**Carl Tropper**
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**Personal**

American citizen, Canadian landed immigrant
Married, 3 children

**Education**

McGill University, Montreal, Canada - B.Sc. 1968
Polytechnic Institute of New York - Ph.D. (Mathematics) 1973.

**Academic and Industrial Experience**

*McGill University, School of Computer Science, Montreal, Canada 1984-present*

My major research interest is in distributed discrete-event simulation and parallel computing in general. I have worked in the area of distributed discrete event simulation since its inception as a research field and have developed algorithms belonging to both of the major classes of synchronization algorithms for distributed simulation, the conservative and optimistic classes of algorithm. I have also developed load-balancing algorithms for both of these classes of algorithm.

For a number of years I have concentrated on the distributed simulation of gate level circuitry. Simulation plays a central role in circuit design. The use of distributed simulation can provide a cost-effective way to simulate larger circuits then can be done on single processors. The cost-effectiveness of this approach is a result of being able to make use of workstations connected by a local area network (e.g. ethernet). My group has developed a simulation environment for gate level circuit simulation of circuits described in Verilog making use of an optimistic simulation engine.

Previously, I did research in the performance of computer networks. This was an outgrowth of my industrial experience (described below) and led to the research in the performance evaluation of computer networks which I did for the first several years after arriving at McGill. .

*California Institute of Technology, Pasadena, California*
*Sabbatical year 1991-92*
A sabbatical was spent at the Jet Propulsion Laboratories of the California Institute of Technology, working on a project whose goal it was to verify the sequence of commands sent to a spacecraft. I developed a synchronization mechanism to execute the verification model on a distributed memory machine ("Parallel Simulation of Communicating Finite State Machines") They can easily be modified to take advantage of a shared memory environment. The algorithms are based on a conservative synchronization strategy, and were implemented on an Intel i860 parallel computer.

*Bolt, Beranek and Newman, 1982-84, Cambridge, Mass, Senior Scientist*

As part of a network design and performance group, I worked on a number of projects whose principle orientation was to develop new routing algorithms and flow control strategies for the ARPANET. The ARPANET was the research predecessor of the INTERNET and was both esigned and implemented by BBN. .

I also participated in the Packet Radio project. Again, my orientation on this project was towards the development of routing and flow control algorithms.

*MITRE Corporation, Bedford, Mass.,1978-82, Member, Technical Staff*

As a member of the local area networking group at MITRE, I participated in design studies for the Air Force and other DOD clients. The local area networking group at MITRE was one the first developers of Ethernet technology, pioneering a broadband approach.

While at MITRE, I wrote a book on the performance of local area networks, /it Local Computer Network Technologies. It contained a description of the (current) LAN access protocols, and compared their performance via both queuing and simulation models.

*Boeing Computer Services, McLean, Virginia, 1976-78 Senior Analyst*

I participated in the development of a combined arms simulation model for the Air Force.

*Rutgers University, 1973-76, Department of Mathematics*

I taught undergraduate mathematics courses. During my tenure at Rutgers, I also worked for *Data Systems Analysts*, a company which developed real-time software for airplane flight controllers.

## Journal Publications

1. "On the Scalability and Dynamic Load Balancing of Time Warp", with Sina Meraji and Wei Zhang, *IEEE Trans. Computer Aided Design of Integrated Circuits and Systems (TCAD)*, accepted for publication

2. A Design Driven Partitioning Algorithm, Lijun Li and Carl Tropper,*Trans. of the Society of Computer Simulation (SCS)*, volume 84, issue 4, April 2009, pp. 257-270

3. "Towards Large Scale Optimistic VLSI Simulation", with Qing Xu, *Simulation Modeling Practice and Theory (SIMPRA,journal of Eurosim)*

4. "Towards Distributed Verilog Simulation", with Lijun Li and Hai Huang, *International Journal of Simulation:Systems, Science and Technology (IJS3T)*, vol 4, nos 3-4, September 2003, pp. 44-55.

5. "Parallel and Discrete Event Simulation-Applications", *Journal of Parallel and Distributed Computing, special issue on parallel and distributed discrete-event simulation*, March2002, p.327-335.

6. "Parallel and Distributed Simulation", *Parallel and Distributed Computing Practices-special issue on distributed simulation*, July 2002

7. "On Rolling back and Checkpointing in Time Warp", with H. Avril, *IEEE Transactions of Parallel and Distributed Systems*, vol. 12, no. 11, November 2001, pp. 1105-1122.

8. "Flow Control and Dynamic Load Balancing in Time Warp", with M. Choe, *Transactions of the Society for Computer Simulation*, vol.18, no. 1, March 2001, pp. 9-24.

9. "Local versus Global Lookahead in Conservative Parallel Simulation", with A. Boukerche, *Parallel Computing*,North-Holland, Elsevier, vol.27,no.8, pp.1033-1055

10. "On the Parallel Simulation of Fixed Channel Allocation Algorithms", with P. Alleyne,*Wireless Networks*,vol.5,pp.209-218,Baltzer Science Science Publishers, the Netherlands

11. "Scalable Clustered Time Warp and Logic Simulation", with H. Avril, the *VLSI Design,Special Issue on Current Advances in Parallel Logic Simulation*, Gordon-Breach, vol9,no3,pp291-313, 1999.

12. "A Distributed Graph Algorithm for the Detection of Local Cycles and Knots", with A. Boukerche, *IEEE Transactions on Parallel and Distributed Systems*, August, 1998, pp. 748-758

13. "Parallel Simulation on the Hypercube Multiprocessor", with A. Boukerche, *Distributed Computing*, Springer Verlag, vol.8, no.4, pp.181-191, 1995

14. "On Load Balancing and Process Migration in Time Warp", with D. Glazer, *IEEE Transactions on Parallel and Distributed Computing*, March 1993,pp 318-328

15. "Optimal Packet Size in packet-Switching Networks", with C. Evequoz, *Computer Networks and ISDN Systems*, vol. 25, 1992, pp.387-404

16. "Approximate Analysis of Bulk Closed Queuing Networks", with C. Evequoz, *INFOR*,Canadian Operational Research Society, Feb.1992

17. "The Distributed Simulation of Clustered Processes", with B. Groselj, *Distributed Computing* Springer-Verlag, 1991, pp. 111-121

18. "A New Metric for Dynamic Routing", with D. Glazer,*IEEE Transactions on Communications*, vol. 38, issue 3,March 1990. pp.360-367.

19. "On Buffer Allocation in Transport Protocols", with A. Zissopoulos, *Computer Networks and ISDN Systems*, vol. 16, no.5, May 1989, pp. 383-393

20. "On Reassembly Delay in Packet-Switching Networks", C.Evequoz,*Computer Networks and ISDN Systems*,vol.15, no.1 1988, pp.1-25

21. "On Priorities and Performance in Packet-Switching Networks", *Computer Networks and ISDN Systems*, vol 12, no.2, 1987, pp.89-99

22. "Pseudosimulation: An Algorithm for Distributed Simulation with Limited Memory", with B. Groselj,*International Journal of Parallel Programming*, vol15, no5, October 1987, pp.42-82

## Papers in refereed conference proceedings

1. "A Multi-State Q-learning Approach for the Dynamic Load Balancing of Time Warp", Sina Meraji, Carl Tropper, Workshop on Advanced and Distributed Simulation (PADS'10), May 16-May 19, Atlanta, Ga.

2. "On the Scalability and Dynamic Load Balancing of Parallel Verilog Simulation", Sina Meraji, Carl Tropper, 2009 Winter Simulation Conference (WSC), Austin, Texas, December 13-December 16, 2009

3. "Using Genetic Algorithms to Limit the Optimism in Time Warp", Jun Wang, Carl Tropper, 2009 Winter Simulation Conference (WSC), Austin, Texas, December 13-December 16, 2009

4. "A Simulated Annealing Technique for Optimizing Time Warp Simulations" Wei Zheng, Sina Meraji, Carl Tropper, International Conference on Parallel and Distributed Systems (ICPADS'09), December 8-December 11, 2009, Shenzhen, China

5. "On the Scalability of Parallel Verilog Simulation", Sina Meraji, Wei Zheng, Carl Tropper, International Conference on Parallel Processing (ICPP), September 22-September 29, 2009, Vienna, Austria

6. "On Determining how many Computers to Use in a Parallel VLSI Simulation", Qing Xu, Carl Tropper, Workshop on Advanced and Distributed Simulation (PADS 2009), June 22-June 25, 2009, Lake Placid, NYS, USA

7. "Selecting the GVT interval in Time Warp distributed simulation using reinforcement learning" Jun Wang and Carl Tropper, Annual Simulation Symposium 2009), March 2009

8. "A multi-way design driven algorithm for distributed VLSI design" , Lijun Li and Carl Tropper, ICPP, Portland, Oregon, September 2008

9. "Optimizing the Time Warp Protocol with Learning Automata", with Jun Wang, 2007 European Simulation and Modeling Conference, ESM 2007

10. "A Design Driven Partitioning Algorithm for Distributed Verilog Simulation", with Lijun Li,PADS 2007, San Diego, California, pp. 211-219 ,*nominated for best paper*

11. "Optimizing Time Warp Simulation with Reinforcement Learning" , with Jun Wang, 2007 Winter Simulation Conference, Washington, DC

12. "Compiled Code in Distributed Logic Simulation", with Jun Wang, 2006 Winter Simulation Conference, Monterey, California

13. "XTW, a Parallel and Distributed Logic Simulator", with Qing Xu, PADS 2005, pp 181-188, June 2005

14. "Parallel Logic Simulation of Million Gate VLSI Circuits", with L.Zhu,G.Chen, B.Szymanski, T. Zhang, MASCOTS05, Atlanta, Ga., September, 2005.

15. "XTW: A Parallel and Distributed Logic Simulator", with Qing Xu, ASP-DAC2005 (Asian South-Pacific Design Automation Conference), January, 2005.

16. "Nicarus: A Distributed Verilog Compiler", with Jun Wang, 2004 International Conference on Parallel Processing, 3rd workshop for compile and run-time techniques, Montreal, Canada

17. "Event Reconstruction vs Dynamic Checkpointing", with Lijun Li, PADS04, May 2004, pp. 37-44.

18. "Accelerate Simulation on Myrinet Cluster", with Lijun Li, ASTC, Arlington, Va. 2004

19. "Flow Control in Optimistic Simulation", with L. Solomen, 17th European Simulation Multiconference, HP5, Nottingham, England, June, 2003

20. "DVS-An Object Oriented Framework for Distributed Simulation", with Lijun Li, PADS2003, June 10-13,2003, San Diego, California, pp. 173-180

21. "Distributed Simulation of Channel Allocation Algorithms" with O. Cismasu, MASCOTS02, October 12-16, 2002, Ft. Worth, Texas,pp.329-338.

22. "The Dependence List in Time Warp", with Jing lei Zheng, PADS2001, pp. 35-46, Lake Arrowhead, California,*nominated for the best paper award*

23. "Flow Control and Dynamic Load Balancing in Time Warp", with M. Choe, Proc. 33rd Annual Simulation Symposium (SS 2000), 16-20 April, 2000, pp. 219-226.

24. "On Learning Algorithms and Balancing Loads in Time Warp", with M. Choe, PADS99, May2-5, Atlanta, Georgia,pp.101-108.

25. "The Parallel Simulation of Distributed Channel Allocation Algorithms", with Peter Alleyne, Wireless Communications Workshop, MASCOTS98, Montreal, Canada, June 19-27,1998

26. "On Metrics for the Dynamic Load Balancing of Optimistic Simulations", with K.el Khatib, HICSS-32, Proceedings of the 32nd Annual Hawaii International Conference on System Sciences,Hawaii,Track 8, January, 1999

27. "An Efficient GVT Algorithm using Snapshots", with M. Choe, CSMA98, Orlando, Florida, November, 1998

28. "Parallel Simulation of Billiard Balls using Shared Variables", with P MacKenzie,PADS'96(Proc. 10th Workshop on Parallel and Distributed Simulation), Philadelphia, Penn., May 22-24, 1996, pp. 190-195.

29. "The Dynamic Load Balancing of Clustered Time Warp for Logic Simulation",with H. Avril, PADS'96, Philadelphia, Penn., May 22-24, 1996, pp.20-27.

30. "SGTNE: Semi-Global Time of the Next Event Algorithm", with A. Boukerche, PADS'95,Lake Placid, New York State, June, 1995, pp.68-77

31. "Clustered Time Warp and Logic Simulation", with H Avril, PADS'95, Lake Placid, New York State, June, 1995, pp.112-119

32. "A Distributed Algorithm for the Detection of Local Knots and Cycles", with A. Boukerche, Proc. Ninth International Parallel Processing Symposium,25-28 April 1995, Santa Barbara, California, pp.118-127.

33. "Hierarchical Schedulings of the Time of Next Event Heuristic on Distributed Memory Machines", with A. Boukerche, Proc. 28th Annual Simulation Symposium, Phoenix, Arizona, 9-13 April 1995, pp. 155-165.

34. "An Efficient Distributed Cycle/Knot Detection Algorithm", Proc 1993 Canadian Conference on Electrical and Computer Engineering", 14-17 September 1993, pp. 619-622, vol.2

35. "A Static Partitioning and Mapping Algorithm for Conservative Parallel Simulations", with A. Boukerche, PADS94, Edinburgh, Scotland, pp.164-173

36. "Parallel Simulation of Communicating Finite State Machines", with A. Boukerche, PADS93, San Diego, California, May 1993, vol. 23, no.1, pp. 143-151

37. "On the Performance of Time Warp", with N. Krivossidis, International Conference on Parallel Processing, Chicago, Illinois, August, 1992

38. "On Distributed and Pseudosimulation",with C. Cote, PADS92, SCS Simulation Series, vol.24, no.3, pp. 97-107

39. "A Performance Analysis of Distributed Simulation with Clustered Processes", with A. Boukerche, 1991 IEEE Workshop on Parallel and Distributed Computing, SCS vol.23, no.1, pp.112-125

40. "End-to-End Delay of Multiple Packet Messages in Window Flow Controlled Packet-Switched Networks", with C. Evequoz, IEEE INFOCOM, 3-7 June, 1990, pp. 47-54, vol.1.

41. "Local Deadlock Detection for Distributed Simulation", with L. Liu, 1990 PADS, SCS vol. 22, no. 1, pp. 64-70

42. "A Deadlock Resolution Scheme for Distributed Simulation", with B. Groselj, 1989 PADS, Tampa, Florida, SCS vol. 21, no. 2, pp.108-113

43. "The Time-of-Next-Event Algorithm", with B. Groselj, PADS88, San Diego, SCS vol. 19,no.3, pp. 25-30

44. "On Re-Assembly Delay in Packet-Switching Networks", with C. Evequoz, INFOCOM'87

45. "A Congestion Based Dynamic Routing Algorithm", with D. W. Glazer ICC'87

46. "On Congestion Based Dynamic Routing ", with D. Glazer, Telecom '87, Geneva, Switzerland, vol. III.3, pp.377-381

47. "On Priorities in a Packet-Switching Network", 19th Annual Hawaiian Conference on System Science, Honolulu, Hawaii, 1986.

48. "Distributed Simulation Using a Look-Ahead Algorithm," with B. Groselj, ACM Workshop on Distributed Computing, Amsterdam, Holland, 1986

49. "Priorities and Performance in Packet-Switching Networks", IEEE INFOCOM '86, Miami, Fla.

50. "Re-Transmission Protocols for Ethernet", ICC83, Boston, Mass. IEEE.

## Book

*Local Computer Network Technologies*, Academic Press, 1981

The book provided a comprehensive overview of channel access techniques for local area networks which were in existence at the time of its publication. It also discussed their performance as portrayed by both analytic(queueing) and simulation models.

## Technical Reports

1. "Window - A Queuing Model of the ARPANET", BBN Internal Report, July 1984.

2. "On Multipath Routing", BBN Internal Report.

3. "Packet size in the ARPANET", BBN Internal Report.

4. "Computerized Models for the Design and Analysis of Computer-Communications Networks", ESD-TR-79-128, MITRE Corp., Bedford, Mass., May, 1979.

5. "Models of Local Networks", ESD-TR-80-111, MITRE Corp., April 1980.

6. "Software Timing Studies for the Hughes Class 1 JTIDS Terminals", Working Papers 23253, MITRE Corp., March 1981.

7. "Applications of Distributed Database Technology to Tactical C3". Working Paper 23323 (joint with D. Lambert and W. Tracton, MITRE Corp. March 1983

## Invited Talks

1. Polytechnic Institute of NYU, "Computational science", November, 2008

2. Monmouth University, "Distributed VLSI Simulation", March 2005.

3. Polytechnic University of New York, "Distributed Verilog Simulation", December, 2003.

4. Nortel Corporation, Ottawa, Ontario, "Optimistic VLSI discrete event simulation", March, 1999.

5. Nortel Corporation, Ottawa, Ontario, "Optimistic algorithms for circuit simulation", February, 1998.

6. Panasonic Laboratories, Princeton, New Jersey, "Optimistic VLSI Simulation", June, 1996.

7. Lucent Laboratories, New Jersey, "Load balancing in distributed simulation", May 1995.

8. SRI, San Francisco, California. "Distributed simulation", May, 1995.

9. Zycad, San Francisco, California, "Distributed simulation of digital circuits", June, 1993. Zycad was a computer aided design company in Silicon Valley.

10. ISI, Los Angeles, California, "Time of Next Event Algorithm", June 1992. ISI is a distinguished research affiliate of the University of Southern California. The foundation Internet protocol, TCP/IP, was created at ISI.

11. Jet Propulsion Laboratories, Pasadena, California. October, 1991, "Scalable conservative distributed simulation". JPL is a laboratory of both NASA and Caltech, and is responsible for unmanned space probes.

## Professional activities in the research community

## External evaluator for theses and promotions

1. *External evaluator for promotion* for Chris Carrothers, to full professor, in the Department of Computer Science, Rennsalaer Polytechnic Institute, Troy, New York State, USA, 2009

2. *External evaluator for promotion* for Wentong Cai, to full professor, Division of Computer Science, School of Computer Engineering, Nanyang Technological University, Singapore, 2007

3. *External evaluator for promotion* for Georgios Theorodopoulos, to senior lecturer, at the School of Computer Science, University of Birmingham, UK. because of my work in load balancing, 2005

4. *external doctoral thesis reviewer* Doctoral dissertation of Zeng Yi, Nanyang Technological University, Singapore, 2004

5. *doctoral thesis opponent* University of Lapeenranta, Finland. This was a formal (oral) exam in which I served as the sole examiner for the doctoral candidate in front of a general audience at the university.

## Reviewer for research grants

1. *research grant reviewer* Israel Science Foundation, 2005.

2. *research grant reviewer* US National Science Foundation, 2002-3.

3. *research grant reviewer* NSERC, 2009,2010

## Program committees
I have done extensive work with PADS, the premier conference in the field of parallel and distributed simulation, having served on the program committee since 1992, and having served as a technical and general chair for the conference.

1. *Program Committee*, DS-RT 2010

2. *Program Committee*, 3rd International Conference on Simulation Tools and Techniques (Simutools), Torremolinos, Malaga, Spain, March, 2010

3. *General Chair*, 23rd Workshop on the Principles of Advanced and Distributed Simulation (PADS 2010)

4. *Program Chair*, 11th Workshop on Parallel and Distributed Simulation (PADS97), held in Lockenhaus, Austria, June 1997

5. *General Chair*, 9th Workshop on Parallel and Distributed Simulation (PADS95), Lake Placid, New York State, June, 1995

6. *Program Co-Chair*, ACM MSWIM, Conference on the Modelling and Simulation of Mobile Networks, Boston, August, 2000.

7. *Program Committee* for PADS (*Parallel and Distributed Simulation Workshop*), 1992-present. PADS is the premier conference in the area of distributed simulation.

8. *Program Committee* for MASCOTS97 (*Sixth International Symposium on Modeling, Analysis, and Telecommunications*)

**Editorial work**

1. *Editorial board*Transactions of the Society for Computer Simulation, *SCS*

2. *Editorial board, Parallel and Distributed Computing Practices, Nova Science Publishers, New York*

3. *Guest Editor, Journal of Parallel and Distributed Computing (Academic Press), Special Issue on Distributed and Parallel Simulation, March 2002.*

4. *Guest Editor, Parallel and Distributed Computing Practices, Nova Science Publishers), Special Issue on Distributed and Parallel Simulation, July 2002*

**Journal and conference reviews** I have reviewed numerous articles for journals, including IEEE Computer, IEEE Transactions on Communications, ACM Transactions on Modelling and Simulation, Transactions of the Society for Computer Simulation, and the IEEE Transactions on Parallel and Distributed Computing, as well as for simulation, computer network and VLSI conferences