the same title, MIT Department of Electrical Engineering and Computer Science, May 1983.
32. J.M. Wing, "Experience with Two Examples: A Household Budget and Graphs," AFFIRM MEMO-30-JMW, USC Information Sciences Institute, Marina del Rey, CA, August 1980.
33. J.M. Wing, "Partial-Match Retrieval Using Tries, Hashing, and Superimposed Codes," S.M. Thesis, MIT Department of Electrical Engineering and Computer Science, Cambridge, MA, May 1979. Also available as Bell Laboratories Technical Memorandum 79-1353-3, May 1979.

Software Artifacts

1. Scenario Graph and Attack Graph Toolkits. Generates a graph of all failure scenarios (attacks) given a desired property of a given model of a system. The attack graph toolkit automatically generates graphs akin to what a Red Team would draw by hand. 2004–2007.
2. The TOM Service. Supports conversions of documents and files of one type to another. 1994–now. <http://tom.cs.cmu.edu/>
3. Venari/ML. System support for persistence, concurrency, and transactions for Standard ML of New Jersey. 1991–1994.

4. Concurrent Object Library. Repository and simulator for implementations of linearizable objects, 1989-1992.
5. Miro. Visual languages and tools for specifying security policies. Built on top of Garnet and CommonLisp. 1988-1991.
6. Avalon/C++. Programming language support for distributed transactions. Built on top of Camelot and Mach. 1987-1990.

University, Industry, and Government Talks

1. "Computational Thinking and Thinking About Computing," Louisiana State University, Baton Rouge, scheduled for March 17, 2010. **Distinguished Lecturer.**
2. "Computational Thinking and Thinking About Computing," Heidelberg, Germany, scheduled for March 8, 2010. **Distinguished Lecturer.**
3. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," 20th Anniversary Celebration, University of California, Riverside, Riverside, CA, scheduled for February 17, 2010.
4. "Confidentiality Policy Extraction," University of Wisconsin, Madison, WI, scheduled for January 27, 2010. **Distinguished Lecturer.**
5. "Computational Thinking," University of Texas, Arlington, TX, scheduled for January 20, 2010. **Distinguished Lecturer.**
6. "Unleashing Waves of Innovation," Federal Communications Commission, October 26, 2009.
7. "Computational Thinking and Thinking About Computing," Colorado State University, October 21, 2009. **Distinguished Lecturer.**
8. "Computational Thinking," St. Joseph's University, Philadelphia, PA, October 8, 2009.
9. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," Microsoft Research Asia, Beijing, China, September 21, 2009.
10. "Computational Thinking and Thinking About Computing," Institute for Human and Machine Cognition, Pensacola, FL, September 2, 2009.
11. "Computational Thinking and Thinking About Computing," Yahoo! Research, Santa Clara, CA, July 29, 2009. **Distinguished Lecturer.**
12. Cyber Physical Systems, Capitol Hill Luncheon for Senator Reid and Senator Rockefeller and staff, Hart Building, Washington, D.C., July 9, 2009.
13. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," AT&T Laboratories, Floram Park, NJ, June 10, 2009. **Distinguished Speaker.**
14. "We Compute" Panel, Strategic Planning Government Forum, Arlington, VA, May 8, 2009
15. "Computational Thinking and Thinking About Computing," University of Michigan, April 15, 2009.
16. "Computational Thinking," Kent State, Kent, OH, April 1, 2009.
17. "Cyber-Physical Systems: Research Challenges," University of Texas, Austin, TX, March 26, 2009.
18. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," University of Maryland, College Park, MD, March 12, 2009.
19. "Cyber-Physical Systems: Research Challenges," University of Illinois, Urbana-Champaign, IL, February 12, 2009.
20. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," IBM Research, Hawthorne, NY, December 4, 2008.

21. "Supporting Basic Research at the National Science Foundation," Microsoft Asia 10th Anniversary Faculty Summit, Beijing, China, November 3, 2008. **Invited Speaker.**
22. "Network Science and Engineering Research Challenges," MIT Laboratory for Information and Decision Systems, Cambridge, MA, October 9, 2008.
to be scheduled.
23. "Computational Thinking: Two and a Half Years Later," Computational Thinking Seminar Series, Carnegie Mellon University, Pittsburgh, PA, September 26, 2008.
24. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," Google Lab Seattle, Fremont, WA, July 29, 2008.
25. "eScience For All: Not If, But When," The Broader Impact of Science, Microsoft Faculty Summit, Redmond, WA, July 29, 2008. **Invited Panelist.**
26. "Computational Thinking and Thinking About Computing," Santa Fe Institute, Santa Fe, NM, July 11, 2008.
27. "Network Science and Engineering: Research Challenges," Stanford University, Palo Alto, CA, May 21, 2008.
28. "Computational Thinking and Thinking About Computing," University of Florida, Gainesville, Florida, April 17, 2008.
29. "Computational Thinking and Thinking About Computing," Villanova University, Villanova, Pennsylvania, Distinguished Lecture Series of the Delaware Valley, April 7, 2008. **Distinguished Lecturer.**
30. "Computational Thinking and Thinking About Computing," Eastern Michigan University, Ypsilanti, Michigan, April 2, 2008.
31. "Computational Thinking and Thinking About Computing," Georgia Tech, Atlanta, GA, March 28, 2008.
32. "Confidentiality Policy Extraction," Cornell University, Ithaca, New York, Gerald Salton Lecture, February 28, 2008.
33. "Computational Thinking and Thinking About Computing," Computer Science and Artificial Intelligence Laboratory, MIT, Cambridge, MA, November 30, 2007.
34. "Computational Thinking," William and Mary College, Williamsburg, Virginia, November 9, 2007. **Distinguished Speaker.**
35. "Computational Thinking," CS4HS Program, University of Washington, July 20, 2007. **Keynote Speaker.**
36. "Automatic Generation and Analysis of Attack Graphs," Tsinghua University, Beijing, China, June 5, 2007.
37. "Computational Thinking," Microsoft Research Asia, Beijing, China, June 4, 2007.
38. "Automatic Generation and Analysis of Attack Graphs," University of Utah, April 26, 2007. **Organick Memorial Lecture.**
39. "Computational Thinking," University of Utah, April 25, 2007. **Organick Memorial Lecture.**
40. "Automatic Generation and Analysis of Attack Graphs," SUNY Stony Brook, February 28, 2007. **Distinguished Lecture.**
41. "Automatic Generation and Analysis of Attack Graphs," University of Wisconsin-La Crosse, February 19, 2007. **Distinguished Lecture.**
42. "Computational Thinking," University of Wisconsin-La Crosse, February 19, 2007. **Distinguished Lecture.**
43. "Automatic Generation and Analysis of Attack Graphs," McGill University, January 19, 2007. **Distinguished Lecture.**

44. "Automatic Generation and Analysis of Attack Graphs," University of Illinois, Chicago, November 9, 2006. **Distinguished Lecture.**
45. "Automatic Generation and Analysis of Attack Graphs," Laboratory of Education and Research in Security Assured Information Systems (LERSAIS), University of Pittsburgh, September 22, 2006. **Distinguished Lecture.**
46. "Formal Methods" ProLogic, Fairmont, VA September 20, 2006.
47. "Computational Thinking," ProLogic, Fairmont, VA, September 20, 2006.
48. "Computational Thinking," Computer Science Pedagogy Colloquium, Carnegie Mellon University, September 19, 2006.
49. "Computational Thinking," CS4HS Program, Carnegie Mellon University, July 22, 2006. **Keynote Speaker.**
50. "Automatic Generation and Analysis of Attack Graphs," NSF TRUST Center, Women in Science and Engineering Program, UC Berkeley, July 10–11, 2006.
51. "Automatic Generation and Analysis of Attack Graphs," ETH, Zurich, June 12, 2006.
52. "Computational Thinking," DARPA Workshop on Computer Science Futures, Pittsburgh, PA, May 31, 2006.
53. "An Attack Surface Metric," CyLab Corporate Partners Meeting, Pittsburgh, PA, April 20, 2006.
54. "Automatic Generation and Analysis of Attack Graphs," Dartmouth College, April 10, 2006.
55. "Computational Thinking and CS@CMU," Hong Kong University of Science and Technology, November 5, 2005.
56. "Predictable Software," Shanghai Jiao Tong University, November 3, 2005.
57. "CS@CMU," Tsinghua University, October 28, 2005.
58. "CS@CMU," Chinese Academy of Sciences, October 28, 2005.
59. "CS@CMU," Beijing University, October 28, 2005.
60. "Predictable Software," Microsoft Asia, Beijing, China, October 27, 2005.
61. "Software Security," National Chiao Tung University, Hsinchu, Taiwan, June 7, 2005.
62. "Automatic Generation and Analysis of Attack Graphs," National Chiao Tung University, Hsinchu, Taiwan, June 6, 2005.
63. "Automatic Generation and Analysis of Attack Graphs," University of Minnesota, **Distinguished Lecture**, February 14, 2005.
64. "Automatic Generation and Analysis of Attack Graphs," University of Pennsylvania, **Distinguished Lecture**, November 23, 2004.
65. "Automatic Generation and Analysis of Attack Graphs," The Center for Education and Research in Information Assurance and Security (CERIAS) Seminar, Purdue University, September 28, 2004.
66. "Automatic Generation and Analysis of Attack Graphs," Carnegie Mellon Software Engineering Institute, June 3, 2004.
67. "Automatic Generation and Analysis of Attack Graphs," Florida International University, Miami, FL, April 23, 2004. **Distinguished Lecture.**
68. "Measuring Relative Attack Surfaces," Microsoft Research, Redmond, WA, August 21, 2003.
69. "Security Research," Microsoft Research, Redmond, WA, July 24, 2003.
70. "Work in Progress: A Model for Attack Surfaces," Microsoft Research, Redmond, WA, March 20, 2003.

71. "Vulnerability Analysis Using Attack Graphs," **Yamacraw Distinguished Speaker Series**, Savannah, GA, February 18, 2003.
72. "Vulnerability Analysis Using Attack Graphs," University of Washington, Seattle, WA, February 11, 2003.
73. "Vulnerability Analysis of Networks Using Attack Graphs," University of Illinois, Urbana-Champaign, IL, February 7, 2002.
74. "Formal Methods: Past, Present, and Future," University of Illinois, Urbana-Champaign, IL, February 7, 2002.
75. "Vulnerability Analysis of Networks Using Attack Graphs," Microsoft Research Labs, Redmond, WA, January 28, 2002.
76. "The Rare Glitch Project Overview," Honeywell Laboratories, Minneapolis, MN, December 3, 2001.
77. "School of Computer Science: Educational Programs," IT-Center, Dortmund, Germany, November 22, 2001.
78. "Survivability Analysis of Networked Systems," Cornell University, **Computer Research Associates–Women and Lucent Distinguished Lecturer Series**, Cornell University, October 4, 2001.
79. "Survivability Analysis of Networked Systems," Information and Communications University, Taejon, Korea, May 14, 2001.
80. "Survivability Analysis of Networked Systems," DARPA OASIS PI meeting, Norfolk, VA, February 14, 2001.
81. "Survivability Analysis of Distributed Systems," University of British Columbia, **Distinguished Lecture Series**, November 9, 2000.
82. "Reasoning About Security Protocols," National University of Singapore, August 2, 2000.
83. "Mobility and Security," National University of Singapore, August 2, 2000.
84. "Reasoning About Security Protocols," Cornell University, **Distinguished Lecture Series**, November 11, 1999.
85. "Reasoning About Security," University of Utah, **Distinguished Lecture Series**, November 4, 1999.
86. "Reasoning About Security Protocols," IBM Research Laboratories, Yorktown Heights, NY, June 28, 1999.
87. "Formal Methods: Past, Present, and Future," DePaul University, **Distinguished Lecture Series**, October 2, 1998.
88. "Formal Methods: Past, Present, and Future," University of Washington, **Distinguished Lecture Series**, February 19, 1998.
89. "A Story in the Practice of Formal Methods," Brown University, April 11, 1997.
90. "Formal Methods: Past, Present, and Future," Programming Systems Cultural Exchange Series, Carnegie Mellon, February 17, 1997.
91. "Formal Methods: Past, Present, and Future," University of Pennsylvania, **Distinguished Lecture Series**, January 28, 1997.
92. "Mathematics for Software Engineers," Harvard University, November 26, 1996.
93. "Using Belief to Reason About Cache Coherence in Distributed Systems," United Nations University, Institute of Information Sciences and Technology, December 27, 1995.
94. "A Behavioral Notion of Subtyping," United Nations University, Institute of Information Sciences and Technology, December 27, 1995.
95. "Using Belief to Reason About Cache Coherence in Distributed Systems," Princeton University, May 2, 1995.

96. "Using Belief to Reason About Cache Coherence in Distributed Systems," University of Maryland, March 27, 1995.
97. "Why Formal Methods?," University of Manitoba, Winnipeg, Canada, March 21, 1995.
98. "What is a Formal Method?," BNR/NT Design Forum, Bell-Northern Research Ltd., June 16, 1994.
99. "Larch," Williams College, Williamstown, MA, April 23, 1994.
100. "What is a Formal Method?," Williams College, Class of 60's Scholar Program, Williamstown, MA, April 22, 1994.
101. "Concurrent Multi-Threaded Transactions," University of Washington, January 21, 1994.
102. "Concurrent Multi-Threaded Transactions," Technical University of Delft, Delft, The Netherlands, September 20, 1993.
103. "Concurrent Multi-Threaded Transactions," ECRC, Munich, Germany, July 22, 1993.
104. "Larch," Queen's University, Kingston, Canada, April 2, 1993.
105. "Family Values: A Semantic Notion of Subtyping," Carnegie Mellon, POP Seminar Series, March 12, 1993.
106. "Specifications in Software Development," National Security Agency, NSASAB Panel on Formal Methods, Ft. George Meade, MD, February 10, 1993.
107. "What is a Formal Method?," National Security Agency, NSASAB Panel on Formal Methods, Ft. George Meade, MD, February 10, 1993.
108. "Avalon: Language Support for Reliable Distributed Systems," The Chinese University of Hong Kong, December 28, 1992.
109. "Larch," INRS/Bell Northern Research, Verdun, Canada, November 6, 1992.
110. "Persistence + Undoability = Transactions," University of Massachusetts, Amherst, MA, May 8, 1992.
111. "What is a Formal Method?," Winona State University, Winona, Minnesota, April 10, 1992.
112. "What is a Formal Method?," University of Wisconsin-La Crosse, La Crosse, Wisconsin, April 9, 1992.
113. "What is a Formal Method?," Carroll College, Waukesau, Wisconsin, April 9, 1992.
114. "Persistence + Undoability = Transactions," MIT Laboratory for Computer Science, Cambridge, MA, April 6, 1992.
115. "Unintrusive Ways to Integrate Formal Specifications in Practice," Motorola, Inc., Phoenix, Arizona, March 9, 1992.
116. "What is a Formal Method?," Motorola, Inc., Phoenix, Arizona, March 9, 1992.
117. "Avalon: Language Support for Reliable Distributed Systems," Hewlett-Packard Laboratories, Bristol, England, January 7, 1992.
118. "Unintrusive Ways to Integrate Formal Specifications in Practice," Concordia University, Montreal, Canada, November 28, 1991.
119. "Specifications as Search Keys," AT&T Bell Laboratories, Murray Hill, NJ, August 12, 1991.
120. "Specifications as Search Keys," DEC/Cambridge Research Lab., Cambridge, MA, March 21, 1991.
121. "Specifications as Search Keys," MIT Laboratory for Computer Science, Cambridge, MA, March 20, 1991.
122. "Specifying Avalon Objects in Larch," Michigan State University, East Lansing, MI, January 29, 1991.
123. "Avalon: Language Support for Reliable Distributed Systems," University of Illinois, Urbana-Champaign, IL, January 28, 1991.

124. "Avalon: Language Support for Reliable Distributed Systems," University of California at Santa Barbara, Santa Barbara, CA, December 7, 1990.
125. "Avalon: Language Support for Reliable Distributed Systems," Cornell University, Ithaca, NY, November 8, 1990.
126. "Avalon: Language Support for Reliable Distributed Systems," Academia Sinica, Taipei, Taiwan, August 1, 1990.
127. "What is a Formal Method?," Academia Sinica, Taipei, Taiwan, August 1, 1990.
128. "Verifying Atomic Data Types," Technion University, Israel, April 6, 1990.
129. "What is a Formal Method?," Information Networking Institute, Pittsburgh, PA, January 29, 1990.
130. "Specifying and Verifying Abstract Data Types," Information Networking Institute, Pittsburgh, PA, January 29, 1990.
131. "What is a Formal Method?," Argonne National Laboratories, Chicago, IL, November 16, 1989.
132. "Formal Specifications in Software Engineering," National Computer Security Center, Baltimore, MD, October 19, 1989.
133. "What is a Formal Method?," Army Science Board Committee on Software in the Army, SEI, Pittsburgh, PA, October 13, 1989.
134. "Avalon: Language Support for Reliable Distributed Systems," IBM Research Laboratories, Yorktown Heights, NY, August 14, 1989.
135. "Avalon: Language Support for Reliable Distributed Systems," University of Tunis, Tunisia, May 26, 1989.
136. "Specifying Avalon Objects in Larch," MIT Laboratory for Computer Science, Cambridge, MA, April 25, 1989.
137. "Beyond Rewrite Rule Engines: Affirm, Reve, Larch Prover," Carnegie Mellon University, Pittsburgh, PA, October 25, 1988.
138. "Avalon: Language Support for Reliable Distributed Systems," University of Science and Technology of China, Hefei, China, May 21, 1988.
139. "The Larch Family of Specification Languages," University of Science and Technology of China, Hefei, China, May 21, 1988.
140. "Avalon: Language Support for Reliable Distributed Systems," East-China Research Institute of Computer Technology, Shanghai, China, May 18, 1988.
141. "Axioms for Concurrent Objects," Shanghai Jiao Tong University, Shanghai, China, May 17, 1988.
142. "The Larch Family of Specification Languages," Shanghai Jiao Tong University, Shanghai, China, May 16, 1988.
143. "The Larch Family of Specification Languages," Northwestern University, Xi'an, China, May 13, 1988.
144. "Specifying and Verifying Abstract Data Types," Northwestern University, Xi'an, China, May 13, 1988.
145. "Specifying Graceful Degradation in Distributed Systems," Institute of Software, Academia Sinica, Beijing, China, May 10, 1988.
146. "Avalon: Language Support for Reliable Distributed Systems," Institute of Software, Academia Sinica, Beijing, China, May 9, 1988.
147. "Specifying and Verifying Abstract Data Types," Tsinghua University, Beijing, China, May 6, 1988.
148. "Specifying and Verifying Abstract Data Types," Information Technology Institute, Beijing, China, May 5, 1988.

149. "Axioms for Concurrent Objects," Institute of Software, Academia Sinica, Beijing, China, May 5, 1988.
150. "The Larch Family of Specification Languages," Institute of Software, Academia Sinica, Beijing, China, May 4, 1988.
151. "Specifying and Verifying Abstract Data Types," Institute of Software, Academia Sinica, Beijing, China, May 3, 1988.
152. "Avalon: Language Support for Reliable Distributed Systems," Center for Dependable Systems, CMU, Pittsburgh, PA, March 23, 1988.
153. "Formal Specifications of Concurrent and Distributed Systems," National Computer Security Center, Ft. George G. Meade, MD, March 16, 1988.
154. "Miro: A Visual Approach to Specifying Security," National Computer Security Center, Ft. George G. Meade, MD, February 23, 1988.
155. "The Larch Family of Specification Languages," Tektronix, Beaverton, OR, October 30, 1987.
156. "Avalon: Language Support for Reliable Distributed Systems," Oregon Graduate Center, Beaverton, OR, October 29, 1987.
157. "The Larch Family of Specification Languages," Software Engineering Institute, Pittsburgh, PA, April 24, 1987.
158. "Axioms for Concurrent Objects," University of Texas, Austin, TX, March 27, 1987.
159. "Axioms for Concurrent Objects," MCC, Austin, TX, March 26, 1987.
160. "A Larch Specification of the Library Example," UNISYS, Los Angeles, CA, April 6, 1987,
161. "Axioms for Concurrent Objects," AT&T Bell Laboratories, Murray Hill, NJ, November 14, 1986.
162. "Axioms for Concurrent Objects," MIT Laboratory for Computer Science, Cambridge, MA, October 14, 1986.
163. "Formal Specifications in Software Engineering," Carnegie Mellon University, Pittsburgh, PA, October 3, 1985.
164. "The Larch Family of Specification Languages," Stanford Research Institute, Menlo Park, CA, April 8, 1986.
165. "Adding Temporal Logic to a Formal Specification Language," Carnegie Mellon University, Pittsburgh, PA, March 22, 1985.
166. "Adding Temporal Logic to a Formal Specification Language," University of California at Berkeley, Berkeley, CA, March 7, 1985.
167. "Practical Problems with Writing Specifications," Imperial College, London, England, October 26, 1984.
168. "Developing Program Specifications Following a Two-Tiered Approach," University of Saarbrücken, Saarbrücken, West Germany, June 1, 1984.
169. "Developing Program Specifications Following a Two-Tiered Approach," University of California at Santa Barbara, Santa Barbara, CA, May 14, 1984.
170. "Developing Program Specifications Following a Two-Tiered Approach," UCLA, Los Angeles, CA, May 10, 1984.
171. "A Two-Tiered Approach to Specifying Programs," System Development Corporation, Santa Monica, CA, April 20, 1984.
172. "A Two-Tiered Approach to Specifying Programs," IBM Research Laboratory, San Jose, CA, March 23, 1984.

173. "A Two-Tiered Approach to Specifying Programs," USC Institute for Information Sciences, Marina del Rey, CA, February 17, 1984.
174. "Design and Analysis of Computer Algorithms," Institute of Southwestern China, Canton, China, June 1979.
175. "Design and Implementation of Programming Languages," Institute of Southwestern China, Canton, China, June 1979.

Conference and Workshop Talks

1. "Computational Thinking," 2010 EDUCAUSE Learning Initiative Annual Meeting on New Learning Environments for a Web 2.0 World, Austin, Texas, scheduled for January 21, 2010. **Keynote Speaker.**
2. "Formal Methods for Privacy," Formal Methods 2009, Eindhoven, The Netherlands, November 4, 2009. **Keynote Speaker.**
3. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," OOPSLA 2009, October 28, 2009, Orlando, FL. **Keynote Speaker.**
4. "Innovation in Information Technology," Accelerating Energy Innovation: Lessons from Multiple Sectors, National Bureau of Economic Research, Washington, D.C., October 23, 2009. **Invited Panelist.**
5. "Computational Thinking and Thinking About Computing," China Computer Science Vision 2020, Tsinghua University, Beijing, China, October 14, 2009. **Invited Speaker**
6. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," ACM International Conference on Mobile Computing and Networking, September 22, 2009. **Keynote Speaker.**
7. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," 46th Design Automation Conference, San Francisco, CA, July 28, 2009. **Invited Speaker**
8. Cyber-Physical Systems: NSF Perspective, Cyber-Physical Systems Security, Newark, NJ, July 22, 2009. Sponsored by US Department of Homeland Security. **Invited Speaker**
9. "Computational Thinking," SIG Computing Teachers Breakfast Forum, National Education Computing Conference, June 29, 2009. **Invited Speaker**
10. "Computational Thinking," Enseignement de TICs dans les Grandes Ecoles de Paris Tech, Paris, France, June 24, 2009. **Invited Speaker**
11. "Research Challenges for the ICT Community," Roundtable on Building a Green Future: Clean Innovation, Investments, and Jobs, OECD Workshop on ICTs, The Environment and Climate Change, Helsingor, Denmark, May 27, 2009. **Invited Panelist**
12. "Computational Thinking and Thinking About Computing," TTI/Vanguard Conference, Washington, DC, May 7, 2009. **Invited Speaker**
13. "Computational Thinking and Thinking About Computing," Consortium for Computing Sciences in Colleges, Northeast Division, Plattsburgh, NY, April 25, 2009. **Invited Speaker.**
14. "Frontiers in Research and Education in Computing: A View from the National Science Foundation," IEEE Wireless Telecommunications Symposium, Prague, CZ, April 22, 2009. **Invited Speaker.**
15. "Computational Thinking and Thinking About Computing," Future and Emerging Technologies Conference, Prague, CZ, April 22, 2009. **Invited Speaker.**
16. "Multidisciplinary Research at NSF," Panel on Multidisciplinary Research in ICT, Future and Emerging Technologies Conference, Prague, CZ, April 21, 2009. **Invited Panelist.**
17. "Computational Thinking," Computational Thinking for Everyone Workshop, National Academies, February 19 2009, Washington, DC. **Invited Panelist.**

18. "Computational Thinking," American Association for the Advancement of Science, AAAS Annual Meeting, Chicago, IL, February 15, 2009. **Invited Speaker.**
19. "Cyber-Physical Systems," NSF Informational Workshop on Cyber-Physical Systems, December 15, 2008.
20. "Computational Thinking," Science in Society: Dialogues and Scientific Responsibility, Workshop on Information and Communications Technology, Paris, France, November 25, 2008. **Invited Speaker**
21. "Computer Science Outside the Box," Computer Science Outside the Box Workshop, co-sponsored by NSF, CRA, CCC, November 10, 2008.
22. "Computational Thinking," Geographic Information Science, Park City, UT, September 24, 2008. **Invited Speaker.**
23. "Network Science and Engineering," NSF Informational Workshop on Network Science and Engineering, September 5, 2008.
24. "A View from DC," Computing Research Associates Conference, Snowbird, UT, July 15, 2008. **Invited Speaker.**
25. "Cyber-Physical Systems Research Challenges," ACM Third International Workshop on Feedback Control Implementation and Design in Computing Systems and Networks, Annapolis, MD, June 6, 2008. **Keynote Speaker.**
26. "Computational Thinking and Thinking About Computing," SIGMETRICS, Annapolis, MD, June 5, 2008. **Keynote Speaker.**
27. "Cyber Security Research Challenges," Cybersecurity Summit 2008, Arlington, VA, May 8, 2008.
28. "Cyber-Physical Systems Research Challenges," Cyber-Physical Systems Summit, St. Louis, Missouri, April 24, 2008. **Keynote Speaker.**
29. "Cyber-Physical Systems Research Challenges," CPSWEEK 2008, St. Louis, Missouri, April 24, 2008. **Invited Speaker.**
30. "Computational Thinking and Thinking About Computing," 22nd IEEE International Conference Parallel and Distributed Processing Symposium, Miami, Florida, April 16, 2008. **Banquet Speaker.**
31. "Cyber-Physical Systems Research Challenges," National Workshop on High-Confidence Automotive Cyber-Physical Systems, Troy, Michigan, April 3, 2008.
32. "Computational Thinking and Thinking About Computing," 46th Annual ACM Southeast Conference, Auburn, Alabama, March 28, 2008. **Invited Speaker.**
33. "Data-Intensive Computing at NSF," Data-Intensive Computing Symposium, Mountain View, CA, March 26, 2008. **Invited Speaker.**
34. "Computational Thinking and Thinking About Computing," Grand Challenges in Computing (United Kingdom) 2008, London, England, March 19, 2008. **Keynote Speaker.**
35. "Computational Thinking and Thinking About Computing" From Computers to Ubiquitous Computing, by 2020, Royal Society of London, London, England, March 17, 2008. **Invited Speaker.**
36. "Network Science and Engineering," GENI Engineering Conference, Arlington, VA, March 3, 2008. **Keynote Speaker.**
37. "Computational Thinking and Thinking About Computing," Biotechnology Symposium, California State University, Oakland, California, January 11, 2008. **Invited Speaker.**
38. "Research Needs and NSF/CISE Perspective," Software for Dependable Systems: Sufficient Evidence? Symposium, National Academies, Washington, D.C., October 23, 2007. **Invited Panelist.**
39. "Looking Ahead for Computing and at NSF," Informatics Europe, Berlin, Germany, October 8, 2007. **Keynote Speaker.**

40. "Computational Thinking," OurCS, Carnegie Mellon, Pittsburgh, PA, October 5, 2007. **Keynote Speaker.**
41. "Privacy Research Ideas," Data Confidentiality Research Workshop, Arlington, Virginia, September 5, 2007.
42. "Computer Science Meets Science and Engineering," "High-End Computing File System and I/O Workshop, Arlington, Virginia, August 6, 2007.
43. "Formal Methods for Software Systems," High Confidence Real-Time Operating Systems, Arlington, Virginia, July 9, 2007. **Keynote Speaker.**
44. "Software Security," First IEEE and IFIP International Symposium on Theoretical Aspects of Software Engineering (TASE 2007), June 7, 2007, Shanghai, China. **Keynote Speaker.**
45. "Computational Thinking," SIGCSE 2007, Special Session on Computational Thinking, Covington, Kentucky, March 8, 2007.
46. "Looking Ahead at NSF," CRA Leadership Summit, Washington, D.C., February 26, 2007.
47. "Computational Thinking and CS@CMU," TechVista 2007, Microsoft India, Bangalore, India, January 23, 2007. **Keynote Speaker.**
48. "An Attack Surface Metric," 10th IASTED International Conference on Software Engineering and Applications, Dallas, Texas, November 13, 2006. **Keynote Speaker.**
49. "Software Assurance," Executive Women's Forum, Phoenix, AZ, September 14, 2006. **Invited Panelist.**
50. "Attack Graph Generation and Analysis," ACM Symposium on Information, Computer, and Communications Security, Taipei, Taiwan, March 22, 2006. **Invited Speaker.**
51. "Strong Girls, Strong Women," Making the Connection Breakfast, March 1, 2006, Carnegie Mellon, Pittsburgh, PA, **Keynote Speaker.**
52. "The View from Carnegie Mellon: What We Did and What We're Doing," National Center for Women and Information Technology (NCWIT) Leadership Team and Alliance Meeting, Pittsburgh, PA, November 17, 2005. **Keynote Speaker.**
53. "Predictable Software," Computing in the 21st Century Conference, Hong Kong, November 5, 2005. **Invited Speaker.**
54. "Predictable Software," Computing in the 21st Century Conference, Hangzhou, China, November 1, 2005. **Invited Speaker.**
55. "Computational Thinking and CS@CMU," Microsoft Research Asia Faculty Summit, Hangzhou, China, October 31, 2005. **Invited Speaker.**
56. "Towards an Algebra for Security Policies," 26th International Conference on Applications and Theory of Petri Nets, Miami, FL, June 23, 2005. **Distinguished Speaker.**
57. "Automatic Generation and Analysis of Attack Graphs," 11th Information Security Conference, Kaohsiung, Taiwan, June 9, 2005. **Keynote Speaker.**
58. "Automatic Generation and Analysis of Attack Graphs," NATO ARW Verification of Infinite State Systems with Applications to Security (VISSAS) 2005, Timisoara, Romania, March 21, 2005. **Invited Speaker.**
59. "Measuring Relative Attack Surfaces," Workshop on Advanced Developments in Software and Systems Security, Taipei, December 7, 2003.
60. "Vulnerability Analysis Using Attack Graphs," Microsoft Academic Conference Germany 2003, Dresden, Germany, November 12, 2003. **Invited Speaker.**
61. "Vulnerability Analysis Using Attack Graphs," Microsoft Research Academic Conference, Budapest, Hungary, November 11, 2003. **Invited Speaker.**

62. "Vulnerability Analysis Using Attack Graphs," Microsoft Research, Cambridge, England, November 10, 2003.
63. "Vulnerability Analysis Using Attack Graphs," Formal Methods for Components and Objects," Leiden, The Netherlands, November 4–7, 2003. **Invited Speaker.**
64. "Vulnerability Analysis Using Attack Graphs," Carnegie Mellon Center for Computers, Communications, and Security, September 30, 2003.
65. "CSTB Security Studies," NSF EDUCAUSE, Washington, D.C., October 22–23, 2002.
66. "What, Who, and How of Tomorrow," Monterey Workshops: Radical Innovations of Software and Systems Engineering in the Future, Venice, Italy, October 6–10, 2002. **Invited Speaker.**
67. "Mathematics in Computer Science Curricula," Sixth International Conference on Mathematics of Program Construction, Dagstuhl, Germany, July 8–10, 2002. **Invited Speaker.**
68. "Survivability Analysis of Networked Systems," IEEE Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises, Workshop on Enterprise Security, Pittsburgh, PA, June 10–12, 2002. **Invited Speaker.**
69. "Survivability Analysis of Networked Systems," FORTE 2001, Cheju Island, Korea, August 31, 2001. **Invited Speaker.**
70. "Code-Level Specification," Specifying and Checking Properties of Software, University of Washington/Microsoft Research Summer Institute, August 12, 2001. **Invited Speaker.**
71. "Scenario Graph Generation and MDP-Based Analysis," ARO Kickoff Meeting, Philadelphia, PA, May 24–25, 2001.
72. "Survivability Analysis of Networked Systems," Seventh Asia Pacific Software Engineering Conference (APSEC'2000), Singapore, December 5–8, 2000, **Keynote Speaker.**
73. "Software Survivability Analysis," NASA Ames, Design for Safety 2000 Workshop, Moffett Training Center, California, October 12, 2000. **Invited Speaker.**
74. "Towards a Science of Survivability," Third Information Survivability Workshop (ISW-2000), Boston, MA, October 24-26, 2000.
75. "Analyzing Survivability Properties of Specifications of Networks," Workshop on Dependability Despite Malicious Faults, New York City, NY, June 28, 2000
76. "Weaving Formal Methods into the Undergraduate Computer Science Curriculum," Eighth International Conference on Algebraic Methodology and Software Technology (AMAST 2000), Iowa City, IA, May 23, 2000. **Invited Speaker for Education Day.**
77. "Whither Larch?," Larch Users Group Meeting, FM'99, September 24, 1999. Toulouse, FR.
78. "Formal Methods: Past, Present, and Future," 1998 Asian Computing Science Conference, Manila, The Philippines, December 10, 1998, **Keynote Speaker.**
79. "Formal Methods: Past, Present, and Future," Fourth Software Reuse Symposium: From Architectures to Products, Ft. Meade, MD, August 19, 1998. **Invited Speaker.**
80. "Subtyping for Distributed Object Stores," Second IFIP International Workshop on Formal Methods for Open Object-based Distributed Systems (FMOODS), July 23, 1997, University of Kent at Canterbury. **Invited Speaker.**
81. "Mathematics for Software Engineering," Mathematical Foundations of Programming Semantics, Boulder, CO, June 4, 1996. **Invited Speaker.**
82. "Model Checking Software Systems: A Case Study," ACM SIGSOFT Foundations of Software Engineering, October 12, 1995.
83. "Teaching Mathematics to Software Engineers," ZUM'95, Z Users Group, Limerick, Ireland, September 9, 1995, **Invited Speaker for Education Day.**

84. "Specifications and Their Use in Defining Subtypes," ZUM'95, Z Users Group, Limerick, Ireland, September 8, 1995. **Invited Speaker.**
85. "Teaching Mathematics to Software Engineers," Fourth International Conference on Algebraic Methodology and Software Technology (AMAST '95), Montreal, Canada, July 3, 1995. **Invited Speaker for Education Day.**
86. "Using Belief to Reason About Cache Coherence in Distributed Systems," Formal Specification: Foundations, Methods, Tools and Applications, Warsaw, Poland, May 30, 1995.
87. "The Role of Logic Programming in Software Engineering" Int'l Conf. on Logic Programming '94, Santa Margherita Ligure, Italy, June 13, 1994. **Invited Speaker.**
88. "Specifications and Their Use in Defining Subtypes," OOPSLA '93, Washington, D.C., September 28, 1993.
89. "A New Definition of Subtyping," ECOOP '93, Kaiserslautern, Germany, July 28, 1993.
90. "Composing Transactional Concepts," ECOOP '93 Workshop on Object-Based Distributed Programming, Kaiserslautern, Germany, July 26, 1993.
91. "Specifications in Software Development," Logic in Computer Science Conference, Santa Cruz, CA, June 23, 1992. **Invited Speaker.**
92. "Extensions to Standard ML to Support Transactions," Workshop on ML and its Applications, San Francisco, CA, June 21, 1992.
93. "Persistence + Undoability = Transactions," Foundations of Inf. Systems Specification and Design, Dagstuhl, Germany, March 17, 1992.
94. "Revisiting Abstraction Functions for Reasoning about Concurrency," Fifth Refinement Workshop: Theory and Practice, London, UK, January 8, 1992. **Invited Speaker.**
95. "Unintrusive Ways to Integrate Formal Specifications in Practice," VDM '91, Delft, The Netherlands, October 25, 1991.
96. "Textual Specifications of Visual Specifications," Workshop on Formal Methods in Computer Graphics, Marina di Carrara, Italy, June 17, 1991. **Keynote Speaker.**
97. "ML as a Basis for Distributed Object Management," Standard ML Workshop, Princeton University, NJ, June 8, 1990.
98. "Larch," ACM Workshop on Formal Methods in Software Development, Napa, CA, May 10, 1990.
99. "Reliable Distributed Computing with Avalon/Common Lisp," IEEE Computer Society 1990 International Conference on Computer Languages, New Orleans, LA, March 14, 1990.
100. "What is a Formal Method?," Formal Methods Workshop 1989, sponsored by the Governments of the US, the UK, and Canada, Halifax, Nova Scotia, July 25, 1989. **Invited Speaker.**
101. "Specifying Security Constraints with Relaxation Lattices," Computer Security Foundations Workshop II, Franconia, NH, June 12, 1989.
102. "Verifying Atomic Data Types," REX Workshop on Stepwise Refinement of Distributed Systems: Models, Formalism, Correctness, Plasmolen, The Netherlands, May 29-June 2, 1989.
103. "Specifying Avalon Objects in Larch," Seminar on Foundations of Innovative Software Development, Conference on Theory and Practice of Software Development (TAPSOFT)," Barcelona, Spain, March 16, 1989. **Invited Speaker.**
104. "Reasoning About Atomic Objects," Symposium on Formal Techniques in Real-Time and Fault-Tolerant Systems," Warwick, England, September 23, 1988.
105. "Specifying Recoverable Objects," Sixth Annual Pacific Northwest Software Quality Conference, Portland, OR, September 19, 1988.

106. "Durra: a Task-Level Description Language," International Conference on Parallel Processing, St. Charles, IL, August 19, 1987.
107. "Specifying Graceful Degradation in Distributed Systems," Sixth Symposium on Principles of Distributed Computing, Vancouver, Canada, August 11, 1987.
108. "A Summary of the Library Problem," Fourth Int'l Workshop on Software Specification and Design, Monterey, CA, April 4, 1987.
109. "A Larch Specification of the Library Example," Fourth Int'l Workshop on Software Specification and Design, Monterey, CA, April 3, 1987.
110. "Specifying Functional and Timing Behavior for Real-Time Applications," Conference on Parallel Architectures and Languages Europe, Eindhoven, June 16, 1987.
111. "Axioms for Concurrent Objects," Fourteenth Symposium on Principles of Programming Languages, Munich, W. Germany, January 21, 1987.
112. "Extending Ina Jo with Temporal Logic," IEEE Symposium on Security and Privacy, Oakland, CA, April 7, 1986.
113. "Geometric Reasoning: A New Paradigm for Processing Geometric Information," IEEE International Symposium on New Directions in Computing, Trondheim, Norway, August 12, 1985.
114. "Specifying and Prototyping: Some Thoughts on Why They Are Successful," Theory and Practice of Software Development, Berlin, West Germany, March 25, 1985.
115. "The Practice of Specifications," Workshop on Formal Aspects of Specification, Swindon, England, October 22, 1984.
116. "Helping Specifiers Evaluate Their Specifications," AFCET Second International Conference on Software Engineering, Nice, France, June 5, 1984.

Professional Societies, Foundations, and Boards Talks

1. "CISE Updates," National Academy of Engineering, Section 5, Irvine, CA, October 5, 2009. To appear.
2. "Frontiers of Research and Infrastructure in CISE," Coalition of Academic Scientific Computation, Arlington, VA, April 29, 2009.
3. "Computational Thinking," CISE and EHR Brown Bag, NSF, Arlington, VA, March 18, 2009.
4. "Computing and CISE," Environment Research and Education Advisory Committee, NSF, Arlington, VA, October 15, 2008.
5. "Computational Thinking and Thinking About Computing," Philosophical Society of Washington, Washington, D.C., October 10, 2008
6. "CISE Updates," National Academy of Engineering, Section 5, Washington, D.C., October 6, 2008.
7. "Computational Thinking for Everyone," National Academies, Washington, D.C., September 19, 2008.
8. "Increasing Female Students in Computer Science at Carnegie Mellon University: What We Did and What We're Doing," Women's Equality Day, NSF, Arlington, VA, August 26, 2008.
9. "Data-Intensive Computing," Corporate Alliance Meeting, NSF, Arlington, VA, June 18, 2008.
10. "Broadening Participation in Computing," Committee on Equal Opportunities in Science and Engineering (CEOSE), NSF, Arlington, VA, June 16, 2008.
11. "CISE Updates," Office of Cyberinfrastructure Advisory Committee Meeting, NSF, Arlington, VA, May 15, 2008.
12. "CISE Director's Review," NSF, Arlington, VA, May 13, 2008.

13. "What's Up at CISE" Committee on Science Policy, Society of Industrial and Applied Mathematics (SIAM), Washington, D.C., November 15, 2007.
14. "What's Up at CISE," Social, Behavioral, and Economic Sciences, Advisory Committee Meeting, NSF, Arlington, VA, November 8, 2007.
15. "What's Up at CISE," Board on Mathematical Sciences and Their Applications, National Academies, Washington, D.C., November 2, 2007.
16. "Looking Ahead at CISE," Office of Cyberinfrastructure Advisory Committee Meeting, NSF, Arlington, VA, November 1, 2007.
17. "Computing Themes and CISE Programs," National Academy of Engineering, Section 5, Washington, D.C., October 1, 2007.
18. "Looking Ahead at NSF/CISE," DARPA ISAT, Woods Hole, MA, August 14, 2007.
19. "Looking Ahead at NSF/CISE," IT Deans Meeting, Computing Research Association, July 19, 2007.

Addresses, Interviews, Testimonies, and Speeches

1. "Computer Security Expert Jeannette Wing," in *Cool Careers in Information Sciences*, Sally Ride Science Publishers, to appear.
2. Welcome Address, Discovery and Innovation in Health IT, San Francisco, CA, October 29, 2009.
3. Welcome Address, NSF Workshop on Design and Automation, Arlington, VA, July 8, 2009.
4. Cyber Security Hearing, testimony to House Committee on Science and Technology's Subcommittee on Technology and Innovation and Subcommittee on Research and Science Education, June 16, 2009.
5. Welcome Address, Collaborative Research in Computational Neuroscience PI Meeting, Pittsburgh, PA, June 7, 2009.
6. "Jeannette Wing, The Computational Thinker," Susan Karlin, *IEEE The Institute* (online), member profile, April 6, 2009.
7. Welcome Address, Science of Power Management Workshop, Arlington, VA, April 9, 2009
8. "Computational Thinking," REU Sites PI Meeting, Arlington, VA, March 12, 2009.
9. The Grill: Jeannette M. Wing, interview by Gary Anthes, *Computerworld*, Vol. 43, No. 8, February 23, 2009, pp. 16–18.
10. Last Byte: Q&A The Upper Limit, interview by Leah Hoffman, *Communications of the ACM*, Vol. 52, No. 1, January 2009, pp. 111–112.
11. "Computational Thinking," Computational Thinking Olympiad Planning Committee, Arlington, VA, November 21, 2008.
12. "Thinking Like a Computer Scientist," Kojo Nnamdi Show, WAMU 88.5, National Public Radio, November 19, 2008.
13. Welcome Address, Molecular Communiation, Arlington, VA, February 20, 2008.
14. Welcome Address, Grace Hopper Conference, Orlando, Florida, October 18, 2007.
15. Welcome Address, NSF Nanoelectronics Workshop, Arlington, Virginia, October 15, 2007.
16. Welcome Address, NSF Quantum Information Systems Workshop, Arlington, Virginia, September 10, 2007.
17. "A Conversation with Jeannette Wing about Computational Thinking," IT Conversations with Jon Udell, <http://www.itconversations.com/shows/detail1844.html>
18. "Dan Siewiorek, the Epitome of Carnegie Mellon," Dan60, December 4, 2006.

19. “Q&A with Jeannette M. Wing,” interview by Lauren Aaronson, *IEEE Spectrum* (online), July 2006.

Invited Participant

1. Government Panel, National Cyber Leap Year Summit, NITRD, Arlington, VA, August 17-19, 2009.
2. Microsoft Faculty Summit, Redmond, WA, July 13–14, 2009.
3. Rebooting Computer Science Summit, January 12–14, 2009, Mountain View, CA.
4. Science in Society: Dialogues and Scientific Responsibility, Mouvement Universel de la Responsibilite Scientifique (MURS), European Union, Paris, France, November 24–25, 2008.
5. “Mindswap on Cloud Computing,” Microsoft Research Asia, Beijing, China, November 3, 2008.
6. “Academia and Government Working Together to Promote Interdisciplinary Research,” Panel on Interdisciplinary Research, Microsoft New England, September 22, 2008. **Invited Panelist.**
7. Microsoft Faculty Summit, Redmond, WA, July 28–29, 2009.
8. “Computing at Scale: Challenges and Opportunities,” Google Faculty Summit, Mountain View, CA, July 24, 2008. **Invited Panelist.**
9. “Data-Intensive Computing Symposium,” Computer Community Consortium, Sunnyvale, CA, March 26, 2008.
10. “National Cyber-Defense Initiative (NCDI) Workshop on Game-changing Solutions for Cyber Security,” Intelligence Advanced Research Projects Activity (IARPA), College Park, Maryland, November 7, 2007.
11. “The Science of Thinking: Europe’s Next Challenge,” Science Business, Brussels, Belgium, September 19, 2007.
12. Google Faculty Summit, Mountain View, CA, July 26–27, 2007.
13. “Optimism for the Future of Computing,” Microsoft Faculty Summit, Redmond, Washington, July 16, 2007. **Invited Panelist.**
14. NSF CyberInfrastructure Team, panel session, Washington, D.C., July 11, 2007.
15. SIGCSE 2007, Birds-of-a-Feather session on Computational Thinking, organized by Peter Henderson, Covington, Kentucky, March 8, 2007.
16. Science 2020 Forum, Venice, Italy, September 4–5, 2006. Organized by Microsoft Research Cambridge.
17. PCAST Subcommittee on Cybersecurity, University Club of Chicago, August 30, 2006.
18. Metricon 1.0, Vancouver, BC, August 1, 2006.
19. Google Faculty Summit, Mountain View, CA, July 27–28, 2006.
20. Microsoft Faculty Summit, Redmond, WA, July 17–18, 2006.
21. NSF Cyber Trust PI Meeting, Newport, CA, September 25–27, 2005.
22. Google Faculty Summit, Mountain View, CA, August 5, 2005.
23. ARO High Confidence Embedded Systems, PI Meeting, Lincoln, Nebraska, May 10–11, 2005.
24. NATO ARW Verification of Infinite State Systems with Applications to Security (VISSAS) 2005, Timisoara, Romania, March 17–22, 2005.
25. CRA Computing Leadership Summit, Washington D.C., February 28, 2005.
26. DARPA ISAT Study “Bolt-on Security,” Alexandria, VA, February 19–20, 2004.
27. Workshop on Advanced Developments in Software and Systems Security,” Taipei, Taiwan, December 5–7, 2003.

28. Computer Research Associates Conference on Grand Research Challenges in Information Security and Assurance, November 16–19, 2003.
29. Carnegie Mellon Sustainable Computing Consortium, **Invited panelist**, Pittsburgh, PA, September 30, 2003.
30. Workshop on Software Engineering for Embedded Systems, Monterey Workshop Series, Chicago, IL, September 24–26, 2003.
31. NSF/NIST Invitational Workshop on Cybersecurity Workforce Needs Assessment and Educational Innovation, Washington, D.C., August 7–8, 2003.
32. Microsoft Faculty Summit, Redmond, WA, July 28–29, 2003. **Invited panelist** on Trustworthy Computing, July 29, 2003.
33. ARO High Confidence Embedded Systems, PI Meeting, Pittsburgh, PA, May 1–2, 2003.
34. Microsoft Research Security Workshop, Snoqualmie, WA, February 28, 2003.
35. Microsoft Research Concurrency Workshop, Snoqualmie, WA, February 24–25, 2003.
36. NSF EDUCAUSE, Cybersecurity in Higher Education, Washington, D.C., October 22–23, 2002.
37. ARO High Confidence Embedded Systems, PI Meeting, Atlanta, GA, May 30–31, 2002.
38. Electronic Tools Infrastructure (ETI) Workshop, IT-Center, Dortmund, Germany, November 23–24, 2001.
39. Using Uncertainty Within Computation, AAAI 2001 Fall Symposium, North Falmouth, Cape Cod, MA, November 2–4, 2001. Invited panelist: “Future Research Directions on Uncertainty Within Computation.”
40. Specifying and Checking Properties of Software, University of Washington/Microsoft Research Summer Institute, August 12–16, 2001.
41. ARO High Confidence Embedded Systems, PI Kickoff Meeting, Philadelphia, May 24–25, 2001.
42. DARPA High Assurance Scientific Computing, Arlington, VA, March 13–15, 2001.
43. DARPA OASIS PI Meeting, Norfolk, VA, February 13–16, 2001.
44. High Dependability Computing Consortium (HDCC) Workshop, NASA/Ames, January 10–12, 2001.
45. Formalism in Software Engineering Education and Practice, Asia-Pacific Software Engineering Conference (APSEC), Singapore, December 6, 2000, invited panelist.
46. SEI and IEEE Computer Society, Third Information Survivability Workshop (ISW-2000), Boston, MA, October 24–26, 2000.
47. NASA/Ames, Design for Safety 2000 Workshop, Moffett Training Center, California, October 10–12, 2000.
48. DARPA High Confidence Aviation Systems Workshop, Arlington, Virginia, June 21, 2000.
49. DARPA IASET PI Meeting, Alexandria, Virginia, April 25–26, 2000.
50. DARPA Formal Methods PI Meeting, Alexandria, Virginia, October 25–26, 1999.
51. ISAT/DARPA Annual Meetings: April 24–25, 2001, April 26, 2000, January 19, 2000, May 6, 1999, January 20–21, 1999, IDA; August 20–24, 2001, July 10–14, 2000, August 23–27, 1999; Woods Hole, MA, November 11–13, 2000, Seattle, WA.
52. University of Washington/Microsoft Research Summer Institute on Technologies to Improve Software Development, Seattle and Semiamoo, August 2–6, 1999.
53. ONR and NSF Workshop in Computer Security, Fault Tolerance, and Software Assurance: From Needs to Solutions, Williamsburg, VA, November 10–12, 1998.
54. DARPA Formal Methods PI Meeting, Palo Alto, October 29–30, 1998.

55. NSF Software Workshop, Baltimore, Maryland, October 15–16, 1998.
56. DARPA EDCS PI Meeting, Baltimore, Maryland, July 21–23, 1998.
57. DARPA ITO PI Meeting, Austin, Texas, November 10–12, 1997.
58. Panel on Funding for Software Research, COMPSAC, Washington, DC, August 14, 1997.
59. DARPA CAETI Meeting, Berkeley, CA, November 19–22, 1996.
60. DARPA ITO PI Meeting, Dallas, Texas, October 7–8, 1996.
61. DARPA CAETI Meeting, University of Arlington, Texas, March 20–22, 1996.
62. ZUM'95, Education Day, Z Users Group, Limerick, Ireland, September 9, 1995.
63. Formal Specification: Foundations, Methods, Tools and Applications, Warsaw, Poland, May 29–June 1, 1995.
64. Workshop on Industrializing Formal Specification Techniques, Ft. Lauderdale, April 5–8, 1995.
65. ARPA Persistent Object Bases/Interoperability Meeting, La Jolla, CA, Oct. 31–Nov. 2, 1994.
66. ARPA Software Composition Meeting, Charleston, SC, May 3–5, 1994.
67. Research and Development for the NII: Technical Challenges, Gaithersburg, MD, NIST, February 28–March 1, 1994. Co-chair of Track on Interoperability.
68. ACM SIGPLAN Workshop on Interface Definition Languages, January 20, 1994. Program chair.
69. ECOOP '93 Workshop on Granularity of Objects in Distributed Systems, Kaiserslautern, Germany, July 26, 1993.
70. ECOOP '93 Workshop on Object-Based Distributed Programming, Kaiserslautern, Germany, July 26–27, 1993. Invited panelist and speaker.
71. NSASAB Panel on Formal Methods, Ft. George Meade, MD, February 9–10, 1993.
72. NSF Workshop on the Future of Programming Languages and Compilers, Charleston, SC, January 6–7, 1993.
73. Software Technology Conference, DARPA Software and Intelligent Systems Technology and Computing Systems Technology Offices, Los Angeles, CA, April 28–30, 1992.
74. Foundations of Information Systems Specification and Design, International Conference and Research Center for Computer Science, Dagstuhl-Seminars, Saarbrucken, Germany, March 16–20, 1992.
75. HPCC Software PI Meeting, DARPA Computing Systems Technology Office, San Diego, CA, January 15–17, 1992.
76. Fifth Refinement Workshop: Theory and Practice of Formal Software, British Computer Society, London, UK, January 8–10, 1992.
77. Intelligent Information Systems Workshop on Data/Knowledge Management, Como, Italy, October 28–30, 1991.
78. Formal Methods '91, Governments of the US, the UK, and Canada, Drymen, Scotland, September 24–27, 1991.
79. Formal Methods in Computer Graphics, Eurographics Association, Marina di Carrara, Italy, June 17–19, 1991.
80. DARPA Information Science and Technology Office PI Meeting, Providence, RI, Feb. 27–March 1, 1991.
81. Programming Concepts and Methods, IFIP Working Group 2.3, Catalina Island, CA, December 10–14, 1990.
82. Research Agenda for Software Engineering and Large Scale Systems, DARPA Information Science and Technology Office, Washington, D.C., June 27–29, 1990.

83. IFIP TC 2 Working Conference on Programming Concepts and Methods, Sea of Galilee, Israel, April 2–5, 1990.
84. Object-Oriented Database Concepts, Panel Session OOPSLA '89, S. Zdonik, organizer, New Orleans, October 4, 1989.
85. Formal Methods Workshop '89, Governments of the US, the UK, and Canada, Nova Scotia, July 23–27, 1989.
86. Stepwise Refinement of Distributed Systems: Models, Formalism, Correctness, Eindhoven, The Netherlands, May 29–June 2, 1989.
87. Integrated Approach for Fault Tolerance: Current State and Future Requirements, University of Maryland at College Park, Institute for Advanced Computer Systems, May 4–5, 1989.
88. Trusted System Design Validation Workshop, Computational Logic Inc., DARPA, Austin, TX, December 1–2, 1988.
89. DARPA PI meeting, Information Science and Technology Office, Austin, TX, November 14–18, 1988.
90. Future of Programming Languages Workshop, ONR, Miami, FL, October 13–14, 1988.
91. Methodologies and Object-Oriented Programming Workshop, ACM OOPSLA, Orlando, FL, October 5, 1987.
92. How Will We Specify Concurrent Systems in the Year 2000?, Western Committee of the IEEE Computer Society, Lake Arrowhead, CA, September 16–18, 1987.
93. IFIP Working Group 2.3 Meeting, Pittsburgh, PA, August 15–19, 1988.
94. Fourth International Workshop on Software Specification and Design, ACM SIGSOFT, IEEE Computer Society, AFCET, The Alvey Programme, and LCRST, Monterey, CA, April 3–4, 1987.
95. Large Grained Parallelism, IEEE Computer Society, Providence, RI, October 27–29, 1986.
96. Testing and Proving: Two Approaches to Assurance, Naval Research Laboratory, in conjunction with COMPASS '86, Georgetown University, Washington, D.C., July 9–11, 1986.
97. Third International Workshop on Software Specification and Design, ACM SIGSOFT, IEEE Computer Society, AFCET, the Alvey Programme, and LCRST, London, UK, August 26–27, 1985.
98. Verification Workshop III, DOD Computer Security Center, Watsonville, CA, February 19–21, 1985.
99. Workshop on Formal Aspects of Specification, The Alvey Programme, Imperial College, London, UK, October 22–24, 1984.
100. Workshop on Formal Software Development Methods, Dansk Datamatik Center (Denmark) and Standard Telephone and Cable (England), Copenhagen, Denmark, May 21–25, 1984.
101. Second International Workshop on Models and Languages for Software Specification and Design, IEEE Computer Society, LCRST, Oregon Graduate Center, and Laval University, Orlando, FL, March 30, 1984.

Grant Support

Current

- “Microsoft-Carnegie Mellon Center for Computational Thinking,” Microsoft Corporation, 2007-2010, \$1,500,000.
- “Perpetually Available and Secure Information Systems,” Army Research Office, 60 months, PI: Pradeep Khosla. \$35,531,264.
- “Formal Methods for Affordable Avionics Software,” Lockheed Martin, 1999–, \$50,000.

Past

- “An Attack Surface Metric,”
SAP, November 2006–December 2007, \$200,000. August–November 2008, \$20,000.
- “Project Olympus,”
Heinz Foundation, 2006–2007, PI: L. Blum. \$400,000.
- “Extracting Security Policies From Source Code,”
CMU CyLab, September 1, 2006–August 31, 2007, \$75,000
- “An Attack Surface Metric,”
CMU CyLab, September 1, 2006–August 31, 2007, \$75,000
- “Measuring Attack Surfaces,”
CMU SEI, September 1, 2005–December 31, 2006, \$137,000.
- “Team for Research in Ubiquitous Secure Technologies,”
NSF Science and Technology Center, \$35 million, five years. Academic partners: UC Berkeley, Stanford, Carnegie Mellon, Cornell, Vanderbilt.
- “Security Through Interaction Modeling,”
NSF CyberTrust, October 1, 2004–September 30, 2009, \$6.4 million, Co-PIs: Mike Reiter, Bruce Maggs, Dena Tsamitis, and Chenxi Wang.
- “Entry and Exit Points,”
CMU CyLab, September 1, 2005–August 31, 2006, \$75,000
- “Software Composition Flaws,”
CMU CyLab, September 1, 2005–August 31, 2006, \$75,000
- “Software Design and Security,”
CMU SEI, June 1, 2004–August 31, 2005, \$200,000
- “Women@IT: Expanding the IT Pipeline at the Graduate Level and Beyond,” Sloan Foundation
January 1, 2004–December 2006. PI: Lenore Blum. \$400,000.
- “Verification Tools for Autonomous and Embedded Systems,”
National Science Foundation, J. Wing (PI), September 1, 2001–August 31, 2005. Co-PIs: R. Bryant, E. Clarke. \$1,000,000.
- “Verification Tools for Embedded Systems,”
Army Research Office, University Research Initiative, J. Wing (PI), May 1, 2001–April 30, 2006. Extended to July 28, 2007. Co-PIs: E. Clarke, D. Garlan, B. Krogh, and R. Simmons, \$4,393,644.
- “Software Design and Security,”
CMU CyLab, September 1, 2004–August 31, 2005, \$70,000
- “A Formal Methods Tool Suite for Education,”
National Science Foundation US-Western Europe, January 1, 2002–February 28, 2005, co-PI: Bernhard Steffan. \$18,700.
- “Formal Verification Tools and Techniques for Autonomous Systems,”
NASA/Ames, J. Wing (PI), January 1, 2001–December 31, 2003. Co-PIs: E. Clarke, D. Garlan, B. Krogh, and R. Simmons, \$175,000.
- “Science-based Methods for Information Assurance Design and Assessment,”
DARPA, April 2000–April 2002. PIs: T. Longstaff and J. Wing, \$1,098,097.
- “A Framework for Verifying Security Protocols,”
National Security Agency, January 1999–September 2000. PIs: E. Clarke and J. Wing, \$200,000.
- “A Technology Investigation Supporting Software Architecture and Analysis for Evolution,”
DARPA, June 1996–August 1999. PIs: D. Garlan and M. Shaw, \$1,247,335.
- “Model Checking of Software Systems,” (supplement)
NSF, July 1998–December 1999. Co-PIs: D. Jackson and J. Wing, \$16,977.

- “Model Checking of Software Systems,”
NSF, September 1996–August 1999. Co-PIs: D. Jackson and J. Wing, \$300,000.
- “Nitpick Development,” NIST, August 1997–July 1998, \$25,000.
- “Educational Infrastructure: TinkerTeach,”
DARPA, August 1995–August 1997. Co-PI’s: D. Garlan, M. Shaw, and J. Wing, \$520,000.
- “Composable Software Systems,”
DARPA, August 1993–July 1997. Co-PI’s: D. Garlan, M. Shaw, and J. Wing, \$4,301,900.
- “Object Management,”
DARPA, August 1990–July 1993, \$4,783,000.
- “First International Workshop on Larch,”
NSF Cooperative Programs with Western Europe, July 1992, \$9,975.
- “A Library of Concurrent Objects,”
NSF Software Capitalization Program, July 1991–June 1992, \$20,000.
- “Highly Concurrent Objects,”
NSF/DARPA Joint Initiative on Parallel Computing Theory, July 1989–July 1992. Co-PIs: S. Brookes and J. Wing (original co-PI: M. Herlihy), \$300,000.
- “Visual Specifications of Software Systems,”
National Computer Security Center, September 1988–December 1991, \$331,242.
- “Research on Concurrent Systems,”
Office of Naval Research, July 1989–September 1991, \$100,000.
- “Reliable Distributed Systems,”
DARPA, June 1987–July 1990. Original PI: A. Spector, \$3,951,000.
- “Formal Methods for Reasoning About Distributed Systems,”
NSF Division of Computer and Computation Research, August 1987–July 1989, \$62,752.
- “A Study of the Specification of Large Programs,”
NSF Engineering Research Initiation Grant Program. June 1984–August 1987, \$47,722.
- “A Geometric Reasoning Laboratory,”
USC Faculty Research and Innovation Fund. 1985. Co-PI’s: F. Arbab, M. Chignell, B. Karasek, B. Khoshinevis, and J. Wing, \$30,000.

Educational Activities

Courses Taught

Post-graduate

- Formal Methods, Software Engineering Evangelists for Korea (SEEK) Program, Institute for Software Research, International, Carnegie Mellon, Summers 2000, 2001, 2002.
- Formal Methods, School of Computer Science Summer School, Carnegie Mellon, Summer 1996.
- Formal Methods, Carnegie Mellon Information Networking Institute: Advanced Training Institute, Mid-Career Program, M. Sirbu, Director, Fall 1989, Spring 1990.
- Science of Programming, Institute for Retraining in Computer Science (IFRICS), sponsored by the MAA, Postdam, NY, Summer 1986.
- Design and Implementation of Modular Software, Intermetrics, Inc., Cambridge, MA, Fall 1982; MIT, Summers 1982, 1980; University of California at Santa Cruz, Summer 1980, laboratory assistant.

Graduate

- Software Security, CMU, Spring 2004, co-instructor.
- Analysis of Software Artifacts, CMU, MSE Program, Spring 1995, 1996; Fall 2001.
- Methods of Software Development, CMU, MSE Program, Fall 2000.
- Security and Cryptography, CMU, Fall 1997, 1998, 1999.
- Software Systems Core Course, CMU, Fall 1996.
- Models of Software Systems, CMU, MSE Program, Fall 1993, 1994, 1995, 2005, 2006.
- Reasoning about Concurrent and Distributed Systems, CMU, Spring 1994.
- Specifications in Software Development, MIT, Fall 1992.
- Programming Systems Core, CMU, Fall 1990, 1991.
- Advanced Topics in Formal Methods, CMU, Spring 1990.
- Term Rewriting Systems and Beyond (as Illustrated by Larch), CMU, Spring 1989.
- Recent Developments in the Specification of Concurrent Systems, CMU, Spring 1988.
- Language Issues in Distributed Computing, CMU, Fall 1986.
- Task-Level Concurrent Programming, CMU, Spring 1986.
- Issues in the Specification and Design of Concurrent Systems, USC, Spring 1985.

Undergraduate

- Principles of Programming (formerly, Fundamental Principles of Computer Science II), CMU, Spring 1999, 2000, 2001, 2002.
- Computer Systems Engineering (6.033), MIT, Spring 1992.
- Software Engineering, CMU, Spring 1991, 1993, 1997, 1998.
- Operating Systems, CMU, Fall 1988.
- Comparative Programming Languages, CMU, Spring 1986, 1987; Fall 1987, 1989.
- Translation of Programming Languages, USC, Fall 1984, Spring 1985.
- Concepts in Programming Languages, USC, Spring 1984.
- Fundamentals of Computer Science, Part II, USC, Fall 1983, Spring 1984.

Current Students

Doctoral

1. Michael Tschantz, CSD, 4th year.

Former Students

Doctoral

1. Pratyusa Manadhata, "An Attack Surface Metric," August 2008, Symantec, CA.
2. Oleg Sheyner, "Scenario Graphs and Attack Graphs," May 2004, Synopsys, MA. ACM Dissertation Award Nominee 2004. SCS Dissertation Award 2004.
3. Theodore Wong, "Decentralized Recovery for Survivable Storage Systems," May 2004, IBM Almaden, CA.
4. Rob O'Callahan (joint with D. Jackson), "Generalized Aliasing as a Basis for Program Analysis Tools," November 2000. ACM Dissertation Award Honorable Mention 2002.
5. Hao-Chi Wong (Pure and Applied Logic), "Protecting Individuals' Interests in Electronic Commerce Protocols," October 2000. Xerox PARC, Palo Alto, CA.
6. Craig Damon, "Selective Enumeration," (joint with D. Jackson), August 2000. University of Vermont, VT.
7. Darrell Kindred, "Theory Generation for Security Protocols," April 1999. Network Associates Laboratories, MD.
8. Amy Moormann Zaremski, "Signature and Specification Matching," January 1996. Xerox Webster Research Center, Rochester, NY.
9. Scott Nettles, "Safe and Efficient Persistent Heaps," December 1995. University of Texas, Austin, TX.
10. J. Gregory Morrisett, "Compiling With Types" (joint with R. Harper), December 1995. Harvard University, Cambridge, MA.
11. Fritz Knabe, "Language Support for Mobile Agents," December 1995. Endeca, Cambridge, MA.
12. Bruce L. Horn, "Constrained Objects," (joint with J. Morris), December 1993. Consultant, Bay Area, CA.
13. Richard A. Lerner, "Specifying Objects in Concurrent Programs," May 1991. Amerinex Artificial Intelligence, 409 Main St., Amherst, MA 02002.
14. David L. Detlefs, "Concurrent, Atomic Garbage Collection," October 1990. Microsoft Corporation, Redmond, WA 98052.

Doctoral Committee Member

Elie Burzstein (LSV, ENS-Cachan, CNRS, INRIA), November 2008; Murali Talipur, December 2006; Sanjit Seshia, May 2005; Michael McDougall (University of Pennsylvania), December 2004; Shawn Butler, May 2003; Adrian Perrig, December 2001; Will Marrero, June 2001; Marius Minea, January 2000; Juergen Dingel, November 1999; John Ockerbloom, January 1998; William Blackmon (Civil Engineering), July 1997; Charles Krueger, July 1997; William Courtright (Electrical and Computer Engineering), April 1997; David Steere, January 1997; Susan Older, December 1996; Qi Lu, May 1996; Chun Gong (University of Pittsburgh), October 1995; Bernhard Humm (University of Wollongong, Australia), September 1994; Nico Plat (Technical University of Delft, The Netherlands), September 1993; Jerry Burch, August 1992; Allan Heydon, October 1991; Olin Shivers, May 1991; John Baugh (Civil Engineering), August 1989.

Master's

1. Oren Dobzinski, ECE, "Alert Abstraction Using Attack Graphs," May 2006.
2. E. Chaos Golubitsky, Information Networking Institute Program, "Measuring Attack Surfaces on Open Source IMAP Servers," May 2005.
3. Meera Sridhar, CSD 5th Year Scholars Program, "Experiments Using an Attack Graph Toolkit," August 2004.
4. Jose Rivera, CMU MSE program, independent study, "Development of a Concurrent Terminal Emulator using Formal Methods," October 1995.
5. Chee Chew, MIT Co-op thesis, "Creator: An Interactive Application Builder," May 1993.
6. Tini Widjojo (USC), 1984–1985.
7. Sharon Anderson (USC), 1983–1985.

Bachelor's

1. Meera Sridhar, "The Honeywell Sensor Voter Algorithm: A Case Study," December 2002.
2. Yuchung Ng, "A Nitpick Specification of IPv6," May 1997.
3. Mandana Vaziri-Farahani, "Model Checking Cache Coherence Protocols for Distributed File Systems," ECE honors thesis, May 1995. Runner-up in the First Computing Research Association Outstanding Female Undergraduate Competition.

Visitors Faculty

- Michael Loui, Professor of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 2000–2001.

Scientists

- Kiyotaka Kuroda, engineer from Mitsubishi Electric Co., Japan, 1994–95.

Postdocs

- Dilsun Kaynar, 2006–07.

Ph.D. Students

- Morten Soerensen, Technical University of Denmark, Lyngby, Denmark, 1994–95.
- Chun Gong, Academia Sinica, Beijing, China, 1988–90.

Other Educational Activities

Participant

- Faculty Seminars on Teaching, CMU, led by E. Fenton, Spring 1987. Series of six lectures on how to improve one's teaching skills.

Video

- CMU Teaching Center. The Center used a videotape of one of my operating systems lectures for university-wide seminars for graduate students and new faculty.

Service Activities

National Organizations

Honors

- ACM Fellow, 1998.
- IEEE Fellow, 2003.
- AAAS Fellow, 2007.
- Phi Beta Kappa, Tau Beta Pi, Eta Kappa Nu, Sigma Xi.

Committees, Boards

- Networking and Information Technology Research and Development (NITRD) Senior Steering Group for Cyber Security, co-chair, 2008–.
- Networking and Information Technology Research and Development (NITRD), co-chair, 2007–.
- CRA Image of Computing Task Force, advisory board, 2007.
- Networking and Information Technology (NITRD) Technical Advisory Group, President's Council of Advisors on Science and Technology (PCAST), July 1, 2006–September 30, 2007.
- ACM Council, Member-at-Large, 2006–2007.
- ACM Task Force on China, co-chair, 2006–2007.
- ACM Education Council, 2006.
- Microsoft Research and Programs Advisory Board, July 2006–June 2007.
- Microsoft Faculty Fellowship Committee, 2006–2007.
- Idaho National Laboratory National and Homeland Security Strategic Advisory Committee, 2005–2007.
- The National Academies: Computer Science Technology Board, 2001–2007, member; 2004–2005, Chair.
- Sloan Foundation Fellowship Award Committee, 2003–2009.
- Intel Research Pittsburgh Advisory Board, 2005–2007.
- Microsoft Trustworthy Computing Academic Advisory Board, 2003–2007.
- Institute for Security Technology Studies Advisory Committee, Dartmouth College, 2004–2006.
- Committee on Science and Technology for Countering Terrorism: Information Technology, 2001–2002.
- ACM Kanellakis Award, 1999–2004. Committee Chair, 2002–2003.
- DARPA Information and Science Technology Study (ISAT) Group member, 1999–2002.
- National Science Foundation (NSF) Scientific Advisory Board, 1995–1998.
- National Security Agency (NSA) Scientific Advisory Board, Ft. George Meade, MD., 1994–1996.
- Council for International Exchange of Scholars, Discipline Advisory Committee for Fulbright Scholar Awards, 1991–1994.
- ACM Karl V. Karlstrom Outstanding Educator Award Committee, 1993–1996. Chair, 1994–1995.
- Educational Testing Service, Quantitative Exam for Engineering GRE, 1993–1994. Examiner for the GRE Computer Science Test, 1988–1990.

Lecturer

- ACM National Lecturer, 1991–1992.
- ACM Distinguished Lecturer, 2006–2007.

Regional Organization

Honor

- Distinguished Daughter of Pennsylvania, 2008.
- Women in Science Award, Women and Girls Foundation of Southwest Pennsylvania, 2005.

Journal Organizations

Editorial Board

- Lecture Notes in Computer Science Subline on Advanced Research in Computing and Software Science, 2009–.
- Communications of the Association for Computing Machinery, 2007–.
- International Journal of Software and Informatics, 2007–.
- IEEE Transactions on Dependable and Secure Computing, 2006–.
- Journal of Information Science and Engineering, 2005–.
- Journal of the Association for Computing Machinery, 1999–.
- Software Tools for Technology Transfer, 2001–.
- Formal Aspects of Computing Journal, British Computer Society, Springer-Verlag, 1988–; North American Editor, 1997–.
- Formal Methods in System Design, 1994–.
- ACM Transactions on Programming Languages and Systems, 1992-1999.
- ACM Transactions on Software Engineering and Methodology, 1989-1999.
- Proceedings of the IEEE, 1995-1996.

Guest Editor

- Three special issues on FM'99: *Formal Aspects of Computing Journal*, vol. 12, no. 3, September 2000, *Formal Methods in System Design*, vol. 17, no. 3, December 2000, *IEEE Transactions on Software Engineering*, vol. 26, no. 8, August 2000; with Jim Woodcock.
- Special issue on Software Specification and Verification, *Formal Methods in System Design*, vol. 8, no. 2, March 1996.

Conference and Workshop Organizations

Workshop Organizer

- *Software Security*, UW-MSR-CMU Summer Institute, Skamania Lodge, Stevenson, WA, June 15–June 18, 2003, co-chair with Jim Larus and John Zahorjan.
- *Mobility and Security*, ISAT Study Group Workshops I and II, Pittsburgh, PA, January 10–11, 2000; Oakland, CA, March 27–28, 2000, co-chair with George Cybenko.
- *Model Checking and Security Protocols*, workshop associated with Logic in Computer Science, Bloomington, Indiana, June 25, 1998, co-chair with Nevin Heintze.
- *Formal Methods Working Group*, ACM Workshop on Strategic Directions in Computing Research, MIT, Cambridge, MA, June 14–15, 1996, co-chair with Edmund Clarke.
- *Interface Definition Languages Workshop*, Portland, OR, January 20, 1994.
- *First International Workshop on Larch*, Endicott House, Dedham, MA, July 13–15, 1992. co-organized with Ursula Martin.

Program Chair

- First International Symposium on Secure Software Engineering,” Washington, DC, March 13–15, 2006. Co-chair with Anthony Hall.
- Formal Methods 1999, Toulouse, France, Fall 1999. Co-chair of technical symposium with Jim Woodcock.
- Interface Definition Languages Workshop, Portland, OR, January 20, 1994.
- First International Workshop on Larch, Endicott House, Dedham, MA, July 13–15, 1992, co-chair with Ursula Martin.
- Second Workshop on Large Grained Parallelism, IEEE Computer Society, Hidden Valley, PA, October 1987.

Session Chair

- “Interoperability” track, Research and Development for the NII: Technical Challenges, Gaithersburg, MD, NIST, February 28–March 1, 1994.
- “Software Development for Parallel and Distributed Systems,” 13th International Conference on Software Engineering, Austin, May 13–17, 1991.
- “What are the Theoretical and Practical Limitations of Formal Methods?,” Formal Methods 1989, Nova Scotia, July 24–27, 1989.
- “Role of Formal Specifications,” Testing and Proving: Two Approaches to Assurance, Naval Research Laboratory Invitational Workshop, Washington, D.C., July 9–11, 1986.

Program Committee

- Computer Research Association (CRA) Snowbird Conference, Snowbird, Utah, July 2006.
- ACM Symposium on Information, Computer and Communications Security, Taipei, Taiwan, March 21–23, 2006.
- 6th International Conference on Formal Engineering Methods, Seattle, October 2004.
- Symposium on Computer Security, IEEE GlobeCom 2003, San Francisco, December 2003.
- Monterey Workshops: Radical Innovations of Software and Systems Engineering in the Future, Venice, Italy, October 2002.
- IEEE Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises, Workshop on Enterprise Security, Pittsburgh, PA, June 10–12, 2002.
- ACM Principles of Distributed Computing, Monterey, CA, 2002.
- Formal Methods Europe 2002, Copenhagen, Denmark.
- Formal Methods 1999, Toulouse, France.
- OOPSLA, Vancouver, Canada, 1998.
- European Joint Conference on Theory and Practice/Fundamental Approaches to Software Engineering, Lisbon, Portugal, 1998.
- International IEEE Conference on Formal Engineering Methods, Hiroshima, Japan, 1997.
- ACM SIGPLAN Symposium on Prog. Lang. Design and Impl., Las Vegas, NV, 1997.
- ACM Principles of Distributed Computing, Philadelphia, PA, 1996.
- First Workshop on Formal Methods in Software Practice, San Diego, CA, 1996.
- IEEE COMPASS, Gaithersburg, MD, 1995.
- Workshop on Industrial-Strength Formal Specification Techniques, Boca Raton, FL, 1995.
- 17th International Conference on Software Engineering, Seattle, WA, 1995.
- ACM SIGSOFT Foundations of Software Engineering Conference, New Orleans, LA, 1994.
- IEEE COMPASS, Gaithersburg, MD, 1994.
- 16th International Conference on Software Engineering, Italy, 1994.

- ACM Symposium on Operating Systems Principles, Ashville, NC, 1993.
- First International Conference on Requirements Engineering, San Diego, CA, 1993.
- History of Programming Languages, Boston, MA, 1993.
- First International Workshop on Larch, Dedham, MA, 1992.
- ACM SIGPLAN Symposium on Prog. Lang. Design and Impl., San Francisco, CA, 1992.
- 14th International Conference on Software Engineering, Australia, 1992.
- International Conference on Computer Languages, San Francisco, CA, 1992.
- OOPSLA, Phoenix, AZ, 1991.
- Sixth Workshop on Software Specification and Design, Como, Italy, 1991.
- ACM Principles of Distributed Computing, Montreal, Canada, 1991.
- 13th International Conference on Software Engineering, Austin, TX, 1991.
- Distributed Computing Systems, Paris, France, 1990.
- Third ACM Testing Analysis and Verification Symposium, Key West, FL, 1989.
- Third Workshop on Large Grained Parallelism, SEI, Pittsburgh, 1989.
- Fifth Workshop on Software Specification and Design, Pittsburgh, PA, 1989.
- Tenth Tunisian French Computer Science Conference, Tunisia, 1989.

Local Arrangements Chair

- Fifth Workshop on Software Specification and Design, Pittsburgh, May 1989.

Steering Committee, Advisory Board

- Workshop on Quality of Protection, September 2005.
- NATO Advanced Research Workshop on Cyberspace Security and Defense, International Advisory Committee, 2003–2004.
- Formal Methods in Education, 2000–.
- International Federation for Computational Logic, 1999–2002.
- Logic in Computer Science, 1997–2003.
- Algebraic Methodology and Software Technology, 1995–.
- International Workshop on Software Specification and Design

Refereeing, Reviewing

Journals

ACM Transactions on Programming Languages and Systems, ACM Transactions on Computer Systems, Communications of the ACM, ACM Computing Surveys, ACM Computing Reviews, IEEE Computer, IEEE Software (special recognition), IEEE Transactions on Computers, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Software Engineering, IEEE Transactions on Knowledge and Data Engineering, Information Processing Letters, International Journal of Computers and Applications, Journal of Internetworking: Research and Experience, Journal of Symbolic Logic.

Conferences

International Symposium on Fault-Tolerant Computing Systems 1998, Hawaii International Conference on System Sciences 1988 and 1990, ACM Principles of Programming Languages Symposium 1987, Logic in Computer Science 1987, Fourth International Workshop on Software Specification and Design 1987, Sixth International Conference on Software Engineering, ACM LISP and Functional Languages Conference 1986, ACM Functional Programming Languages and Computer Architecture 1981.

Grant Proposals

Army Research Office, National Science Foundation, National Computer Security Center, State of Idaho, University of California, Belgium Office for Scientific, Technical and Cultural Affairs, Natural Sciences and Engineering Research Council of Canada, Hong Kong Research Grants Council, The Israel Academy of Sciences and Humanities (Basic Research Foundation), Swedish Embassy (Office of Science and Technology, Washington, D.C.), The Netherlands Computer Science Research Foundation, Council of Physical Sciences of the Netherlands Organization for Scientific Research.

Books

Addison-Wesley Publishing Company, Reading, MA, Boyd and Fraser Publishing Company, Boston, MA, Cambridge University Press, Stanford, CA, McGraw-Hill Book Company, New York, NY, The MIT Press, Cambridge, MA, Charles E. Merrill Publishing, Co., IL, Prentice-Hall, Englewood Cliffs, NJ, Wadsworth Publishing Company, Belmont, CA.

Other

National Research Council, Computer Science and Telecommunications Board, "Trust in Cyberspace," 1997–1998. National Research Council, Commission on Engineering and Technical Systems, 1992.

University-wide Service

University

- Research Review Committee, 2007.
- International Committee, 2006–2007.
- Committee on Globalization, 2005.
- Carnegie Mellon CyLab Technical Advisory Board, 2003–2007.
- Diversity Advisory Council, CMU, 1999–2002.
- Associate Deans on Graduate Policy, CMU, 1998–2004.
- Presidential Search Committee, CMU, 1996–1997.
- Committee on Tenure Level Appointments, CMU, 1993–1995.
- Committee on Special Faculty Appointments, CMU, 1989–1991.
- Faculty Senate, CMU, 1988–90.
- Faculty Affairs Council, CMU, 1988–1990.
- Faculty Senate Elections Committee, CMU, 1989–1990.
- Task Force on the Appointment and Tenure Policy, CMU, 1989–1990, 1993–1994.
- President's Distinguished Lecture Series Committee, CMU, 1988–1990.
- Writing Across the Curriculum Ad-hoc Committee, CMU, 1987.

School

- SCS Hiring Czar, CMU, 2000–2002.
- SCS Self-Assessment Committee, CMU, 1998.
- Master's of Software Engineering Program, core curriculum redesign, 1993.
- SCS Policy Committee, SCS Council, CMU, 1992–2007.
- Dean Search Committee, CMU, 1991–1992.
- Programming Systems Syllabus Revision Ad-hoc Committee, CMU, 1986–1987, 1989–1990.
- Programming Systems Qualifications Committee, CMU, 1986–1989.
- Master's of Software Engineering Program, curriculum review, 1989;
- Graduate Admissions Committee, CMU, 1988–1989.

Department

- Speakers Club, 1999–2002.
- Ph.D. Program Committee, 1998–1999.
- Doctoral Review Committee, 1995–2007. Chair 1996–2004.
- Qualifier Review Committee, 1995–1996.
- Department Policy (Silver Oaks, SDRC) Committee, 1994–1999.
- Programming Systems Coordinator, CMU, 1993–2000.
- Faculty Hiring Committee, CMU, 1993–95, 1996–1997.
- Computer Science Graduate Admissions Committee, USC, 1984–1985.
- Computer Science Colloquia, Committee Chair, USC, 1983–1984.

Other Universities

- Chinese University of Hong Kong, Advisory Board, 2005–2007
- Academia Sinica External Review Committee, Taipei, Taiwan, December 8–9, 2003.
- Columbia University Computer Science Department External Review Committee, 2003.
- MIT Aeronautics and Astronautics Department Visiting Committee, 2000–2007.
- MIT Electrical and Computer Science Engineering Department Visiting Committee, 1999–2007.
- University of Michigan, Computer Science Program, Letters of Arts and Sciences, Visiting Committee, April 1999.
- University of Pennsylvania, Computer Science Department, Department Chair Search Committee, external member, 1999.

Other Professional Activities

Advisory Board

- European Network of Excellence on Advanced Cooperating Tools for Specification and Validation, 2002.
- Mu Security, Sunnyvale, 2006–2007.

Consultant

- Microsoft Research, Redmond, WA.
- European Space Agency.
- Lockheed Martin.
- Digital Equipment Corporation, Technical Languages and Environments, Spit Brook, NH.
- Digital Equipment Corporation, Systems Research Center, Palo Alto, CA.
- Institute of Software, Academia Sinica, Beijing, China.
- Mellon Institute, Pittsburgh, PA.
- System Development Corporation, Santa Monica, CA.
- Jet Propulsion Laboratory, Pasadena, CA.

Visiting Professor

- National University of Singapore, hosted by Dr. Jin Song Dong, August 1–5, 2000.
- University of Saarbrücken, Germany, hosted by Dr. Jacques Loeckx, June 1984.
- Academia Sinica, Jiao Tong University, China University of Science and Technology, hosted by Prof. C.S. Tang, Beijing, Xi'an, Shanghai, Hefei, China, May 1988.

Member

- AAAS (Fellow)
- ACM (Fellow)
- IEEE (Fellow)
- Sigma Xi