Curriculum Vitae

Notarization. I have read the following and certify that this *curriculum vitae* is a current and accurate statement of my professional record.

Signature W. Rance Cleaveland II Date March 12, 2023

I. Personal Information

I.A. Full Name and Contact Information

Walter Rance Cleaveland II

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I.B. Academic Appointments at UMD

11/07/2023–	Associate Dean for Research, College of Computer, Mathematical and Natural Sciences	
07/01/2006–	Professor	Institute for Systems Research, College of Engineering
06/01/2005–	Professor	Univ. Maryland Institute for Advanced Computer Studies, CMPS / CMNS
06/01/2005–	Professor	Department of Computer Science, CMPS / CMNS

I.D. Other Employment

02/01/1999–	Chairman of the Board, Reactive Systems Inc.
07/09/2018–07/08/2022	Division Director, Computing and Communication Foundations, NSF
06/01/2005–12/31/2014	Executive and Scientific Director, Fraunhofer Ctr. for Exp. Software Eng.
02/01/1999–09/01/2008	CEO, Reactive Systems Inc.
08/16/1998–05/31/2005	Professor of Computer Science, Stony Brook University
08/16/1994–08/15/1998	Associate Professor of Computer Science, N.C. State Univ.
08/16/1989–08/15/1994	Assistant Professor of Computer Science, N.C. State Univ.
07/01/1987–06/30/1989	Research Associate in Computer Science, Univ. Sussex, Brighton, England

I.E. Educational Background

1987	PhD	Cornell University	Computer Science
1985	MS	Cornell University	Computer Science
1982	BS *summa cum laude*	Duke University	Mathematics, Computer Science

II. Research, Scholarly and Creative Activities

II.A. Books

II.A.1. Books Authored

1. R.L. Constable, S. F. Allen, H. M. Bromley, W. R. Cleaveland, J. F Cremer, R. W. Harper, D. J. Howe, T. B. Knoblock, N. P. Mendler, P. Panangaden, and J. T Sasaki. *Implementing Mathematics with the NUPRL Proof Development System*. Prentice-Hall, Englewood Cliffs, New Jersey, 1986. ISBN-13: 978-1-4680-5910-6.

II.A.2. Books Edited

2. E. Bartocci, R. Cleaveland, R. Grosu and O. Sokolsky, editors. *From Reactive Systems to Cyber-Physical Systems: Essays Dedicated to Scott A. Smolka on the Occasion of His 65th Birthday*, volume 11500 of *Lecture Notes in Computer Science*. Springer International Publishing, 2019. ISBN: 978-3-030-31514-6.

3. R. Cleaveland and H. Garavel, editors. *FMICS'02: 7*th *International ERCIM Workshop in Formal Methods for Industrial Critical Systems*, volume 66 of *Electronic Notes in Theoretical Computer Science*. Elsevier, University of Málaga, Spain, December 2002. ISBN-13: 978-0-444-51341-0.

4. R. Cleaveland, editor. *Tools and Algorithms for the Construction and Analysis of Systems (TACAS '99)*, volume 1579 of *Lecture Notes in Computer Science*, Amsterdam, March 1999. Springer-Verlag. ISBN-13: 978-3-540-65703-3.

5. E. Brinksma, R. Cleaveland, K.G. Larsen, and B. Steffen, editors. *Tools and Algorithms for the Construction and Analysis of Systems (TACAS '95)*, volume 1019 of *Lecture Notes in Computer Science*, Aarhus, Denmark, May 1995. Springer-Verlag. ISBN-13: 978-3-540-60630-7.

6. R. Cleaveland, editor. *CONCUR '92*, volume 630 of *Lecture Notes in Computer Science*. Springer-Verlag, Stony Brook, New York, August 1992. ISBN-13: 978-3-540-55822-4.

II.B. Chapters

II.B.1. Books

7. R. Cleaveland. Better automata through process algebra. In N. Jansen, M. Stoelinga and P. van den Bos, editors, *A Journey From Process Algebra via Timed Automata to Model Learning - A Festschrift Dedicated to Frits Vaandrager on the Occasion of His 60th Birthday*, volume 13560 of *Lecture Notes in Computer Science*, Springer Cham., 2022. DOI: https://doi.org/10.1007/978-3-031-15629-8_7.

8. R. Cleaveland. Scott Smolka and Me. In E. Bartocci, R. Cleaveland, R. Grosu and O. Sokolsky, editors, *From Reactive Systems to Cyber-Physical Systems: Essays Dedicated to*

Scott A. Smolka on the Occasion of His 65th Birthday, volume 11500 of *Lecture Notes in Computer Science*, Chapter 1, pages 1–6. Springer International Publishing, 2019. ISBN: 978-3-030-31514-6.

9. R. Cleaveland, A.W. Roscoe, and S. Smolka. Process algebra and model checking. In E. Clarke, T. Henzinger, and H. Veith, editors, *Handbook of Model Checking*, Chapter 32, pages 1149–1195. Springer International Publishing, 2018. ISBN-13: 978-3-319-10574-1.

10. A. Ray, C. Ackermann, R. Cleaveland, C. Shelton, and C. Martin. Functional and nonfunctional design verification for embedded software systems. In M.V. Zelkowitz, editor, *Security on the Web*, volume 83 of *Advances in Computers*, Chapter 6, pages 277 – 321. Elsevier, 2011. ISBN-13: 978-0-12-385510-7.

11. R. Cleaveland, G. Luettgen, and V. Natarajan. Priority in process algebra. In J.A. Bergstra, A. Ponse, and S.A. Smolka, editors, *Handbook of Process Algebra*, Chapter 12, pages 711–765. North-Holland, Amsterdam, 2001. ISBN-13: 978-0-08-053367-4.

12. R. Cleaveland and O. Sokolsky. Equivalence and preorder checking for finite-state systems. In J.A. Bergstra, A. Ponse, and S.A. Smolka, editors, *Handbook of Process Algebra*, Chapter 6, pages 391–424. North-Holland, Amsterdam, 2001. ISBN-13: 978-0-08-053367-4.

II.B.3. Encyclopedia

13. R. Cleaveland and S. Smolka. Process algebra. In J.G. Webster, editor, *Encyclopedia of Electrical and Electronics Engineering*, volume 17, pages 241–255. John Wiley & Sons, 1999. ISBN-13: 978-0-471-35895-4.

II.C. Articles in Refereed Journals

14. R. Cleaveland and J. Keiren. Extensible proof systems for infinite-state systems. *ACM Transaction on Computational Logic*, accepted for publication, to appear.

15. S. Huang and R. Cleaveland. Temporal-logic query checking over finite data streams. *International Journal on Software Tools for Technology Transfer*, 24:473–492, April 2022. DOI: https://doi.org/10.1007/s10009-022-00656-0.

16. S. Huang and R. Cleaveland. A tableau construction for finite linear-time temporal logic. *Journal of Logical and Algebraic Methods in Programming*, 125:100743, February 2022. DOI: 10.1016/j.jlamp.2021.100743.

17. B. Ramasubramanian, M. Rajan, M. Chandra, R. Cleaveland and S. Marcus. Resilience to denial-of-service and integrity attacks: A structured systems approach. *European Journal of Controls*, 63:61–69, January 2022. DOI: 10.1016/j.ejcon.2021.09.005.

18. B. Ramasubramanian, R. Cleaveland and S. Marcus. Notions of centralized and decentralized opacity in linear systems. *IEEE Transactions on Automatic Control*, 65(4):1442–1455, 2020. DOI: 10.1109/TAC.2019.2920837.

19. Md. Islam, R. Cleaveland, F. Fenton, R. Grosu, P. Jones and S. Smolka. Probabilistic reachability for multi-parameter bifurcation analysis of cardiac alternans. *Theoretical Computer Science*, 765:158–169, Elsevier, 2019. DOI: 10.1016/j.tcs.2018.02.005.

20. C. Schulze and R. Cleaveland. Improving invariant mining via static analysis. *ACM Transactions on Embedded Computing Systems (TECS)*, 16(5s): 167:1–167:20, October 2017. DOI: 0.1145/3126504. Special issue for ESWeek 2017, Seoul, South Korea, October 2017.

21. J. Keiren, P. Fontana and R. Cleaveland. Corrections to "A Menagerie of Timed Automata." *ACM Computing Surveys*, 50(3): 42:1–42:88, 2017. DOI: 10.1145/3078809.

22. Z. Daw and R. Cleaveland. Comparing model checkers for timed UML activity diagrams. *Science of Computer Programming*, 111(Part 2):277–299, 2015. Special Issue on Automated Verification of Critical Systems (AVoCS 2013).

23. Z. Daw, R. Cleaveland, and M. Vetter. Formal verification of software-based medical devices considering medical guidelines. *International Journal of Computer Assisted Radiology and Surgery*, 9(1):145–153, 2014.

24. P. Fontana and R. Cleaveland. A menagerie of timed automata. *ACM Computing Surveys (CSUR)*, 46(3):40, 2014.

25. R. Hierons, K. Bogdanov, J. Bowen, R. Cleaveland, J. Derrick, J. Dick, M. Gheorghe, M. Harman, K. Kapoor, P. Krause, G. Luettgen, A. Simons, S. Vilkomir, M. Woodward, and H. Zedan. Using formal specifications to support testing. *ACM Computing Surveys*, 41(2):9:1–9:76, February 2009.

26. R. Cleaveland, G. Luettgen, and V. Natarajan. Priority and abstraction in process algebra. *Information and Computation*, 205(9):1426–1458, September 2007.

27. B. Sengupta and R. Cleaveland. Triggered message sequence charts. *IEEE Transactions on Software Engineering*, 32(8):587–607, August 2006.

28. I. Lee, G. Pappas, R. Cleaveland, J. Hatcliff, B. Krogh, P. Lee, H. Rubin, and L. Sha. High-confidence medical device software and systems. *IEEE Computer*, 39(4):33–38, April 2006.

29. R. Cleaveland, S. Purushothaman Iyer, and M. Narasimha. Probabilistic temporal logics via the modal mu-calculus. *Theoretical Computer Science*, 342(2–3):316–350, September 2005.

30. D. Hansel, R. Cleaveland, and S.A. Smolka. Distributed prototyping from validated specifications. *Journal of Systems and Software*, 70(3):275–298, 2004.

31. A. Ray and R. Cleaveland. Unit verification: The CARA experience. *Software Tools for Technology Transfer*, 5(4):351–369, May 2004.

32. R. Cleaveland and S. Sims. Generic tools for verifying concurrent systems. *Science of Computer Programming*, 42(1):39–47, January 2002.

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34. R. Cleaveland, Z. Dayar, S. Smolka, and S. Yuen. Testing preorders for probabilistic processes. *Information and Computation*, 154(2):93–148, November 1999.

35. X. Du, S.A. Smolka, and R. Cleaveland. Local model checking and protocol analysis. *Software Tools for Technology Transfer*, 2(3):219–241, November 1999.

36. G. Bhat, R. Cleaveland, and G. Luettgen. A practical approach to implementing real-time semantics. *Annals of Software Engineering*, 7:127–155, October 1999. Special issue on real-time software engineering.

37. R. Cleaveland, G. Luettgen, and V. Natarajan. A process algebra with distributed priorities. *Theoretical Computer Science*, 195(2):227–258, March 1998.

38. W. Elseaidy, R. Cleaveland, and J.W. Baugh Jr. Modeling and verifying active structural control systems. *Science of Computer Programming*, 29(1–2):99–122, July 1997.

39. R. Cleaveland and S. Smolka. Strategic directions in concurrency research. *ACM Computing Surveys*, 28(4):607–625, December 1996.

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41. R. Cleaveland. Semantic theories and system design. *ACM Computing Surveys*, 28(4es), December 1996. Article 41, URL `http://www.acm.org/surveys`.

42. R. Cleaveland, G. Luettgen, V. Natarajan, and S. Sims. Modeling and verifying distributed systems using priorities: A case study. *Software Concepts and Tools*, 17(2):50–62, 1996.

43. W. Elseaidy, J.W. Baugh Jr., and R. Cleaveland. Verification of an active control system using temporal process algebra. *Engineering with Computers*, 12:46–61, 1996.

44. U. Celikkan and R. Cleaveland. Generating diagnostic information for behavioral preorders. *Distributed Computing*, 9:61–75, 1995.

45. R. Cleaveland and M.C.B. Hennessy. Testing equivalence as a bisimulation equivalence. *Formal Aspects of Computing*, 5:1–20, 1993.

46. R. Cleaveland, J. Parrow, and B. Steffen. The Concurrency Workbench: A semantics-based tool for the verification of finite-state systems. *ACM Transactions on Programming Languages and Systems*, 15(1):36–72, January 1993.

47. R. Cleaveland and B. Steffen. A linear-time model-checking algorithm for the alternation-free modal mu-calculus. *Formal Methods in System Design*, 2:121–147, 1993.

48. R. Cleaveland. Tableau-based model checking in the propositional mu-calculus. *Acta Informatica*, 27(8):725–747, September 1990.

49. R. Cleaveland and M.C.B. Hennessy. Priorities in process algebra. *Information and Computation*, 87(1/2):58–77, July/August 1990.

50. R. Cleaveland and P. Panangaden. Type theory and concurrency. *International Journal of Parallel Programming*, 17(2):153–206, 1988.

II.D. Published Conference Proceedings (main publishing mechanism in Computer Science)

II.D.1. Refereed Conference Proceedings

51. S. Huang, M. Diep, K. Jang, E. Cherry, F. Fenton, R. Cleaveland, M. Lindvall, R. Mangharam and A. Porter. Towards Automated Comprehension and Alignment of Cardiac Models at the System Invariant Level. In *CSBio '20: Proceedings of the Eleventh International Conference on Computational Systems*, pages 18–28, Bangkok, Thailand, November 2020. ACM Press. DOI: 10.1145/3429210.3429225.

52. S. Huang and R. Cleaveland. Temporal-logic query checking over finite data streams. In M. ter Beek and D. Nickovic, editors, *Formal Methods for Industrial Critical Systems - 25th International Conference, FMICS 2020*, volume 12327 of *Lecture Notes in Computer Science*, pages 252–271, Vienna, Austria, September 2020. Springer. DOI: 10.1007/978-3-030-58298-2_11.

53. J. Ferlez, R. Cleaveland and S. Marcus. Bisimulation in behavioral dynamical systems and generalized synchronization trees. In *57th IEEE Conference on Decision and Control, CDC 2018*, pages 751–758, Miami, Florida, December 2018. IEEE. DOI: 10.1109/CDC.2018.8619607.

54. R. Cleaveland. Programming is modeling. In T. Margaria and B. Steffen, *Leveraging Applications of Formal Methods, Verification and Validation. Modeling - 8th International Symposium, ISoLA 2018*, volume 11244 of *Lecture Notes in Computer Science*, pages 150–161, Limassol, Cyprus, November 2018. Springer. DOI: 10.1007/978-3-030-03418-4_10.

55. C. Schulze, R. Cleaveland and M. Lindvall. Automated specification extraction and analysis with Specstractor. In E. Johnsen and I. Schaefer, editors, *Software Engineering and Formal Methods - 16th International Conference*, volume 10866 of *Lecture Notes in Computer Science*, pages 37–53, Toulouse, France, June 2018. Springer. DOI: 10.1007/978-3-319-92970-5_3.

56. J. Ferlez, R. Cleaveland and S.I. Marcus. Bisimulation and Hennessy-Milner Logic for Generalized Synchronization Trees. In K. Peters and S. Tini, editors, *Combined 24th International Workshop on Expressiveness in Concurrency and 14th Workshop on Structural Operational Semantics, Proceedings*, volume 255 of *Electronic Proceedings in Theoretical Computer Science*, pages 35–50, Berlin, Germany, September 2017. Open Publishing Association. DOI: 10.4204/EPTCS.255.3.

57. S. Huang and R. Cleaveland. Query checking for Linear Temporal Logic. In L. Petrucci, C. Seceleanu and A. Cavalcant, editors, *Critical Systems: Formal Methods and Automated Verification - Joint 22nd International Workshop on Formal Methods for Industrial Critical Systems - and - 17th International Workshop on Automated Verification of Critical Systems, FMICS-AVoCS 2017*, volume 10427 of *Lecture Notes in Computer Science*, pages 34–48, Turin, Italy, September 2017. Springer. DOI: 10.1007/978-3-319-67113-0_3.

58. B. Ramasubramaniam, R. Cleaveland and S.I. Marcus. Opacity for switched linear systems: Notions and characterization. In *56th IEEE Conference on Decision and Control (CDC)*, pages 5310-5315, Sydney, Australia, December 2017. IEEE. DOI: 10.1109/CDC.2017.8264445.

59. B. Ramasubramanian, R. Cleaveland and S.I. Marcus. A framework for opacity in linear systems: Notions and characteriziation. In *2016 American Control Conference (ACC)*, pages 6337–6344, Boston, July 2016. IEEE.

60. Md.A. Islam, G. Byrne, S. Kong, E. Clarke, R. Cleaveland, F. Fenton, R. Grosu, P. Jones and S. Smolka. Bifurcation analysis of cardiac alternans using δ-decidability. In E. Bartocci, P. Lio and N. Paoletti, editors, *Computational Methods in Systems Biology: 14th International*

Conference, CMSB 2016, Cambridge, UK, September 21-23, 2016, Proceedings, pages 132–146, Cambridge, UK, September 2016. Springer International Publishing.

61. B. Ramasubramanian, R. Cleaveland and S.I. Marcus. A framework for decentralized opacity in linear systems. In *2016 54th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, pages 274–280, Monticello, Illinois, September 2016. IEEE.

62. D. Ganesan, M. Lindvall, S. Hafsteinsson, R. Cleaveland, S.L. Strege and W. Moleski. Experience report: Model-based test automation of a concurrent flight software bus. In *2016 IEEE 27th International Symposium on Software Reliability Engineering (ISSRE)*, pages 445–454, Ottawa, Canada, October 2016. IEEE.

63. Z. Daw and R. Cleaveland. An extensible operational semantics for UML activity diagrams. In R. Calinescu and B. Rumpe, editors, *Software Engineering and Formal Methods - 13th International Conference, SEFM 2015, York, UK, September 7-11, 2015. Proceedings*, pages 360–368, York, UK, September 2015. Springer-Verlag.

64. P. Fontana and R. Cleaveland. The power of proofs: New algorithms for timed automata model checking. In A. Legay and M. Bozga, editors, *12th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS 2014)*, volume 8711 of *Lecture Notes in Computer Science*, pages 115–129. Springer Verlag, Florence, Italy, September 2014.

65. C. Schulze, D. Ganesan, M. Lindvall, R. Cleaveland, and D. Goldman. Assessing model-based testing: An empirical study conducted in industry. In *Companion Proceedings of the 36th International Conference on Software Engineering*, pages 135–144, Hyderabad, India, May 2014. ACM.

66. J. Ferlez, R. Cleaveland, and S. Marcus. Generalized synchronization trees. In A. Muscholl, editor, *17th International Conference on Foundations of Software Science and Computation Structures*, volume 8412 of *Lecture Notes in Computer Science*, pages 304–319, Grenoble, France, April 2014. Springer Berlin Heidelberg.

67. A. Ray and R. Cleaveland. An analysis method for medical device security. In *Proceedings of the 2014 Symposium and Bootcamp on the Science of Security*, page 16. ACM, April 2014.

68. Z. Daw, R. Cleaveland, and M. Vetter. Integrating model checking and UML-based model-driven development for embedded systems. *Electronic Communications of the EASST*, 66, 2014. ISSN 1863-2122.

69. Z. Daw, R. Cleaveland, and M. Vetter. Integrating model checking and UML-based model-driven development for embedded systems. In S. Schneider and H. Treharne, editors, *13th International Workshop on Automated Verification of Critical Systems (AVOCS 2013)*, Technical Report CS-13-05, Surrey, England, September 2013. University of Surrey.

70. Z. Daw, M. Vetter, and R. Cleaveland. Formal verification of software-based medical devices considering medical guidelines. In *27th International Conference on Computer Assisted Radiology and Surgery*, Heidelberg, Germany, June 2013.

71. A. Ray and R. Cleaveland. Constructing safety assurance cases for medical devices. In *2013 1st International Workshop on Assurance Cases for Software-Intensive Systems (ASSURE)*, pages 40–45. IEEE, May 2013.

72. P. Fontana and R. Cleaveland. Data structure choices for on-the-fly model checking of real-time systems. In *DIFTS: First International Workshop on Design and Implementation of Formal Tools and Systems*, pages 13–22, Austin, Texas, November 2011.

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74. C. Ackermann, R. Cleaveland, S. Huang, A. Ray, C. Shelton, and E. Latronico. Automatic requirement extraction from test cases. In H. Barringer, Y. Falcone, B. Finkbeiner, K. Havelund, I. Lee, G. Pace, G. Rosu, O. Sokolsky, and N. Tillmann, editors, *First International Conference on Runtime Verification*, volume 6418 of *Lecture Notes in Computer Science*, pages 1–15, St. Julians, Malta, November 2010. Springer-Verlag.

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76. A. Ray, I. Morschhaeuser, C. Ackermann, R. Cleaveland, C. Shelton, and C. Martin. Validating automotive control software using instrumentation-based verification. In *Automated Software Engineering*, pages 15–25, Auckland, New Zealand, November 2009. IEEE Computer Society Press.

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80. R. Cleaveland, S. Smolka, and S. Sims. An instrumentation-based approach to controller model validation. In M. Broy, I. Krueger, and M. Meisinger, editors, *Model-Driven Development of Reliable Automotive Services: Second Automotive Software Workshop*, volume 4922 of *Lecture Notes in Computer Science*, pages 84–97, San Diego, California, March 2006. Springer-Verlag. Post-proceedings ©2008.

81. A. Ray and R. Cleaveland. Executable specifications for real-time distributed systems. In M. Mendler and J. Aguado, editors, *SLA++P 2007*, Electronic Notes in Theoretical Computer Science, Braga, Portugal, March 2007. Elsevier.

82. A. Ray and R. Cleaveland. A software architectural approach to security by design. In *30$^{\text{th}}$ Annual International Computer Software and Applications Conference (COMPSAC'06)*, pages 83–86, Chicago, September 2006. IEEE Computer Society Press. Short papers volume.

83. A. Ray, R. Cleaveland, S. Jiang, and T. Fuhrman. Model based verification and validation of distributed control architectures. In *Convergence 2006 Transportation Electronics Conference*, Detroit, October 2006. Society for Automotive Engineers. Paper #2006-21-0046.

84. E. Stark, R. Cleaveland, and S. Smolka. Probabilistic I/O automata: Theories of two equivalences. In C. Baier and H. Hermanns, editors, *CONCUR 2006*, volume 4137 of *Lecture Notes in Computer Science*, pages 343–357, Bonn, Germany, August 2006. Springer-Verlag.

85. D. Zhang and R. Cleaveland. Fast on-the-fly parametric real-time model checking. In 26^{th} *IEEE Real-Time Systems Symposium (RTSS 2005)*, pages 157–166, Miami Beach, Florida, December 2005. IEEE Computer Society Press.

86. B. Sengupta and R. Cleaveland. Executable requirements specifications using triggered message sequence charts. In D. Chakraborty, editor, 2^{nd} *International Conference on Distributed Computing and Internet Technology (ICDCIT 2005)*, volume 3816 of *Lecture Notes in Computer Science*, pages 482–493, Bhubaneswar, India, December 2005. Springer-Verlag.

87. B. Sengupta and R. Cleaveland. An integrated framework for scenarios and state machines. In J. Romijn, G. Smith, and J. Pol, editors, *Integrated Formal Methods:* 5^{th} *International Conference (IFM 2005)*, volume 3771 of *Lecture Notes in Computer Science*, pages 366–385, Eindhoven, the Netherlands, November / December 2005. Springer-Verlag.

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89. D. Zhang and R. Cleaveland. Fast generic model-checking for data-based systems. In F. Wang, editor, *Formal Techniques for Networked and Distributed Systems (FORTE 2005)*, volume 3731 of *Lecture Notes in Computer Science*, pages 83–97, Taipei, Taiwan, October 2005. Springer-Verlag.

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91. A. Ray, B. Sengupta, and R. Cleaveland. Secure requirements elicitation through triggered message sequence charts. In R. K. Ghosh and Hrushikesha Mohanty, editors, *Distributed Computing and Internet Technology: First International Conference, ICDCIT 2004*, volume 3347 of *Lecture Notes in Computer Science*, pages 273–282, Bhubaneswar, India, December 2004. Springer-Verlag.

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93. E. Stark, R. Cleaveland, and S. Smolka. A process-algebraic language for probabilistic I/O automata. In R. Amadio and D. Lugiez, editors, *CONCUR 2003*, volume 2761 of *Lecture*

Notes in Computer Science, pages 193–207, Marseille, France, September 2003. Springer-Verlag.

94. B. Sengupta and R. Cleaveland. TRIM: A tool for Triggered Message Sequence Charts. In W. Hunt and F. Somenzi, editors, *Computer Aided Verification (CAV 2003)*, volume 2725 of *Lecture Notes in Computer Science*, pages 106–109, Boulder, Colorado, July 2003. Springer-Verlag.

95. B. Sengupta and R. Cleaveland. Towards formal but flexible scenarios. In S. Uchitel, editor, *Proceedings of the Second International Conference on Scenarios and State Machines: Models, Algorithms and Tools*, Portland, Oregon, May 2003. `www.doc.ic.ac.uk/~su2/SCESM/`. Satellite workshop of ICSE'03.

96. A. Ray and R. Cleaveland. Architectural interaction diagrams: AIDs for system modeling. In *International Conference on Software Engineering*, pages 396–407, Portland, Oregon, May 2003. IEEE Computer Society Press.

97. D. Zhang, R. Cleaveland, and E. Stark. The integrated CWB-NC/PIOATool for functional verification and performance analysis of concurrent systems. In H. Garavel and J. Hatcliff, editors, *Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2003)*, volume 2619 of *Lecture Notes in Computer Science*, pages 431–436, Warsaw, Poland, April 2003. Springer-Verlag.

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II.E. Talks

II.E.1. Keynotes

1. "Query Checking for Finite Linear-Time Temporal Logic" keynote address at AAAI Spring Symposium, San Francisco, March 2023.

2. "Back-To-Back, and Back Again" keynote address at Smart Key Technology Forum, Shanghai, China, May 2019.

3. "Prove If You Can, Test If You Cannot" keynote address at 7th Midwest Verification Day, University of Illinois at Urbana Champaign, October 2015.

4. "Approximate Formal Verification using Model-Based Testing" keynote address at 26th International Conference on Computer-Aided Verification, Vienna, Austria, July 2014.

5. "Approximate Formal Verification Using Model-Based Testing" keynote address at 2nd International Workshop on Design and Implementation of Formal Tools and Systems, Portland, Oregon, October 2013.

6. "Instrumentation-Based Verification for Medical-Device Software" keynote address at the Summer Software Symposium, Minneapolis, Minnesota, July 2012.

7. "Model-Based Testing – For Fun and Profit" keynote address at the International Symposium on Software Testing and Analysis (ISSTA), Minneapolis, Minnesota, July 2012.

8. "New Directions in Model-Based Verification and Validation" keynote address at Society of Instrument and Control Engineers Workshop on Plant Modeling, Tokyo, Japan, April 2012.

9. "Automatic Requirement Extraction from Test Cases" keynote address at the Conference on Runtime Verification (RV 2010), St. Julians, Malta, November 2010.

10. "Validating Automotive Control Software using Instrumentation-Based Verification" keynote address at the Conference on Automated Software Engineering (ASE 2009), Auckland, New Zealand, November 2009.

11. "Formal Methods, from Practice to Theory" keynote address at the QUASIMODO Workshop (part of FMWeek 2009), Eindhoven, the Netherlands, November 2009.

12. "Model-Based Verification of Automotive Control Software" keynote address at the Workshop on Formal Methods for Industrial Critical Systems, L'Aquila, Italy, September 2008.

13. "There, and Back Again: Lessons Learned on the Way to the Marketplace" keynote address at the European Joint Symposia on Theory and Practice of Software, Braga, Portugal, March 2007.

14. "Probabilistic Model Checking via the Modal Mu-Calculus" keynote address at the Workshop on Mathematical Foundations of Programming Semantics, Hoboken, New Jersey, April 2000.

15. "A Temporal Process Logic" keynote address at CONCUR '99, Eindhoven, the Netherlands, August 1999.

16. "Probabilistic Model Checking via the Modal Mu-Calculus" keynote address at the Workshop on Probabilistic Methods in Verification, Eindhoven, the Netherlands, August 1999.

17. "A Tool Framework for Verifying Concurrent Systems" keynote address at the Second International Workshop on Applied Formal Methods in System Design, Zagreb, Croatia, June 1997.

18. "Model Checking in the Modal Mu-Calculus" keynote address at the *Workshop on Theory and Practice in Verification*, sponsored by the European Research Consortium in Informatics and Mathematics, Pisa, Italy, December 1992.

II.E.2. Invited Talks

19. "Data Mining Vs. Data 'Mine-ing': AI/ML in Health Care." Invited presentation at NSF Principal Investigator Meeting for Cyber-Physical Systems program, Arlington VA, November 2022.

20. "Query Checking for Finite Linear-Time Temporal Logic." Invited presentation at Technical University of Eindhoven, Eindhoven, the Netherlands, July 2022.

21. "Back-To-Back, and Back Again." Invited presentation in CS Department, Stony Brook University, December 2021.

22. "A Tableau Construction for Finite Linear-Time Temporal Logic." Invited presentation at 3rd International Workshop on Formal Methods and Artificial Intelligence (FMAI), Imperial College, London, April 2021.

23. "Verification and Validation Issues in Machine-Learning and Control." Invited presentation at 2019 PRECISE Lab Industry Day, University of Pennsylvania, Philadelphia PA, November 2019.

24. "Agile Testing and Safety Criticality." Invited presentation at DoD Joint Artificial Intelligence Center, Arlington VA, September 2019.

25. "Scott Smolka and Me." Invited presentation at symposium celebrating 65th birthday of Prof. Scott Smolka of Stony Brook University, Stony Brook NY, August 2019.

26. "Moore's Law, and More?" Invited panel presentation at Workshop Celebrating 25th Anniversary of the International Symposium on Tools and Algorithms for the Construction and Analysis of Systems, Prague, Czech Republic, April 2019.

27. "The Road from Arthur's Seat." Invited presentation at symposium celebrating 60th birthday of Prof. Dr. Bernhard Steffen, of TU-Dortmund, Limassol, Cyprus, November 2018.

28. "Formal Methods Meets Testing" invited presentation at NSF Workshop on Formal Methods for Cyber-Physical Systems, Alexandria, Virginia, November 2017.

29. "Compositional Modeling of Cyber-Physical Systems" invited lightning talk at NSF Cyber-Physical Systems PI meeting, Alexandria, Virginia, November 2017.

30. "Prove If You Can, Test If You Cannot" invited colloquium at Duke University Departmment of Electrical and Computer Engineering, Durham, North Carolina, October 2017.

31. "Formal Methods and Autonomy" invited presentation at Autonomy, Robotics and Cognition Workshop, University of Maryland, College Park, Maryland, October 2017.

32. "Intelligent and Learning Autonomous Systems: Composability and Correctness" invited presentation at kick-off meeting for PERISCOPE MURI project, Cornell University, September 2017.

33. "Bisimulations for Non-Discrete Systems" invited presentation at Workshop on Open Problems in Concurrency Theory, Klosterneuburg, Austria, June 2017.

34. "Process Algebra and Attack Graphs" invited remote presentation to United Technology Research Center, East Hartford, Connecticut, June 2017.

35. "Formal Methods for Cyber-Physical Systems" invited presentation at CyberCardia PI meeting, Philadelphia, Pennsylvania, April 2017.

36. "Model Checking" invited remote presentation given to CyberCardia project, February 2017.

37. "Generalized Synchronization Trees" invited presentation at Computer Science departmental colloquium, Stony Brook University, Stony Brook, New York, December 2016.

38. "Testing Meets Formal Methods" invited presentation at United Technologies Research Center, East Hartford, Connecticut, November 2016.

39. "Prove If You Can, Test If You Cannot" invited presentation at Computer Science departmental colloquium at University of Bamberg, Germany, August 2016.

40. "Formal Methods for Cyber-Physical Systems" invited presentation at Max-Planck Institute for Software Systems, Kaiserslautern, Germany, August 2016.

41. "Prove If You Can, Test If You Cannot" invited address at Cybernet Systems Technology Forum, Taipei Taiwan, May 2015.

42. "Prove If You Can, Test If You Cannot" invited address at Shonan Village Seminar on Integration of Formal Methods and Testing for Model-Based Systems Engineering, Shonan, Japan, December 2014.

43. "Generalized Synchronization Trees" invited address at Matthewfest 2014: Symposium in Honor of Matthew C.B. Hennessy, Lucca, Italy, October 2014.

44. "On-the-fly Model Checking" invited address at EMC 2014: Symposium in Honor of Edmund M. Clarke, Pittsburgh, Pennsylvania, September 2014.

45. "Model Checking for Security" invited tutorial at Maryland Cybersecurity Center symposium, College Park, Maryland, June 2014.

46. "Generalized Synchronization Trees" invited presentation at ExCAPE project meeting (via webex), November 2013.

47. "Approximate Formal Verification using Model-Based Testing" Computer Science departmental colloquium at Caltech, Pasadena, California, October 2013.

48. "Validating Automotive Control Software using Instrumentation-Based Verification" at Johns-Hopkins Applied Physics Laboratory, Laurel, Maryland, July 2013.

49. "Validating Automotive Control Software using Instrumentation-Based Verification" at the University of Waterloo, Waterloo, Ontario, August 2010.

50. "Validating Automotive Control Software using Instrumentation-Based Verification" at the Fraunhofer Institute for Experimental Software Engineering, Kaiserslautern, Germany, June 2010.

51. "Model-Based Verification of Automotive Control Software" at the Technical University of Eindhoven, Eindhoven, the Netherlands, August 2009.

52. "Model-Based Verification of Automotive Control Software" at the State University of New York at Stony Brook, Stony Brook, New York, August 2009.

53. "Model-Based Verification of Automotive Control Software" at Reykjavik University, Reykjavik, Iceland, May 2009.

54. "Model-Based Verification of Automotive Control Software" at the University of Saarland, Saarbruecken, Germany, December 2008.

55. "Model-Based Verification of Embedded Control Software" at PLM Road Map 2008, Plymouth, Michigan, September 2008.

56. "An Instrumentation-Based Approach to Controller Model Validation" at the ARTIST2 Summer School 2008 in Europe, Autrans, France, September 2008.

57. "Model-Based Verification of Embedded Control Software" at Siemens Corporate Research, Princeton, New Jersey, June 2008.

58. "Modeling in Certification: An FAA Experience" at Workshop on Software Certification, Arlington, Virginia, April 2008.

59. "Formal Methods in Control System Design" invited talk at Car Testing Japan 2008, Tokyo, Japan, March 2008.

60. "An Instrumentation-Based Approach to Controller Validation" invited talk at the GM R&D Workshop on Next Generation Design and Verification Methodologies for Distributed Embedded Control Systems, Bangalore, India, January 2007.

61. "Model-Based Validation of Embedded Software" at Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, November 2006.

62. "Does Certification = Verification? Formal Methods and Software Certification" invited talk at CERTSOFT 2006, Hamilton, Ontario, Canada, August 2006.

63. "Model-Based Validation for Embedded Software," invited tutorial at Formal Techniques for Networked and Distributed Systems, Taipei, Taiwan, October 2005.

64. "Model-Based Processes for Embedded System Development," invited presentation at High-Tech Connections 2005, Cambridge, Massachusetts.

65. "Automating Software Validation in Model-Based Development" at the 2004 MATLAB Expo, Tokyo, Japan, December 2004.

66. "Executable Software Architectures Using Architectural Interaction Diagrams" at University of Maryland, College Park, Maryland, October 2004.

67. "Commercial Tool Integration: The Reactis Experience" at the 2004 Monterey Workshop on Software Engineering Tools: Compatibility and Integration, Vienna Austria, October 2004.

68. "Validating Embedded Software Using Reactis" at the Fraunhofer Institute for Experimental Software Engineering, College Park, Maryland, September 2004.

69. "Perspectives on Software V&V: The Story of Reactive Systems" to Japanese MathWorks Automotive Advisory Board, Tokyo, Japan, December 2003.

70. "Automated Software Validation Using Reactis, Simulink and Stateflow" at the 2003 MATLAB Expo, Tokyo, Japan, December 2003.

71. "Validating Embedded Software Using Reactis" at University of York, United Kingdom, July 2003.

72. "Crossing Boundaries, Compositionally" at the Centrum voor Wiskunde en Informatica, Amsterdam, the Netherlands, February 2003.

73. "Understanding Behavior in Software Design Languages: A Compositional Semantics of Statecharts" at University of Málaga, Málaga, Spain, July 2002.

74. "Adventures in Early-Stage Finance at Reactive Systems, Inc." at National Science Foundation SBIR Grantees Workshop, Washington DC, April 2002.

75. "Understanding Behavior in UML: A Compositional Semantics of Statecharts" at DePaul University, October 2001.

76. "A Semantic Theory for Heterogeneous System Design" at DePaul University, October 2001.

77. "Verifying Active Structural Control Systems: A Case Study in Formal Analysis" at Institute for Computer Applications in Science and Engineering, NASA Langley Research Center, Hampton, Virginia, June 1999.

78. "A Tool Framework for Verifying Concurrent Systems" at Indiana University, December 1998.

79. "An Operational Semantics of Temporal Logic" at Indiana University, December 1998.

80. "An Operational Semantics of Temporal Logic" at Institute for Computer Applications in Science and Engineering, NASA Langley Research Center, Hampton, Virginia, September 1998.

81. "Verifying Active Structural Control Systems: A Case Study in Formal Analysis" at Army Research Office Workshop on Software Design Automation for Reactive Systems, Durham, North Carolina, July 1998.

82. "Observational Equivalences for Process Algebras with Priority" at INRIA-Rhône-Alpes, Grenoble, France, April 1998.

83. "A Tool Framework for Verifying Concurrent Systems" at State University of New York at Stony Brook, March 1998.

84. "A Tool Framework for Verifying Concurrent Systems" at the National University of Singapore, July 1997.

85. "A Tool Framework for Verifying Concurrent Systems" at the University of Passau, Germany, June 1997.

86. "A Tool Framework for Verifying Concurrent Systems" at State University of New York at Stony Brook, March 1997.

87. "A Tool Framework for Verifying Concurrent Systems" at Kansas State University, November 1996.

88. "Verifying Active Structural Control Systems: A Case Study in Formal Analysis" at Kansas State University, October 1996.

89. "Verifying Active Structural Control Systems: A Case Study in Formal Analysis" at the University of North Carolina, April 1996.

90. "Verifying Fault-Tolerant Active Structural Control Systems" at AT&T Bell Laboratories, Murray Hill, NJ, October 1995.

91. "Verifying Active Structural Control Systems: A Case Study in Formal Analysis" at University of Maryland at College Park, April 1995.

92. "Verifying Active Structural Control Systems: A Case Study in Formal Analysis" at State University of New York at Stony Brook, March 1995.

93. "Testing-Based Abstractions for Value-Passing Systems" at University of Illinois at Chicago, October 1994.

94. "A Uniform Approach to Real-Time Schedulability Analysis" at Institut National de Recherche en Informatique et en Automatique, Sophia-Antipolis, France, May 1994.

95. "An Operational Framework for Value-Passing Processes" at University of Passau, Germany, February 1994.

96. "Model Checking in the Modal Mu-Calculus" at University of Maryland Computer Science Department, March 1993.

97. "Model Checking in the Modal Mu-Calculus" at Chalmers University of Technology, Gothenburg, Sweden, March 1993.

98. "Model Checking in the Modal Mu-Calculus" at the Swedish Institute of Computer Science, Kista, Sweden, March 1993.

99. "Model Checking in the Modal Mu-Calculus" at Uppsala University, Uppsala, Sweden, March 1993.

100. "Model Checking in the Modal Mu-Calculus" at L'Institut National de Recherche en Informatique et en Automatique, Sophia-Antipolis, France, December 1992.

101. "The Concurrency Workbench" at University of Maryland Computer Science Department, October 1992.

102. "The Concurrency Workbench" at the Naval Research Laboratory, Washington, DC, May 1992.

103. "The Concurrency Workbench" at the University of Southern California Computer Science Department, April 1992.

104. "The Concurrency Workbench" at IBM Research Triangle Park, March 1992.

105. "Computing Behavioral Equivalences" invited tutorial at *CONCUR '91*, Amsterdam, Holland, August 1991.

106. "The Concurrency Workbench" at McMaster University Computer Science Department, Hamilton, Ontario, Canada, March 1991. Part of *Functional Programming, Concurrency and Automated Reasoning* international lecture series.

107. "The Concurrency Workbench" at the University of Pennsylvania Computer Science Department, October 1990.

108. "On Automatically Distinguishing Inequivalent Processes" at University of Aarhus Computer Science Department, Aarhus, Denmark, August 1990.

109. "On Automatically Distinguishing Inequivalent Processes" at Hewlett-Packard European Research Labs, Bristol, England, August 1990.

110. "The Concurrency Workbench" at Carnegie-Mellon University Computer Science Department, April 1989.

111. "The Concurrency Workbench" at Johns-Hopkins University Computer Science Department, March 1989.

112. "Priorities in Process Algebras" at *Third Annual Symposium on Logic in Computer Science*, Edinburgh Scotland, July 1988.

113. "Priorities in Process Algebras" at Cambridge University Computer Science Department, Cambridge, England, June 1988.

II.E.3. Refereed Presentations

114. "Programming is modeling" at 8th International Symposium On Leveraging Applications of Formal Methods, Verification and Validation, Limassol Cyprus, November 2018.

115. "Automated Specification Extraction and Analysis with Specstractor" at 16th International International Conference on Software Engineering and Formal Methods, Toulouse, France, June 2018.

116. "Generalized Synchronization Trees" at 17th International Conference on Foundations of Software Science and Computation Structures, Grenoble, France, April 2014.

117. "Model-Based Design Verification: A Monitor Based Approach" at 2008 Society for Automotive Engineering World Congress, Detroit, Michigan, April 2008.

118. "Model Based Verification and Validation of Distributed Control Architectures" at the 2006 Convergence Transportation Electronics Conference, Detroit, Michigan, October 2006.

119. "An Instrumentation-Based Approach to Controller Model Validation" at the Automotive Software Workshop, San Diego, California, March 2006.

120. "Verification and Validation within Model-Based Design using Reactis" at the 2005 MATLAB Expo, Tokyo, Japan, December 2005.

121. "Fast Generic Model-Checking for Data-Based Systems" at Formal Techniques for Networked and Distributed Systems, Taipei, Taiwan, October 2005.

122. "Distributed Prototyping from Validated Specifications" at the Twelfth IEEE International Workshop on Rapid System Prototyping, Monterey, California, June 2001.

123. "Simulation Revisited" at the Seventh International Conference on Tools and Algorithms for the Construction and Analysis of Systems, Genoa, Italy, April 2001.

124. "A Compositional Approach to Statecharts Semantics" at the Eighth International Symposium on Foundations of Software Engineering, San Diego, California, November 2000.

125. "GCCS: A Graphical Coordination Language for System Specification" at COORDINATION 2000, Limassol, Cyprus, September 2000.

126. "Branching-Time Probabilistic Model Checking" at the Eighth International Workshop on Process Algebra and Performance Modelling, Geneva, Switzerland, July 2000.

127. "Statecharts via Process Algebra" at CONCUR '99, Eindhoven, the Netherlands, August 1999.

128. "Probabilistic Temporal Logics via the Modal Mu-calculus" at the 1999 Conference on Foundations of Software Science and Computation Structures, Amsterdam, the Netherlands, March 1999.

129. "A Tool Framework for Verifying Concurrent Systems" at the 1998 ARO/ONR/ NSF/DARPA Monterey Workshop on Engineering Automation of Computer-Based Systems, Monterey, California, October 1998.

130. "The Concurrency Factory Software Development Environment" at Second International Workshop on Tools and Algorithms for the Construction and Analysis of Systems, Passau, Germany, March 1996.

131. "Mu-Calculus Model Checking via LTL Model Checking" at AT&T/SUNY Stony Brook Workshop on Verification, Stony Brook, NY, November 1995.

132. "An Operational Semantics of Value Passing" at *Second North American Process Algebra Workshop*, Ithaca, New York, August 1993.

133. "On Computing Diagnostic Information for Preorder Checking" at *Third Annual Workshop on Computer-Aided Verification*, Montréal, Canada, June 1992.

134. "Computing Behavioral Relations, Logically" at *Eighteenth International Colloquium on Automata, Languages and Programming*, Madrid, Spain, July 1991.

135. "On Automatically Distinguishing Inequivalent Processes" at *Second Annual Workshop on Computer-Aided Verification*, Piscataway NJ, June 1990.

136. "Implementing the Concurrency Workbench Using Standard ML" at *Standard ML Workshop*, Princeton NJ, June 1990.

137. "When Is 'Partial' Adequate? A Logic-Based Proof Technique Using Partial Specifications" at *Fifth Annual Symposium on Logic in Computer Science*, Philadelphia PA, June 1990.

138. "Testing Equivalence as a Bisimulation Equivalence" at *Workshop on Automatic Verification Methods for Finite-State Systems*, Grenoble France, June 1989.

II.E.5. Refereed Posters

1. Zamira Daw, John Mangino and Rance Cleaveland. "UML-VT: A Formal Verification Environment for UML Activity Diagrams." In MODELS 2015 conference, Ottawa, Canada, October 2015.

II.E.7. Non-Refereed Presentations

Numbering below continues from presentations listing above.

139. "Intelligent and Learning Autonomous Systems: Composability and Correctness" (with J. Baras) at ONR Science of Autonomy PI meeting, Arlington Virginia, August 2020.

140. "Composed Control: Towards a Framework for Compositional Modeling of Hybrid Systems" at ONR Science of Autonomy PI meeting, Arlington Virginia, August 2019.

141. "Agile Processes and Methods for Safe, Assured, Robust, Verifiable and Trustworthy Autonomy: Panel Statement" at ONR Science of Autonomy PI meeting, Arlington Virginia, August 2019.

142. "Model-based Specification Mining" to Honda Research, College Park, Maryland, July 2016.

143. "Model-Based Testing" at NASA Goddard Space Flight Center, Code 580, Greenbelt, Maryland, November 2013.

144. "Model-Based Testing Research at Fraunhofer" to Agilent, College Park, Maryland, April 2013.

145. "Analyzing Consistency and Completeness of Requirements: A Model-Based Approach" at 10th Software Certification Consortium Workshop, Food and Drug Administration, Silver Spring, Maryland, January 2013.

146. "Generalized Synchronization Trees" at CMACS PI meeting, Stony Brook, New York, October 2012.

147. "Model-Based Testing – For Fun and Profit" at the CMACS / ARiSE Workshop, Austrian Embassy, Washington DC, September 2012.

148. "Security as an Issue for Medical-Device Software" at Software Certification Consortium meeting, Annapolis, Maryland, May 2012.

149. "Verifying Embedded Control Software" at Siemens-UMD Transportation Workshop, College Park, Maryland, May 2012.

150. "New Directions in Model-Based Verification and Validation" at Nissan Technical Center, Atsugi, Japan, April 2012.

151. "New Directions in Model-Based Verification and Validation" at DENSO Research and Development, Kariya, Japan, April 2012.

152. "New Directions in Model-Based Verification and Validation" at Toyota Technical Center, Higashifuji, Japan, April 2012.

153. "Making Medical Device Software Safe" at Fraunhofer Gesellschaft Netzwert 2011, Munich, Germany, November 2011.

154. "Software Testing / Validation" at Center for the Modeling and Analysis of Complex Systems (CMACS) industrial workshop, Carnegie Mellon University, Pittsburgh, Pennsylvania, October 2011.

155. "Generalized Synchronization Trees" at Center for the Modeling and Analysis of Complex Systems PI meeting, September, 2011, Carnegie-Mellon University, Pittsburgh, Pennsylvania, September 2011.

156. "Formal Methods: Past, Present, Future" at Division of Software Engineering and Systems Assurance, Center for Systems and Software Engineering, Office of the Secretary of Defense, Arlington, Virginia, February 2008.

157. "An Instrumentation-Based Approach to Controller Validation" at Dagstuhl Workshop on Model-Based Engineering of Embedded Real-Time Systems, Dagstuhl, Germany, November 2007.

158. "Does Certification = Verification? Formal Methods and Software Certification" at Workshop on Software Certification, Arlington, Virginia, August 2007.

159. "Model-Based Validation of Embedded Control Software" at Software Engineering Consortium meeting, Raleigh, North Carolina, May 2007.

160. "Model Verification Using Reactis Validator" at General Motors Research and Development Center, Warren, Michigan, November 2003.

161. "Model Verification Using Reactis Validator" at Delphi Technical Research Center, Brighton, Michigan, November 2003.

162. "Observational Equivalences for Process Algebras with Priority" at IFIP Working Group 2.2 meeting, Shelter Island, New York, June 1998.

163. "Building Better Büchi Automata: An Operational Semantics of Temporal Logic" at the meeting of IFIP Working Group 2.2, Graz, Austria, September 1997.

164. "Divergence and Fair Testing" at IFIP Working Group 2.2 meeting, Amsterdam, June 1995.

165. "Model Checking in the Modal Mu-Calculus" at Dagstuhl Workshop on Algorithms in Automata Theory, Dagstuhl, Germany, February 1994.

166. "Practical Approaches to Proving Systems Correct" at Alcatel Network Systems, Raleigh, NC, June 1993.

II.E.9. Non-Refereed Posters

1. "Modal Logic and Bisimulation for Generalized Synchronization Trees" at NSF Cyber-Physical Systems Program Annual PI meeting, Alexandria VA, November 2017.

2. "Model-based Specification Reconstruction" at NSF Cyber-Physical Systems Program Annual PI meeting, Alexandria VA, November 2017.

3. "Opacity and Structural Resilience in Cyberphysical Systems" at NSF Cyber-Physical Systems Program Annual PI meeting, Alexandria VA, November 2017.

4. "Opacity for Linear Systems" at NSF Cyber-Physical Systems Program Annual PI meeting, Arlington VA, November 2016.

5. "Generalized Synchronization Trees" at NSF Cyber-Physical Systems Program Annual PI meeting, Arlington VA, November 2015.

6. "Formal Verification of Safety-Critical Systems using UML" at UMD Institute for Systems Research 30th Anniversary Meeting, May 2015.

7. "Generalized Synchronization Trees" at UMD Institute for Systems Research 30th Anniversary Meeting, May 2015.

8. "Compositional Approaches to Modeling Cyber-Physical Systems" at NSF Cyber-Physical Systems Program Annual PI meeting, Arlington VA, November 2014.

9. "CMACS: Computational Modeling and Analysis of Complex Systems" at NSF Expeditions in Computing PI meeting, Arlington VA, May 2013.

10. "Algebraic Approach for the Composition of Hybrid Systems" at Computational Modeling and Analysis of Complex Systems Expeditions in Computing Project PI meeting, November 2011.

11. "Model-Based Analysis of Embedded Systems" at UMD Institute for Systems Research 25th Anniversary meeting, College Park, November 2010.

II.G. Book Reviews, Notes, and Other Contributions

II.G. 3. Notes

Numbering below continues from publications listing above.

161. R. Cleaveland. Alternative approaches to symbolic verification: An STTT special section. *Software Tools for Technology Transfer*, 3(3):247–249, August 2001.

162. R. Cleaveland. Pragmatics of model checking: An STTT special section. *Software Tools for Technology Transfer*, 2(3):208–218, November 1999.

163. R. Cleaveland, T. Magaria, and B. Steffen. Editorial. *Software Tools for Technology Transfer*, 1(1+2):1–5, December 1997.

II.H. Completed Creative Works

II.H.8. Software and Applications

1. Reactis®. One of chief designers and implementors of this tool, which provides automated testing and validation support for Simulink® / Stateflow® models of embedded software. Software is being distributed by Reactive Systems, Inc.

2. The Concurrency Workbench. One of chief designers and implementors of this tool, which supports a variety of different automatic techniques for verifying finite-state concurrent systems. Software has been acquired by, and used at, numerous sites around the world.

3. PAC. With group at INRIA in Sophia-Antipolis, France, designed and built a front-end generator, the Process Algebra Compiler, for the Concurrency Workbench. All Workbench front ends are now built using this tool.

4. The Concurrency Factory. With group at SUNY-Stony Brook, am building C++/X-based design and verification tool for concurrent systems. Prototype has been completed.

5. VTVIEW/VTSIM. One of chief designers of these systems, which support the graphical editing and simulation of structured networks of communicating finite-state processes. Tools are being incorporated into Concurrency Factory (see below).

6. GDR. One of chief designers of this system, an X-based graph algorithm animation tool. Tool has been used for instructional purposes at N.C. State University in discrete math and automata theory classes.

II.J. Sponsored Research

II.J.1. Grants

1. Office of Naval Research. Proposal title: "Intelligent and Learning Autonomous Systems: Composability and Correctness." Fellow PIs: Yiannis Aloimonos (University of Maryland), John Baras (University of Maryland). Duration: 9/1/2017–8/31/2023. Amount: $3,749,983.

2. National Science Foundation. Proposal title: "Compositional, Approximate and Quantitative Reasoning for Medical Cyberphysical Systems." Fellow PIs: Elizabeth Cherry (Rochester Institute of Technology), Ed Clarke (CMU), Sanjay Dixit (UPenn), Sicun Gao (CMU), James Glimm (SUNY Stony Brook), Richard Gray (Food and Drug Administration), Flavio Fenton (Georgia Tech), Radu Grosu (Technical University of Vienna), Rahul Mangharam (UPenn), Arnab Ray (Fraunhofer), Scott Smolka (SUNY Stony Brook). Duration: May 2015–April 2020. Amount: $450,000 (UMD contract; $5,100,000 total).

3. National Science Foundation. Proposal title: "CPS: Breakthrough: Compositional Modeling of Cyberphysical Systems." Co-PI: Steve Marcus (UMD). Duration: September 2014–August 2018. Amount: $500,000.

4. National Science Foundation. Proposal title: "RECOVERY: Collaborative Research: Next-Generation Model Checking and Abstract Interpretation with a Focus on Embedded Control and Systems Biology." Fellow PIs: Ed Clarke (CMU), Patrick Cousot (NYU), James Fader (U. Pittsburgh), Flavio Fenton (Cornell), Robert Gilmour (Cornell), Jim Glimm (SUNY Stony Brook), Nancy Griffeth (CUNY), Radu Grosu (SUNY Stony Brook), Klaus Havelund (NASA JPL), Gerard Holzmann (NASA JPL), Chris Langmead (CMU), Bruce Krogh (CMU), Steve Marcus (UMD), Bud Mishra (NYU and Cold Spring Harbor Laboratory), Andre Platzer (CMU), Amir Pnueli (NYU), Scott Smolka (SUNY Stony Brook), Tongtong Wu (UMD). Duration: September 2009–August 2015. Amount: $1,848,083 (UMD contract; $10,000,000 total).

5. Defense Advanced Research Projects Agency. Proposal title: "AESOP: Adaptive Environmental for Supercompiling for Optimized Parallellism." Fellow PIs: David August (Princeton U. and Parakinetics), Rajeev Burua (UMD), Alan Sussman (UMD), Scott Mahlke (U. Michigan and Parakinetics), Jothy Rosenberg (BAE Systems), Greg Sullivan (BAE Systems). Duration: March 2009–February 2013. Amount: $2,535,001 (UMD subcontract).

6. Fraunhofer USA Center for Experimental Software Engineering. Proposal title: "Fraunhofer Research Student Assistantships." Duration: January 2009–December 2015. Amount: $452,812.

7. National Science Foundation. Proposal title: "Verification of Open-Loop Embedded Control Systems." Duration: August 2008–July 2011. Amount: $350,000.

8. National Science Foundation. Proposal title: "Formal Approaches to Verifying Medical Device Software." Fellow PI: Arnab Ray. Duration: March 2008–February 2009. Amount: $55,000.

9. Office of Naval Research (Small Business Innovation Research). Proposal title: "A Software Hub for High Assurance Model-Driven Development and Analysis." Fellow PI: Steve Sims. Duration: October 2007–September 2009. Amount: $375,000.

10. Fraunhofer USA Center for Experimental Software Engineering. Proposal title: "Fraunhofer Research Student Assistantships." Duration: August 2006–August 2008. Amount: $180,248.

11. Office of Naval Research (Small Business Innovation Research). Proposal title: "A Software Hub for High Assurance Model-Driven Development and Analysis." Fellow PI: Steve Sims. Duration: August 2006–January 2007. Amount: $100,000.

12. Army Research Office. Proposal title: "Advanced Formal Methods for Reliable Systems Engineering." Fellow PIs: Scott Smolka, Eugene Stark. Duration: February 2001–January 2005. Amount: $408,000.

13. Army Research Office. Proposal title: "An Integrated Environment for Control Software Engineering." Fellow PIs: Scott Smolka, Eugene Stark. Duration: November 2000–October 2004. Amount: $365,000.

14. National Science Foundation. Proposal title: "Heterogeneous Specification Formalisms for Reactive Systems." Duration: May 2000–April 2005. Amount: $325,000.

15. National Science Foundation. Proposal title: "Automated Analysis of Probabilistic Open Systems" Co-PI: Purushothaman Iyer Duration: May 2001–May 2003 Amount: $210,000.

16. National Science Foundation (Small Business Innovation Research). "Advanced Formal Techniques for Dependable Reactive Systems." Fellow PIs: Steve Sims, Scott Smolka. Duration: March 2001–March 2003. Amount: $499,890.

17. National Science Foundation (Small Business Innovation Research). "Advanced Formal Techniques for Dependable Reactive Systems." Fellow PIs: Steve Sims, Scott Smolka. Duration: January 2000–June 2000. Amount: $99,726.

18. National Science Foundation. Proposal title: "Specification Formalisms for Component-Based Concurrent Systems." Duration: July 1998–June 2001. Amount: $148,000.

19. Army Research Office. Proposal title: "Abstraction-Based Approaches to Correct Reactive Software." Co-PI: S. Purushothaman Iyer. Duration: July 1998–June 2001. Amount: $270,000.

20. DARPA. Proposal Title: "GIANT: Global Intrusion Assessment Through Distributed Decision Making" Co-PI: Felix Wu. Duration: May 1998–November 1999. Amount: $1,022,402.

21. National Science Foundation. Proposal title: "Verification Tools for Net-based Programming." NSF Postdoctoral Researcher Award. Duration: April 1998–April 2000. Amount: $66,000.

22. National Science Foundation. Proposal title: "Development and Implementation of Heterogeneous Verification Methods for Distributed Systems." International collaboration with University of Passau, Germany. Duration: April 1997–March 1999. Amount: $16,395.

23. DARPA. Proposal title: "Scalable Intrusion Detection for Network Infrastructure." Co-PI: Felix Wu. Duration: September 1996–September 1999. Amount: $189,527.

24. National Science Foundation. Proposal title: "Practical Techniques for the Design, Specification, Verification, and Implementation of Concurrent Systems." Fellow PIs: Scott Smolka and Philip Lewis, SUNY–Stony Brook. Duration: February 1996–January 1999. Amount: $309,000.

25. Air Force Office of Scientific Research. Proposal title: "Advanced Formal Methods for Reliable Critical Systems Software." Fellow PIs: Insup Lee, University of Pennsylvania, and Scott Smolka, SUNY–Stony Brook. Duration: August 1995–August 1998. Amount: $1,220,000.

26. National Science Foundation. Proposal title: "Analysis and Verification of Concurrent Systems" (equipment grant). Fellow PIs: S. Purushothaman Iyer, K.C. Tai, Mladen Vouk. Duration: May 1995–April 1996. Amount: $37,083.

27. National Science Foundation. Proposal title: "Methodologies for the Automatic Verification of Concurrent Systems." Duration: September 1994–August 1997. Amount: $165,632.

28. National Science Foundation National Young Investigator Award. Duration: August 1992–July 1997. Amount: $212,500.

29. Office of Naval Research Young Investigator Award. Duration: June 1992–October 1996. Amount: $375,000.

30. National Science Foundation. Proposal title: "Automated Generation of Verification Tools." International collaboration with INRIA-Sophia Antipolis, France. Duration: June 1992–April 1996. Amount: $22,235.

31. National Science Foundation. Proposal title: "The Concurrency Factory—Practical Tools for the Automated Verification of Concurrent Systems." Fellow PIs: Scott Smolka and Philip Lewis, SUNY–Stony Brook. Duration: March 1992—February 1996. Amount: $523,064.

32. National Science Foundation. Proposal title: "CONCUR '92—Third International Conference on Concurrency Theory." Co-PI: Scott Smolka, SUNY–Stony Brook. Duration: February 1992–December 1992. Amount: $3,000.

33. Joint National Science Foundation/DARPA Initiative on Formal Methods in Software Engineering. Proposal title: "Methodologies for the Automated Verification of Concurrent Systems." Duration: September 1990–July 1994. Amount: $309,903.

34. National Science Foundation, Research Initiation Award. Proposal title: "Automated Verification of Concurrent Systems." Duration: June 1990–June 1992. Proposal approved; funding included in above grant.

II.J.2. Contracts

Numerous contracts with medical-device companies, government contractors and federal agencies ($2.5m annually), while I was director of Fraunhofer 2005–2014.

II.K. Fellowships, Gifts and Other Funded Research

II.K.2. Gifts

1. Agilent, Inc., Gift. $35,000. April 2013.

II.M. Centers for Research, Scholarship, and Creative Activities

II.M.2. Centers Directed

1. Executive and Scientific Director of Fraunhofer USA Center for Experimental Software Engineering (CESE), 2005–2014. CESE is an applied-research center devoted to improving technologies for developing software. It is part of the Fraunhofer network of applied-research institutes based in Germany, and is affiliated with UMD. I oversaw doubling in revenues and retained earnings of Center, to $4.7m and $1.2m, respectively, and staff growth of 60%.

II.M.3. Symposia Organized (through center)

1. Maryland Software Day 2007.
2. Maryland Software Day 2006.

II.N. Patents

II.N.2. Other

1. U.S. Patent 6,385,765, "Specification and Verification for Concurrent Systems with Graphical and Textual Editors," issued May 7, 2002. Inventors: Rance Cleaveland, Scott Smolka, Phil Lewis, Y.S. Ramakrishna.
2. U.S. Patent 7,644,398, "System and Method for Automatic Test-Case Generation for Software," issued January 5, 2010. Inventors: Rance Cleaveland, Steve Sims, David Hansel.

III. Teaching, Mentoring and Advising

III.A. Courses Taught

Includes courses taught in the last five years.

Semester	Course	Enrollment	Other
F 2023	CMSC 630	15	
S 2018	CMSC 498G	7	Special topics course
S 2018	CMSC 630	22	
F 2017	CMSC 433	86	
S 2017	CMSC 838M	11	Special topics course
S 2017	CMSC 433	84	Overload
F 2016	CMSC 433	85	
S 2016	CMSC 474	40	Co-taught with another faculty member
S 2016	CMSC 433	80	
F 2015	CMSC 433	80	
S 2015	CMSC 630	10	

III.B. Teaching Innovations

III.B.5. Course or Curriculum Development

1. 2018 – Devised new special topics course, CMSC 498G, on formal methods.
2. 2017 – Devised new course, CMSC 838M, on model checking.
3. 2014, 2015 – Revised CMSC 433 content
4. 2010–2012 Led team that overhauled Software Engineering Curriculum for Graduate Certificate in Software Engineering program
5. 2007 – Revised CMSC 630 content

III.B.6. Historical Innovations (10+ years ago)

1. At N.C. State and Stony Brook, completely redeveloped undergraduate programming-language class to emphasize theoretical and practical underpinnings of interpreters.
2. At Stony Brook, revised undergraduate automata-theory class.
3. At Stony Brook, developed graduate-level course on formal methods.

III.C. Advising: Research or Clinical

III.C.1. Undergraduate

1. 2016 Danny Schofield (UMD).
2. 2016 John Mangino (UMD).
3. 2015 John Mangino (UMD).
4. 1998 Alex Groce (N.C. State). Finished PhD at Carnegie-Mellon. Currently Associate Professor of EECS at Oregon State University.
5. 1994 Brad Mott (N.C. State). Subsequently finished PhD at N.C. State. Currently Senior Research Scientist at IntelliMedia Group at N.C. State.

III.C.2. Master's

1. John Locke (adviser) M.S. University of Maryland 2011.
2. Samuel Huang (adviser), M.S. University of Maryland 2010. Current position: Senior engineer, Amazon.
3. Yutao Xie (adviser), M.S. N.C. State University 1999. Current position: Director of Engineering, Microsoft, Beijing, China.

4. Pranav Tiwari (adviser), M.S. N.C. State University 1997. Current position: Chief Technology Officer, Cellworks Research, Bangalore, India.

5. Bradford Mott (adviser), M.S. N.C. State University 1996. Current position: Senior Research Scientist, N.C. State University.

6. Jayesh N. Gada (adviser), M.S. N.C. State University 1995. Current position: Software Engineering Manager, NetApp, Sunnyvale, California.

7. Sunil Jain (adviser), M.S. N.C. State University 1994. Current position: Technical Solution Architect, Cisco Systems, Raleigh, North Carolina.

8. Granville "Randy" Miller (adviser), M.S. N.C. State University 1993. Current position: Architect, U.S. Department of State, Washington, D.C.

9. Zeynep Dayar (adviser), M.S. N.C. State University 1993. Current position: Senior Software Engineer, Zoetis, Research Triangle Park, North Carolina.

10. Roderic Hughes-Oliver (adviser), M.S. N.C. State University 1993. Current position: Account Manager / Delivery Project Executive, IBM, Washington, D.C.

11. Vikas Trehan (adviser), M.S. N.C. State University 1992. Current position: Senior Vice President of Business and Corporate Development, InfoVista, Dallas, Texas.

12. Abhay Raina (committee) M.S. Electrical and Computer Engineering, University of Maryland 2017.

13. Kyle Kelly (committee) M.S. Electrical and Computer Engineering University of Maryland 2017.

14. John McGahagan (committee) M.S. Systems Engineering University of Maryland 2013.

15. David Hansel (committee) M.S. Technical University of Munich (Germany) 2000.

III.C.3. Doctoral

1. Samuel Huang (adviser), Ph.D. University of Maryland, 2020. Current position: Senior engineer, Amazon.

2. James Ferlez (co-adviser), Ph.D. ECE University of Maryland, 2019. Current position: Postdoctoral researcher, University of California at Irvine.

3. Bhaskar Ramasubramanian (co-adviser), Ph.D. ECE University of Maryland 2018. Current position: Assistant Professor, Western Washington University.

4. Christoph Schulze (adviser), Ph.D. University of Maryland 2018. Current position: Senior Research Engineer, Raytheon Technologies, Berkeley, California.

5. Peter Fontana (adviser), Ph.D. University of Maryland 2014. Current position: National Institute of Standards and Technology, Gaithersburg, Maryland.

6. Christopher Ackermann (advisor), Ph.D. University of Maryland 2010. Current position: Senior Technical Staff Member, IBM, Fairfax, Virginia.

7. Dezhuang Zhang (adviser), Ph.D. Stony Brook 2005. Current position: Technical staff, Bloomberg, New York, New York.

8. Arnab Ray (adviser), Ph.D. Stony Brook 2004. Current position: Principal Medical Device Cybersecurity Engineer, Abbott, Sylmar, California.

9. Bikram Sengupta (adviser), Ph.D. Stony Brook 2003. Current position: Chief Technology Officer, Anudip Foundation, Kolkata, India.

10. Li Tan (adviser), Ph.D. Stony Brook 2002. Current position: Assistant Professor, Washington State University, Richland, Washington.

11. James Riely (co-adviser), Ph.D. UNC 1999. Current position: Professor of Computer Science, DePaul University.

12. Girish Bhat (adviser), Ph.D. NCSU 1998. Current position: Director of Engineering, Qualcomm Inc., San Diego, California.

13. Steven Sims (adviser), Ph.D. NCSU 1997. Current position: Chief Executive Officer, Reactive Systems Inc., Cary, North Carolina.

14. Natarajan Vaidhynathan (adviser), Ph.D. NCSU 1996. Current position: Principal Deep Learning Architect, Qualcomm, Research Triangle Park, North Carolina.

15. Ufuk Celikkan (adviser), Ph.D. NCSU 1995. Current position: Assistant Professor of Software Engineering, Izmir University of Economics, Izmir, Turkey.

16. André Fredette (adviser), Ph.D. NCSU 1993. Current position: Senior Principal Software Engineer, Red Hat Inc., Research Triangle Park, North Carolina.

17. Thomas Neele (committee) PhD. Technical University of Eindhoven (The Netherlands) 2020.

18. Yazdan Movahedi (committee) Ph.D. Reliability Engineering University of Maryland 2019.

19. Ishan Banerjee (committee) Ph.D. University of Maryland 2016.

20. Andrey Gorlin (committee) Ph.D Stony Brook University 2016.

21. Ilya Chukhman (committee) Ph.D. ECE University of Maryland 2015.

22. Jeffrey Stuckman (committee) Ph.D. University of Maryland 2015.

23. Kishan Sudusinghe (committee) Ph.D. ECE University of Maryland 2015.

24. Sureyya Tarkan (committee) Ph.D. University of Maryland 2013.

25. Ed Condon (committee) Ph.D. Reliability Engineering University of Maryland 2012.

26. Byungchong Jung (committee) Ph.D Mechanical Engineering University of Maryland 2011.

27. Charles Song (committee) Ph.D University of Maryland 2011.

28. Shomir Wilson (committee) Ph.D. University of Maryland 2011.

29. Ali Taleghani (committee) Ph.D. University of Waterloo (Canada) 2010.

30. Penelope Brooks (committee) Ph.D. University of Maryland 2009.
31. Bas Ploeger (committee) Ph.D. Technical University of Eindhoven (The Netherlands) 2009.
32. Anu Singh (committee) Ph.D. SUNY Stony Brook 2009.
33. Pavlos Papageorgiou (committee) Ph.D University of Maryland 2008.
34. Lijun Zhang (committee) Ph.D. University of Saarland (Germany) 2008.
35. Cyntrica Eaton (committee) Ph.D University of Maryland 2007.
36. Usa Sammapun (committee) Ph.D. University of Pennsylvania 2007.
37. Misa Keinänen (committee) Ph.D. Helsinki University of Technology (Finland) 2006.
38. Qing Xie (committee) Ph.D. University of Maryland 2006.
39. Emilio Tuosto (committee) Ph.D. University of Pisa (Italy) 2003.
40. Tim Willemse (committee) Ph.D. Technical University of Eindhoven (The Netherlands) 2003.
41. Craig Damon (committee) Ph.D. Carnegie-Mellon University 2000.
42. Simone Tini (committee) Ph.D. University of Pisa (Italy) 1999.
43. Gerald Lüttgen (committee) Ph.D. University of Passau (Germany) 1998.
44. Radu Mateescu (committee) Ph.D. L'Institut National Polytechnique de Grenoble (France) 1998.
45. Vasumathi Narayanan (committee) Ph.D. Concordia University (Montréal) 1997.
46. Sergio Campos (committee) Ph.D. Carnegie-Mellon University 1996.
47. Oleg Sokolsky (committee) Ph.D. SUNY Stony Brook 1996.
48. Shipei Zhang (committee) Ph.D. SUNY Stony Brook 1995.
49. Linda Christoff (committee) Ph.D. Uppsala University 1993.
50. Hakan Erdogmus (committee) Ph.D. University of Quebec 1993.
51. Daniel Yankelevich (committee) Ph.D. University of Pisa (Italy) 1993.
52. C.-C. Jou (committee) Ph.D. SUNY Stony Brook 1992.
53. Huajun Qin (committee) Ph.D. SUNY Stony Brook 1991.
54. Di-Wei Huang (committee) Ph.D. University of Maryland (expected 2017).

III.C.4. Post-doctoral

1. 2022–present Liyi Li.
2. 2013–2015 Zamira Daw. Currently Senior Research Scientist, Raytheon Technologies, Berkeley, California.

3. 1999–2000 Shoji Yuen. Currently Professor of Information Engineering, Nagoya University, Japan.
4. 1996–1997 S. Arun-Kumar. Currently Professor of Computer Science, IIT-Delhi, India.
5. 1995–1996 Marco Bernardo. Currently Professor of Computer Science, University of Urbino, Italy.
6. 1993–1994 Daniel Yankelevich. Currently Professor of Computer Science, University Torcuato Di Tella, Argentina and Co-Founder and Director, Pragma Consulting.
7. 1991–1992 Eric Madelaine. Currently Senior Researcher, INRIA Sophia Antipolis, France.

IV. Service and Outreach

IV.A. Editorships, Editorial Boards, and Reviewing Activities

IV.A.1. Editorships

1. Founding co-editor-in-chief *Software Tools for Technology Transfer* journal (Springer-Verlag), 1997–2001

IV.A.2. Editorial Boards

1. *Software Tools for Technology Transfer* (Springer), 1996–.
2. *Science in Computer Programming* (Elsevier), 2018–2020.
3. *Journal of Logical and Algebraic Methods in Programming* (Elsevier), 2013–2020.
4. *Journal of Computing Science and Engineering*, 2007–.
5. *Electronic Notes in Theoretical Computer Science* (Elsevier), 2000–.
6. *Formal Methods in System Design* journal (Kluwer), 1997–2020.
7. *IEEE Transactions on Software Engineering*, 2006–2010.

IV.A.3. Reviewing Activities for Journals and Presses

Numerous reviews of article and book submissions.

IV.A.4. Reviewing Activities for Agencies and Foundations

1. Proposal reviewer, National Science Foundation PIRE program, 2015.
2. Member, Review Panel, National Science Foundation Cyber-Physical Systems Program (Synergy), 2014.
3. Member, Review Panel, National Science Foundation Computing and Communications Foundations Division (SHF Small), 2014.

4. Member, Review Panel, National Science Foundation Computing and Communications Foundations Division (SHF Small), 2013.
5. Member, Review Panel, National Science Foundation Computing and Communications Foundations Division (SHF Testing), 2010.
6. Member, Review Panel, National Science Foundation Computer and Network Systems Division, 2007.
7. Member, Review Panel, National Science Foundation Software Engineering and Languages Program, 2004.
8. Member, Review Panel, National Science Foundation Information Technology Research (Largescale) Preproposals, 2003.
9. Member, Review Panel, National Science Foundation Information Technology Research (Medium-Size), 2001.
10. Invited participant, Strategic Research Directions workshop of Army Research Office, 2001.
11. Member, Review Panel, National Science Foundation National Science Foundation Information Technology Research (Medium-Size) Preproposals, 2001.
12. Member, Review Panel, National Science Foundation CISE Postdoctoral Research Associates in Experimental Computer Science, 2000.
13. Member, Review Panel, National Science Foundation Experimental Software Systems Program, 1997.
14. Member, Review Panel, National Science Foundation Evolutionary Development of Complex Systems Initiative, 1996.
15. Member, Review Panel, 1991 National Science Foundation Research Initiation Awards.
16. Grant proposal reviewer for Army Research Office, Canadian National Science and Engineering Research Council, Netherlands Organization for Scientific Research (NWO), French Institute for Computer Science and Automation (INRIA), Italian Ministry for Universities and Research, Israel Science Foundation, National Science Foundation.

IV.A.5. Reviewing Activities for Conferences

Numerous submission reviews, in addition to service on program committees (listed below).

IV.A.7. Other

Service on following conference and workshop program committees (primary publication vehicles in my field):

1. 2023 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Paris, France, April 2023.

2. 2022 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Munich, Germany, April 2022.

3. 2021 Conference on Tools and Algorithms for the Construction and Analysis of Systems, held virtually, March-April 2021.

4. 2020 International Conference on Formal Methods for Industrial Critical Systems, Vienna Austria.

5. 2020 Conference on Tools and Algorithms for the Construction and Analysis of Systems, to have been held in Dublin, Ireland.

6. 2019 International Conference on Concurrency Theory (CONCUR), Amsterdam, The Netherlands.

7. 2019 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Prague, Czech Republic.

8. 2018 SPIN Symposium, Malaga, Spain.

9. 2018 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Thessaloniki, Greece.

10. 2017 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Uppsala, Sweden.

11. 2016 ACM/IEEE 19th International Conference on Model Driven Engineering Languages and Systems, Saint Malo, France.

12. 2016 ACM SIGBED International Conference on Embedded Software (EMSOFT), Seoul, South Korea.

13. 2016 Conference on Automated Technology for Verification and Analysis, Chiba, Japan.

14. 2016 First International Workshop on Pre- and Post-Deployment Verification Techniques (PrePost), satellite of 12th International Conference on integrated Formal Methods, Reykjavik, Iceland.

15. 2016 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Eindhoven, the Netherlands.

16. 2015 Workshop on Models for Formal Analysis of Real Systems, satellite of 20th International Conference on Logic for Programming, Artificial Intelligence and Reasoning (LPAR 20), Suva, Fiji.

17. 2015 IFIP International Conference on Formal Techniques for Distributed Objects, Components and Systems (FORTE 2015), Grenoble, France.

18. 2015 Conference on Tools and Algorithms for the Construction and Analysis of Systems, London, England.

19. 2015 Conference on Automated Technology for Verification and Analysis, Shanghai, China.

20. 2014 Real-Time Systems Symposium, Rome, Italy.

21. 2014 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Grenoble, France.

22. 2013 International Conference on Model-Driven Engineering Languages and Systems, Miami, Florida.

23. CONCUR 2013, Buenos Aires, Argentina.

24. 2013 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Rome, Italy.

25. 2012 International Conference on Formal Engineering Methods, Kyoto, Japan, November 2012.

26. 2012 NASA Software Engineering Workshop, Heraklion, Greece, October 2012.

27. 2012 International Conference on Software Engineering (SEiP track), Zurich, Switzerland, June 2012.

28. 2012 NASA Formal Methods Symposium, Norfolk, Virginia, April 2012.

29. 2012 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Tallinn, Estonia, March / April 2012.

30. 2011 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Saarbruecken, Germany, March / April 2011.

31. 2011 NASA Formal Methods Symposium, Pasadena, California, April 2011.

32. 2011 IEEE Software Engineering Workshop, Limerick, Ireland, June 2011.

33. 2011 Conference on Hybrid Systems: Computation and Control, Chicago, Illinois, April 2011.

34. 2011 Workshop on Formal Methods for Industrial Critical Systems, Trento, Italy, August 2011.

35. 2010 Conference on Runtime Verification, St. Julians, Malta, November 2010.

36. 2010 International Conference on Software Engineering (industry track), Cape Town, South Africa, May 2010.

37. 2010 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Paphos, Cyprus, March 2010.

38. 2009 International Conference on Formal Engineering Methods, Rio de Janeiro, Brazil, December 2009.

39. 2009 Symposium on Automotive/Avionics Systems Engineering, San Diego, California, October 2009.

40. 2009 Symposium on Logic in Computer Science, Los Angeles, California, August 2009.

41. 2009 International Workshop on the Automation of Software Test, Vancouver, Canada, May 2009.

42. 2009 Conference on Tools and Algorithms for the Construction and Analysis of Systems, York, England, March 2009.

43. 2008 Real-Time Systems Symposium, Barcelona, Spain, December 2008.

44. 2008 International Conference on Software Engineering (Automotive Experience Track), Leipzig, Germany, May 2008.

45. 2008 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Budapest, Hungary, March 2008.

46. 20007 Monterey Workshop on Innovations for Requirements Analysis: From Stakeholders Needs to Formal Designs, Monterey, California, September 2007.

47. 2007 Workshop on Software Engineering for Automotive Systems, Minneapolis, Minnesota, May 2007.

48. 2007 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Braga, Portugal, March 2007.

49. 2007 Hawaii International Conference On System Sciences (Automated Software Testing and Analysis: Techniques, Practices and Tools topic), The Big Island, Hawaii, January 2007.

50. 2006 International Workshop on Software Certification, Hamilton, Ontario, Canada, August 2006.

51. 2006 International Workshop on Formal Methods for Industrial Critical Systems, Bonn, Germany, August 2006.

52. 2006 Annual ACM Conference on Embedded Software, Seoul, South Korea, August 2006.

53. 2006 ACM-IEEE International Conference on Formal Methods and Models for Codesign (MEMOCODE'06), Napa Valley, California, July 2006.

54. 2006 Workshop on Software Engineering for Automotive Systems, Shanghai, China, May 2006.

55. 2006 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Vienna, Austria, March 2006.

56. 2005 Workshop on Software Engineering for Automotive Systems, St. Louis, Missouri.

57. 2005 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Edinburgh, Scotland.

58. 2004 Real-Time Systems Symposium, Lisbon, Portugal.

59. 2004 Workshop on Software Engineering for Automotive Systems, Edinburgh, Scotland.

60. 2004 Workshop on Semantic Foundations of Engineering Design Languages, Barcelona, Spain.

61. 2004 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Barcelona, Spain.

62. 2003 Workshop on Radical Innovations of Software and Systems Engineering in the Future, Venice, Italy.

63. 2003 Workshop on Run-Time Verification, Boulder, Colorado.

64. 2003 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Warsaw, Poland.

65. 2002 Workshop on Real-Time Tools, Copenhagen, Denmark.

66. 2002 Workshop on Run-Time Verification, Copenhagen, Denmark.

67. 2002 Workshop on Formal Methods in Industrial Critical Systems, Málaga, Spain.

68. 2002 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Grenoble, France.

69. 2002 Workshop on Semantic Foundations of Engineering Design Languages, Grenoble, France.

70. 2001 Workshop on Runtime Verification, Paris, France.

71. 2001 Workshop on Expressiveness Issues in Concurrency (EXPRESS 2001), Aalborg, Denmark.

72. 2001 Workshop on Probabilistic Methods in Verification, Aachen, Germany.

73. 2001 Symposium on Logic in Computer Science, Boston, Massachusetts.

74. 2001 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Genoa, Italy.

75. 2000 Real-Time Systems Symposium, Orlando, Florida.

76. 2000 Symposium on Foundations of Software Technology and Theoretical Computer Science, New Delhi, India.

77. 2000 Workshop on Expressiveness Issues in Concurrency (EXPRESS 2000), State College, Pennsylvania.

78. 2000 International Colloquium on Automata, Languages and Programming, Geneva, Switzerland.

79. 2000 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Berlin, Germany.

80. 2000 Symposium on Principles of Programming Languages, Boston, Massachusetts.

81. 1999 Workshop on Process Algebra and Performance Modelling, Zaragoza, Spain.

82. 1999 Symposium on Principles of Distributed Computing, Atlanta, Georgia.

83. 1999 AMAST Workshop on Real-Time and Probabilistic Systems, Bamberg, Germany.

84. 1999 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Amsterdam, the Netherlands.

85. 1998 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Lisbon, Portugal.
86. 1997 Second Joint US/Brazil Workshop on Formal Foundations of Software Systems, New Orleans.
87. 1997 Conference on Computer-Aided Verification, Haifa, Israel.
88. 1997 Workshop on Tools and Algorithms for the Construction and Analysis of Systems, Enschede, the Netherlands.
89. 1996 Asian Computing Science Conference, Singapore.
90. CONCUR '96, Pisa, Italy.
91. 1996 Workshop on Tools and Algorithms for the Construction and Analysis of Systems, Passau, Germany.
92. 1996 Symposium on Principles of Programming Languages, St. Petersburg, Florida.
93. 1996 International Symposium on Software Testing and Analysis, San Diego.
94. CONCUR '95 conference, Philadelphia.
95. 1995 Workshop on Tools and Algorithms for the Construction and Analysis of Systems, Aarhus, Denmark.
96. 1995 Symposium on Principles of Programming Languages, San Francisco.
97. 1994 Conference on Computer-Aided Verification, Palo Alto, California.
98. 1993 North American Process Algebra Workshop, Ithaca, New York.
99. CONCUR '93 conference, Hildesheim, Germany.
100. 1993 Conference on Computer-Aided Verification, Heraklion, Greece.
101. 1993 Symposium on Protocol Specification, Testing and Verification, Liège, Belgium.
102. 1992 North American Process Algebra Workshop, Stony Brook, New York.
103. 1992 Symposium on Logic in Computer Science, Santa Cruz, California.
104. 1991 Workshop on Computer-Aided Verification, Aalborg, Denmark.

IV.B. Committees, Professional & Campus Service

IV.B.1. Campus Service - Department

1. Chair, SE/PL/HCI Field Committee, 2022–2023.
2. Chair, Faculty Hiring Committee, 2017-2018
3. Chair, Professorial Faculty Merit-Pay Committee, 2017-2018.

4. Chair, Middle States Accreditation Committee, 2016–2017.
5. Chair, Software Engineering and Programming Languages Field Committee, 2010–2013.
6. Member, Professorial Faculty Merit-Pay Committee, 2011-2012, 2016-2018.
7. Member, Strategic Planning Committee (Research), 2014–2015.
8. Member, Teaching Evaluation Committee, 2013–2017.
9. Member, APT Committee, 2005–2018, 2022–.
10. Member, Education Committee, 2005–2018.
11. Member, Middle States Accreditation Committee, 2013–2018.
12. Member, Department Council, 2007–2013.
13. Member, Academic Integrity Committee, 2009–2011 (chair, 2010–2011).
14. Member, Graduate Admissions Committee, 2006–2008, 2014–2015.
15. Member, Faculty Hiring Committee, 2011–2012.
16. Member, Professorial Faculty Merit-Pay Committee, 2011–2012.
17. Member, Thesis Awards Committee, 2012, 2015, 2016.

IV.B.2. Campus Service - College

1. Member, College of Computing, Mathematical and Natural Sciences Appointment and Tenure Committee, 2017-2018.
2. Executive and Scientific Director, Fraunhofer USA Center for Experimental Software Engineering (June 2005–December 2014)
    - Doubled revenues from 2005, to $4.7m in 2014.
    - Arranged for Fraunhofer support for UMD PhD students beginning 2006.
    - Oversaw acquisition of new offices, 2009.
    - Oversaw expansion of staff to 25 FTEs, internship program.
    - Spearheaded Fraunhofer overhaul of College of Engineerings Graduate Certificate in Software Engineering.
    - Implemented new emphases in embedded software, testing and verification, and model-based development.
    - Expanded interactions with UMD faculty.
    - Led effort to develop cybersecurity collaboration, strategic partnerships with NASA and industrial organizations
    - Led organizations of joint Fraunhofer / UMD Maryland Software Days, 2006–2007.
3. Initiated, led collaboration between GNSI (one of industrial partners of College) and Fraunhofer, 2008–2013.

4. Worked with Dean to identify employment possibilities at Fraunhofer for trailing spouses, 2006 and 2010.

IV.B.3. Campus Service - University

1. Campus Senator, 2015–2018, 2022–.
2. Chair, University of Maryland Institute for Advanced Computing Studies Self-Study Committee, 2022.
3. Chair, Institute for Systems Research Faculty Assembly, 2015–2016.
4. Participant in Siemens 360 partner meetings, 2012.
5. With Mike Ball in business school, organized workshop on transportation collaboration opportunities with Siemens, 2012.

IV.B.5. Campus Service - Other

1. Chair, Institute for Systems Research Merit Pay Review Committee, 2013-2014.
2. Member, Institute for Systems Research Review Committee, 2014–2016.
3. Member, Institute for Systems Research Merit Pay Review Committee, 2012-2013, 2017-2018.
4. Leader of campus effort for successful NSF Expeditions in Computing that involved faculty from Colleges of CMNS, Engineering and Public Health.
5. Hosted visit of Kurt Beck, Minister-President (equivalent to state governor) of Rheinland-Pfalz state in Germany, 2005.

IV.B.7. Leadership Roles in Meetings and Conferences

1. Co-Founder, member of steering committee for international research conference Tools and Algorithms for the Construction and Analysis of Systems, 1995–.
2. Co-chairman, 2002 Workshop on Formal Methods in Industrial Critical Systems, Málaga, Spain.
3. Chairman, Program Committee, 1999 Conference on Tools and Algorithms for the Construction and Analysis of Systems, Amsterdam, the Netherlands.
4. Member, Steering Committee, European Joint Conferences on Theory and Practice of Software, 1998–1999.
5. Co-organizer, 1998 IFIP Working Conference on Programming Concepts and Methods, Shelter Island, New York.
6. Co-organizer, 1997 DARPA-ITO Workshop on Software-Enabled Control, Atlanta, Georgia.
7. Co-chairman, 1997 Workshop on Automated Analysis of Software, Paris, France.
8. Chairman, Program Committee, 1992 CONCUR conference, Stony Brook, New York.

IV.B.8. Other Non-University Committees, Memberships, Panels, etc.

1. Invited participant, NITRD Workshop on Research on Transportation Cyber-Physical Systems: Automotive, Aviation, and Rail, Tysons Corner, Virginia, 2008.
2. Invited participant, NITRD Workshop on High-Confidence Automotive Cyber-Physical Systems, Troy, Michigan, 2006.
3. Invited participant, NITRD Workshop on High-Confidence Medical Device Software and Systems, University of Pennsylvania, 2005.
4. Invited participant, NITRD High-Confidence Medical Device Software and Systems planning meeting, Arlington VA, 2004.
5. Invited participant, Strategic Research Directions workshop of Army Research Office, 2001.
6. Invited participant, Second Joint Brazilian / NSF Workshop on Formal Foundations of Software Systems, New Orleans, 1997.
7. Invited participant, First Joint Brazilian / NSF Workshop on Formal Foundations of Software Systems, Rio de Janeiro, Brazil, 1997.
8. Member, Formal Methods and Concurrency working groups, 1996 ACM Workshop on Strategic Directions in Computing Research.

IV.C. External Service and Consulting

IV.C.1. Community Engagements, Local, State, National, International

1. Division Director of Computing and Communication Foundations, National Science Foundation, 2018–2022.
2. Chair, Math Advisory Committee, Arlington (VA) Public Schools, 2006–2012.
3. Youth League Basketball Coach, 2008–2015.

IV.C.2. International Activities

1. Member, Scientific Advisory Panel, Canadian Network for the Engineering of Complex Software-Intensive Systems for Automotive Systems, 2010–2015.
2. Member, External Review Team, INRIA Research Direction, Paris, France, 2007.
3. Member, External Review Team, INRIA Research Direction, Paris, France, 2003.

IV.C.3. Corporate and Other Board Memberships

1. Chairman of the Board, Reactive Systems Inc., 1999–.

IV.C.4. Entrepreneurial Activities

1. Co-Founder, Reactive Systems Inc.

IV.E. Media Contributions

IV.E.2. TV

1. Interviewed on-air by WUSA-TV Channel 9 reporter about electromagnetic radiation and its effects on automobiles, 2010.

IV.E.5. Print Media

1. Interviewed for *Baltimore Sun* news story on medical-device safety, 2007.

V. Awards, Honors and Recognition

V.A. Research Fellowships, Prizes and Awards

1. 2022 Fellow of IEEE.
2. 2021 Senior Member of IEEE.
3. 2008 Excellence in Oral Presentation Award, Society for Automotive Engineers.
4. 1998 Elected Member of IFIP Working Group 2.2.
5. 1994 Alcoa Foundation Engineering Research Achievement Award.
6. 1992 National Science Foundation National Young Investigator Award.
7. 1992 Office of Naval Research Young Investigator Award.

V.2 Teaching Awards

2011 Computer Science Excellence in Teaching Award, University of Maryland

1991 Shell Undergraduate Teaching Award, North Carolina State University