

CURRICULUM VITAE

Donald D. Cowan

PRESENT POSITION: Distinguished Professor Emeritus and Director, Computer Systems Group,
University of Waterloo

DATE and PLACE OF BIRTH: March 11th, 1938, Toronto, Ontario, Canada

MARITAL STATUS: Married, 3 Children

CITIZENSHIP: Canadian

EDUCATION:

B.A.Sc. Engineering Physics, 1960, University of Toronto
M.Sc. Applied Mathematics, 1961, University of Waterloo
Ph.D. Applied Mathematics, 1965, University of Waterloo

CAREER:

1960 - 1962 Research Assistant and Teaching Fellow, University of Waterloo
1962 - 1965 Lecturer, University of Waterloo
1965 - 1967 Assistant Professor, Associate Director of the Computing Centre, University of Waterloo
1966 - 1972 Chairman, Applied Analysis & Computer Science Department, University of Waterloo
1967 - 1975 Associate Professor, Applied Analysis & Computer Science Department, University of Waterloo
1969 - Consultant to the Graduate Program, Pontifical Catholic University of Rio de Janeiro, Brazil
1972 - 1973 Visiting Associate Professor, Computer Science Department, Stanford University
1972 - 1973 Scientist - Xerox Palo Alto Research Centre, Palo Alto, California
1974 - 1982 Co-Director, CIDA/COMBRA Project Co-Director, CIDA/COMBRA Project
1974 - 2003 Director, Waterloo Foundation For The Advancement of Computing (WATFAC)
1974 -78 Associate Dean of Graduate Studies, Faculty of Mathematics, University of Waterloo
1975 - 1996 Professor, Computer Science Department, University of Waterloo
1978 - 79 Visiting Research Scientist, IBM Research Laboratory, Zurich
1979 - Director, Waterloo Mathematics Foundation
1980 - Senior Associate Scientist, Computer Systems Group, University of Waterloo
1980 -1985 President, Waterloo Software Applications Centre Inc.
1980 -1985 Director, Waterloo Software Applications Centre Inc.
1982 -1984 Secretary, WATSOFT Products Inc.
1982 - 1984 Director, WATSOFT Products Inc.
1982 - 1992 Director, WATCOM Group Inc.
1982 -1986 President, WATCOM Seminars
1983 -1989 Director, Ontario Centre for Advanced Manufacturing
1984 - 1992 Director, WATCOM Products Inc.
1986- 1992 Director, Project ARIES
1992- Director, Computer Systems Group
1996 - 1999 Professor Emeritus/Adjunct Professor, Computer Science Department, University of Waterloo
1994 - 2003 Director Education Program for Software Professionals
1999 - Distinguished Professor Emeritus/Adjunct Professor, Computer Science Department, University of Waterloo
2000 - 2004 President and Director Waterloo Mathematics Foundation
2002 - 2005 Distinguished Professor Emeritus/Adjunct Professor, School of Computer Science, University of Waterloo
2003 - Adjunct Professor, Department of Biology, University of Waterloo
2003 - 2008 Adjunct Professor, Faculty of Computer Science, Dalhousie University
2002 - Director, J.W. Graham Information Technology Trust

2005 - Distinguished Professor Emeritus/Adjunct Professor, David R. Cheriton, School of Computer Science, University of Waterloo
2005 - Founding Member of Intelligent Waterloo Committee
2005 – 2011 Chief Technology Officer and Director, Medmanager Interactive Corporation
2007- 2010 President and Director, Waterloo Mathematics Foundation
2005 – 2009 Board Chair and Director, Centre for Community Mapping
2010 – 2014 Trustee Waterloo Mathematics Charitable Trust Foundation
2013 – 2015 Adjunct Professor, Environment and Resource Studies, University of Waterloo
2015 – Canadian Index of Wellbeing (CIW) Research Associate, University of Waterloo
2015 – Member, Water Institute, University of Waterloo
2015 – Member, Centre for Bioengineering and Biotechnology, University of Waterloo
2016 – Adjunct Professor, School of Environment, Resources and Sustainability

Awards

Major Awards

AWARD OF MERIT, for contributions to software development for the Volunteer Action Centre, 2017.
Doctor of Science, honoris causa, University of Guelph, 2011
ACM Distinguished Scientist 2010
Waterloo Award 2009 - the City of Waterloo's highest civic honour for outstanding contributions to the Waterloo community
Grand Cross of Scientific Merit, Brazilian National Order of Scientific Merit, - Brazil's Highest Civilian Scientific Honour (2007)
Award of Excellence in Graduate Supervision – University of Waterloo (2006)
Distinguished Professor Emeritus - University of Waterloo (1999)

Other Awards

50 year founding member IEEE (2012)
Innovator, 1957 Society, University of Waterloo (2007)
Canadian Pioneer in Computing, IBM Center for Advanced Studies (2005)
IBM Innovation Award (2003)
Information Management Excellence in the Public Sector - Silver Medal (1999)
Compaq Award for Scientific Production (best scientific publication in 1995)
Founding Fellow of the Institute of Combinatorics and its Applications (1989)
Brazil-Canada Scientific Exchange Award (1970)
Brazil-Canada Scientific Exchange Award (1969)

Biographical Sketch

Donald D. Cowan is Distinguished Professor Emeritus of Computer Science at the University of Waterloo and Director of the Computer Systems Group, and has been at the University since 1960. Professor Cowan was the founding Chairman of the Computer Science Department at the University of Waterloo. He has graduated over 120 graduate students (PhD and MMath) and postdoctoral fellows during his career.

His research interests in software engineering have involved him in many of the software systems that have been created at the University of Waterloo during the period of 1965 to 1995, and distributed in over 40 countries. These software systems include: WATFOR, WATFIV, WATBOL, WIDJET, WATERLOO Pascal, APL, BASIC, COBOL, and FORTRAN, the local area networks Waterloo JANET and MacJANET and many other software systems for education.

Dr. Cowan's current interest in software engineering focuses on design and implementation of Web-based and mobile software systems, particularly in reducing the number of abstractions required to produce and validate such software. Reducing the number of abstractions will lower the technological barriers for individuals and organizations to build and maintain Web-based and mobile systems. During his entire research career he has received over \$20,000,000 in research support.

Dr. Cowan was the creator and director of EPStar (EP*), a suite of university-level programs designed to teach the foundations of many university subjects to professionals. The programs were in areas such as software development, networking, electronic commerce, health informatics, photonics, organizational communications, digital brand design, and water quality management.

Professor Cowan is the author, co-author or editor of over 280 refereed papers and 17 books in computer/communications, software engineering, education, environmental information systems and mathematics. He is a pioneer in the field of computer/communications having co-authored several papers with Dr. Vinton Cerf, a Father of the Internet. He also co-authored one of the seminal papers in computer networking and economics in the early 70s, and has worked with Dr. Paul Baran, the originator of the computer network concept.

Professor Cowan has served as a consulting scholar with IBM Corporation providing advice on the application of computers in education. He has also served as a consultant to many businesses, government agencies and universities including Apple, Xerox, Fasken and Calvin, Sasktel, Gulf Oil, Microsoft, the Organization of American States (OAS), the United Nations and various ministries of both the Ontario, Canadian and foreign governments.

Donald Cowan is a co-founder of several University of Waterloo spin-off companies; the most noteworthy ones being WATCOM, now iAnywhere Solutions and part of SAP, and of LivePage Corporation, now part of Oracle Corporation. He has served on the Board of Directors of WATCOM, LivePage, the Waterloo Foundation for the Advancement of Computing (WATFAC), the Ontario Centre for Advanced Manufacturing and as President and Director of Waterloo Software Applications Centre Inc., a company owned by the University of Waterloo. He currently is a Director of the J.W. Graham Information Technology Trust and a former Trustee of the Waterloo Mathematics Charitable Trust. He is a founding member of the Intelligent Waterloo Committee that prepared the submission that won the Intelligent Community award in 2007 for the City of Waterloo.

Among several honours, Donald Cowan has received the Brazilian National Order of Scientific Merit - Grand Cross, Brazil's Highest Scientific Honour (2007) in recognition of his research and the more than 45 years he has helped with the development of Brazilian Computer Science. He is the only non-Brazilian computer scientist to hold this award. He also received the Award of Excellence in Graduate Supervision (2006) from the University of Waterloo in acknowledgement of his work with and supervision of over 120 graduate students and postdoctoral fellows during his academic career. In 2009 he received the Waterloo Award, the City of Waterloo's highest civic honour, for his contributions to the City of Waterloo. In 2010 he was named a Distinguished Scientist by the Association for Computing Machinery. In 2011 he received a Doctor of Science (Honoris Causa) from the University of Guelph for his contributions to Computer

Science and Software Engineering. In 2017 he along with colleague Kyle Yung received the Award of Merit from the Volunteer Action Centre of Kitchener Waterloo for the development of volunteer matching software that is used locally, provincially and nationally.

Dr. Cowan is a designer of the Web Informatics Development Environment (WIDE) toolkit which provides the underlying technology for the development of web-based community information utilities for over 80 geographic communities and communities of interest in areas such as socio-economic development, environment, population health, cultural heritage and community support. The communities represent organizations ranging from NGOs, businesses, universities and research centres, to all levels and types of government including First Nations groups and the United Nations. Examples can be found at <http://www.comap.ca/fwis/>, <http://inweh.unu.edu/archive/River/KnowledgeManagement/KIM-UNU.htm>, <http://bricksandmortar.artsbuildontario.ca/>, <http://www.volunteerkw.ca>, and <http://www.buildingstories.co/>. The same technology has been used to build enterprise management systems for business and government.

Dr. Cowan is also the designer of StudySpace a computer-based learning tool that has been used in many online courses and is currently being used worldwide by the United Nations University in courses on water quality management.

The Computer Systems Group

The Computer Systems Group at the University of Waterloo is a research group that specializes in document and software engineering, and software design and implementation. The members of the group study the process of building software and then implement practical software systems to test the ideas. Many of these software systems have solved key problems in several application areas and have been made available through various commercial arrangements. Current research focuses on building software from components specifically those associated with the Internet and World-Wide Web.

Recent examples of practical software systems include the Web Informatics Development Environment (WIDE) toolkit which has been used to build over 50 information utilities based on Web 2.0 principles, LivePage, a software system for managing and publishing large scale Web sites and VxReXX a scripting language for Windows. Earlier systems focused on education. These software systems included WATFOR, WATFIV, WATBOL, WIDJET, WATERLOO Pascal, APL, BASIC, COBOL, and FORTRAN, and the local area networks Waterloo JANET and MacJANET. Over 3000 copies of these software systems have been distributed in 40 countries.

The University of Waterloo

The University of Waterloo is one of Canada's most research intensive and innovative universities, and is ranked first in the annual survey of Canadian Universities conducted by Macleans, Canada's national news magazine and is also ranked in the top 100 in reputation by the Times Higher Education World University Rankings.

Waterloo has a broadly based education and research program with particular emphasis on information technology and communications, mathematics, engineering and science. There are also excellent programs in humanities, applied health sciences, and environmental studies. The University operates as six faculties or academic units: Applied Health Sciences, Arts, Engineering, Environment, Mathematics and Science. An in-depth look at the University can be found at www.uwaterloo.ca. The Faculty of Mathematics operates the world's largest Mathematics and Computer Science program.

The University of Waterloo operates the largest cooperative education program in the world (Northeastern University in Boston is second) where students alternate 4-month periods of study and work. This program operates within all academic units of the University, but is strongly emphasized within Mathematics, Engineering and Science. Although many students in cooperative education programs work in Canada during work terms, Waterloo students are in high demand both on their coop term and after graduation at companies all over the world including organizations such as Google, Intel, IBM and Microsoft.

The University of Waterloo attracts many of the brightest students from across Canada and always enters teams in both the Putnam Mathematics Competition and the ACM Intercollegiate Programming Contest. University of Waterloo teams regularly finish in the top half-dozen places in both these contests along with U.S. schools such as Stanford, Harvard, MIT, Berkeley and Carnegie-Mellon.

Spin-off companies are a well-known phenomenon at the University of Waterloo; at least 500 companies have been spawned because of Waterloo innovation and research. The University of Waterloo generates more spin-off companies than any other university in Canada and credit for that frequently goes to its policy of allowing professors to own the knowledge they create through their research. Spin-off companies such as RIM (Blackberry), OpenText and iAnywhere Solutions (Sybase) are world leaders in mobile communications, collaborative software and mobile commerce. Products from these companies are used around the globe and adopted by many large American corporations, the US government and the U.S. military.

The University of Waterloo and the City of Waterloo also provide homes for the Centre for International Governance Innovation, the Perimeter Theoretical Physics Institute, the Institute for Quantum Computing and *Balsillie School* of International Affairs. These three institutes have been established by local philanthropists and businessmen and have been supported with an endowment totaling over \$300,000,000.

REFEREED PAPERS IN JOURNALS (92 Total)

1. Vahid R. Karimi , Paulo S. C. Alencar, Donald D. Cowan “A formal modeling and analysis approach for access control rules, policies and their combinations.” *International Journal of Information Security*. <http://dx.doi.org/10.1007/s10207-016-0314-4> pp 1-32
2. Holly L. Gardner, Denis Kirchhoff, Don Cowan, and Leonard J.S. Tsuji "An approach to collecting, collating, reviewing, and disseminating technical information for the advancement of evidence-based environmental decision-making including Environmental Assessments in remote First Nations of northern Canada" in press *The International Indigenous Policy Journal*. 2015.
3. Vahid R. Karimi, Paulo S. C. Alencar, Donald D. Cowan. “A uniform approach for business and access control models with explicit rule realization,” *International Journal of Information Security* February 2015 DOI 10.1007/210207-015-0275-z Volume 15, Issue 2, 2016 pp 145-171.
4. Raquel M. Pillat, Toacy C. Oliveira, Paulo S. C. Alencar, Donald D. Cowan *BPMNt: A BPMN Extension for Specifying Software Process Tailoring Information and Software Technology* Volume 57 January 2015 pp 95-115.
5. V.R. Karimi, D.D. Cowan, P.S.C. Alencar An Approach to Correctness of Security and Operational Business Policies *International Journal of Accounting Information Systems* , Volume 15, July 2014 pp 323-334.
6. Andrea Isogai, Daniel D. McCarthy, Holly L. Gardner, Jim D. Karagatzides, Skye Vandenberg, Christine Barbeau, Nadia Charania, Vicky Edwards, Don Cowan, Leonard J.S. Tsuji, “Examining the Potential Use of the Collaborative-Geomatics Informatics Tool to Foster Intergenerational Transfer of Knowledge in a Remote First Nation Community.” *The Australian Journal of Indigenous Education* 08/2013; 42(01). DOI:10.1017/jie.2013.10. pp44-57.
7. Ingrid Nunes, Simone D.J. Barbosa, Don Cowan, Simon Miles, Michael Luck and Carlos J.P. de Lucena. “Natural Language- based Representation of User Preferences,” *Interacting with Computers* Volume 27, Issue 2 Pp. 133-158., Oxford Journals, Oxford University press .
8. McCarthy, Daniel D; Whitelaw, Graham; King, Carolyn; King, Clynt; Viswanathan, Leela; Cowan, Don; McGarry, Fred; and Anderson Scott. “Collaborative Geomatics and the Mississaugas of the New Credit First Nation: Triaging Requests. for Planning Development Consultation.” *The International Journal of Technology, Knowledge, and Society* Volume 9, 2013 pp1-15.
9. Nadia A. Charania, Dr. Don Cowan, Dr. Leonard J. S. Tsuji, "Health Care Delivery in Remote and Isolated First Nations Communities in Canada: The Need for a Collaborative Health Informatics System" *International Journal of Technology, Knowledge and Society*, Volume 8, Issue 5, pp.71-84 <http://ijt.cgpublisher.com/product/pub.42/prod.886>, 2012.
10. Dr. Daniel D. McCarthy, Christine D. Barbeau, Dr. Donald Cowan, Dr. Leonard J. S. Tsuji, "Potential Use of an Interactive Web-Based Informatics Tool to Decrease the Incidence of Human-Polar Bear Encounters Along the Western James Bay Coast of Ontario, Canada," *International Journal of Technology, Knowledge and Society*, Volume 8, Issue 5, pp.113-127 <http://ijt.cgpublisher.com/product/pub.42/prod.889>, 2012.
11. D.D. Cowan, F.M. McGarry, H. Moran, D.D. McCarthy, C. King. Information Technology to Support Indigenous Peoples *IEEE IT Professional*. Special Issue on IT in Emerging Markets, Vol 14, No 4, pp39-47.
12. Dr. Daniel D. McCarthy, Holly L. Gardner Youden, Andrea D. Isogai, Dr. Donald Cowan, Dr. Leonard J. S. Tsuj "The Collaborative Geomatics Informatics Tool: Engaging Youth using Place-Based Learning," *THE INTERNATIONAL JOURNAL OF TECHNOLOGY, KNOWLEDGE AND SOCIETY* <http://ijt.cgpublisher.com/product/pub.42/prod.830> pp 131-142.
13. Holly L. Gardner-Youden, Christine Barbeau, Daniel D. McCarthy, Vicky Edwards, Don Cowan, Leonard J. S. Tsuji “Indigenous Mapping Technologies: The Past, Present and Future of the Collaborative Geomatics Web-based Tool” *Knowledge Management for Development Journal* Volume 7, Issue 3, 2011 pp 340-353 Special Issue: Indigenous Knowledge Technology Conference 2011: Selected Papers <http://www.tandfonline.com/doi/abs/10.1080/19474199.2012.684500>
14. Christine D. Barbeau, Nadia A. Charania, Andrea D. Isogai, Dr. Daniel D. McCarthy, Dr. Donald Cowan, Dr. Leonard J. S. Tsuji, "Fostering Adaptive Capacity and Resilience to Environmental Change

- in Sub-Arctic First Nations" *The International Journal of Technology, Knowledge and Society*, Volume 7, Issue 3 <http://ijt.cgpublisher.com/product/pub.42/prod.781>, 2011 pp44-57.
15. Don Cowan, Paulo Alencar, Fred Mc*Garry, Daniel McCarthy "Collaborative Geomatics for Innovation in Health Research and Policy" Vol 6, No 4 (2011): Special Issue on the Advances in Health Informatics Conference (AHIC 2010) <http://www.ejhi.net/ojs/index.php/ejhi/issue/view/13> pp1-10.
 16. Toacy Cavalcante de Oliveira, Paulo S. C. Alencar, Donald D. Cowan: ReuseTool - An extensible tool support for object-oriented framework reuse. *Journal of Systems and Software* 84(12): pp2234-2252 (2011)
 17. Nadia A. Charania, Dr. Daniel DP McCarthy, Dr. Donald Cowan, Dr. Leonard JS Tsuji, "Developing a Collaborative Health Informatics System to Foster Inter-Agency Collaboration and Communication during Public Health Emergencies: Remote and Isolated First Nation Communities of Sub-Arctic Ontario, Canada." *The International Journal of Technology, Knowledge and Society* <http://ijt.cgpublisher.com/product/pub.42/prod.792> pp 75-92.
 18. Christine Barbeau, Andrea Danielle Isogai, Dr. Daniel D. McCarthy, Dr. Donald Cowan, Dr. Leonard JS Tsuji, "Collaborative Geomatics in Society and the Environment: Using an Interactive Web-Based Informatics Tool in Remote First Nation Communities in Sub-Arctic Canada." *The International Journal of Technology, Knowledge and Society* 2011, http://t11.cgpublisher.com/proposals/217/index_html.
 19. Daniel D.P. McCarthy, Graham S. Whitelaw, Scott Anderson, Donald Cowan, Fred McGarry, Anthony Robins, Zachariah General, Jeff Liedtke, Holly Younden, Celine Sutherland, Paulo Alencar, Leonard J.S. Tsuji. "Collaborative geomatics and the Mushkegowuk Cree First Nations: Fostering adaptive capacity for community-based sub-arctic natural resource management." *Geoforum*, Volume 43, Issue 2, March 2012, Pages 305–314.
 20. NUNES, I., COWAN, D., CIRILO, E.J.R., LUCENA, C.J.P. (2011), A Case for New Directions in Agent-oriented Software Engineering, in Danny Weyns and Marie-Pierre Gleizes, ed., *Agent-Oriented Software Engineering XI*, Vol. 6788 of LNCS, Springer-Verlag, 2011, p. 37-61.
 21. NUNES, I., LUCENA, C.J.P., COWAN, D., KULESZA, U., ALENCAR, P., NUNES, C. (2011), Developing Multi-agent System Product Lines: From Requirements to Code, *International Journal of Agent-Oriented Software Engineering (IJAOSE)* 4(4), pp353-389
 22. Mendonca, Marcilio, Cowan, Donald, Decision-making coordination and efficient reasoning techniques for feature-based configuration, *Science of Computer Programming* 75 (2010) 311-332.
 23. Dai, W., Covvey, D., Alencar, P., Cowan, D., Lightweight Query-Based Analysis of Workflow Process Dependencies, *Journal of Systems and Software*, 82 (2009) 915-931.
 24. Paes Rodrigo, Lucena Carlos, Carvalho Gustavo, Cowan Donald D, An Event-Driven High Level Model for the Specification of Laws in Open Multi-Agent Systems, *the Journal of Systems and Software* 82 (2009) pp629–642.
 25. ZAUPA, Fabio Gabriel, GIMENES, I. M. S., COWAN, D., ALENCAR, P., LUCENA, Carlos José Pereira de A Service-oriented Process to develop Web Applications. *Journal of Universal Computer Science*, Vol. 14, No. 8, pp. 1368-1387. Special Issue on "Software Components, Architectures and Reuse" edited by Rogerio Lemos and Cecilia Rubira.
 26. DIMARCO, C, BRAY, P., COVVEY, H.D., COWAN, D.D., DICICCIO, V., HOVY, E, LIPA, J., YANG, C., "Authoring and Generation of Individualized Patient Education Materials", *Journal on Information Technology in Healthcare*, February 2008 pp195-199.
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28. Jing Dong, Paulo S. C. Alencar, Donald D. Cowan, and Sheng Yang Composing Pattern-Based Components and Verifying Correctness *Journal of Systems and Software* vol 80, Issue 11, Pages 1755-1769, Elsevier Science, November 2007.
 29. Oliveira, T.C., Alencar, P.S.C., Lucena, C.J.P, Cowan, D.D., RDL: A Language for Framework Instantiation Representation, *Journal of Systems and Software*, Volume 80, Issue 11, November 2007, pp 1902-1929.
 30. Cowan, Donald, Covvey Dominic, Fenton, Shirley, Miller Judith, Mulholland, Douglas, de Groot Martin, Matyas Cathy, McGarry Fred, Sustainability Models for Web-Based Information Systems Supporting Communities of Practice *International Journal of Technology, Knowledge and Society* 2007 <http://ijt.cgpublisher.com/product/pub.42/prod.174>.
 31. M. Nelson, P.S.C. Alencar, D.D. Cowan, Informal Description and Analysis of Geographic Requirements: An Approach based on Problems, *Software and Systems Modeling*, Springer Berlin / Heidelberg ISSN 1619-1366 (Print) pp 223-245, 1619-1374 (Online) pp 1-23, 2006.
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 33. Nelson, M., Alencar, P.S.C., Cowan, D.D., Formal Description and Analysis of Geographic Problem Frames, *Requirements Engineering Journal (REJ)*, 2007.
 34. Cowan, D.D., Fenton, S.L., Mulholland, D.W., Lowering Technological Barriers to Developing, Deploying and Maintaining Web-based Interactive Information Systems *International Journal of Technology, Knowledge and Society*, Volume 1, Issue 4, 2005, pp.175-182.
 35. Alencar, P.S.C., Dong, J., Cowan, D.D., Automating the analysis of design component contracts *Software: Practice and Experience* Volume 36, Issue 1, Date: January 2006, Pages: 27-71.
 36. Alencar, P.S.C., Oliveira, T., Cowan, D.,D., Filho, M., Lucena, C.J.P., Software Process Representation and Analysis for Framework Instantiation, *IEEE Transactions on Software Engineering (IEEE TSE)*, vol. 30, no. 3, pp. 145-159, March 2004.
 37. Alencar, P.S.C., Nelson, M., Nelson, T., Cowan, D.D., An Approach to Explore Problem Frame Concerns using Formal Analysis, *Journal of Information and Software Technology*, vol. 47, no. 14, pp. 913-927, 2005.
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INDUSTRIAL REPORTS

1. D.D. Cowan, D.W. Mulholland, M.D. Cowan, M.J.W. Doran "The Southern Ontario Water Consortium IT Platform" (2012) 53 pages.
2. P.J. Bumbulis, D.D. Cowan, C.M. Durance, T.M. Stepien. "The X.500 Architecture - An Introduction," Bell Canada, (1989). 49 pages.

3. P.J. Bumbulis, D.D. Cowan, C.M. Durance, T.M. Stepien. "Application Processes in the OSI Model," Bell Canada, (1989). 32 pages.
4. P.J. Bumbulis, D.D. Cowan, C.M. Durance, T.M. Stepien. "Abstract Syntax Notation 1 (ASN.1)," Bell Canada, (1989). 25 pages.
5. P.J. Bumbulis, D.D. Cowan, C.M. Durance, T.M. Stepien. "The ISO Development Environment (ISODE) - An Introduction," Bell Canada, (1989). 49 pages.
6. P.J. Bumbulis, D.D. Cowan, C.M. Durance, T.M. Stepien. "The X.500 Directory Service - Implementation Issues," Bell Canada, (1989). 22 pages.
7. P.J. Bumbulis, D.D. Cowan, C.M. Durance, T.M. Stepien. "The X.500 Architecture - A Glossary," Bell Canada, (1989). 13 pages.

GOVERNMENT REPORTS

1. Fred McGarry, Tom Brenner, Donald D. Cowan, Brian Harvey, Dan D. P. McCarthy, Stephen D. Murphy. "Collaborative Geomatics for Participatory Democracy and Sustainable Development: Opportunities, Issues and Design Implications." TOWARD A BROADBAND RESEARCH AGENDA FOR ONTARIO - A Working Paper for the Ministry of Government Services.
2. Young G., D.D. Cowan et al. "Water for People Water for Life – The United Nations World Water Development Report," Berghan Books, July 2003. 500 pages
3. D.D. Cowan, J.W. Graham. "A Study of the Package Software Industry in Canada," a Report Submitted to the Department of Industry, Trade and Commerce August 1983. 68 pages.
4. N.D. Brewer, D.D. Cowan, C.C. Gotlieb, L.F. MacRae. "Utilization of Computer Networks - A Preliminary Study of the Methods of Using Computer Networks and of Applications which might be Available over a Computer Network," a report prepared by the CANUNET Advisory Committee, March, 1972. 66 pages.
5. D.D. Cowan, L. Waverman. "The Good Corporate Citizen in the Computer Industry - Policies to Maximize Canadian Welfare," Study for the Science Council of Canada, July 1971. 30 pages.
6. D.D. Cowan, L. Waverman. "Economics of Integration in Communications and Data Processing" - in "Policy Considerations with Respect to Computer Utilities," Tele Commission Study, Department of Communications, Government of Canada, April, 1971. 20 pages.

PROFESSIONAL MEMBERSHIPS

- Association of Professional Engineers of the Province of Ontario
- Association for Computing Machinery
- Institute of Electrical and Electronic Engineers
- Canadian Information Processing Society
- Founding Fellow of the Institute of Combinatorics and its Applications

CURRENT GRADUATE STUDENTS

PhD

1. Malyk W.
2. Barrenechea E.
3. Serge Savigny
4. Luis Blanco
5. Ivens Portugal

MMath

-
1. Tavares Cristina
 2. Kumar Akshat
 3. Srivastava Vishnu.
 4. Kumar Vijay.
 5. Peng Peng

POSTDOCTORAL FELLOWS SUPERVISED

1. Karimi Vahid 2012 - 2015
2. Mendonca M. 2009
3. Oliveira T. 2008-2010
4. Gimenes I. - 2005
5. Nelson, M.A.V. - 2003
6. Nelson, T.P. - 2003
7. Oliveira T. – 2002/03
8. Nova, L.C.M. 2000
9. Yanmin S. 2000
10. Figueiredo L.H.F. 1994/95
11. Ierusalimchy R. 1992/93

THESES SUPERVISED

Ph.D

1. Barrenechea Eduardo
2. Malyk W.
3. Karimi Vahid. “A Uniform Formal Approach to Business and Access Control Models, Policies and their Combinations” 2012
4. Mendonca Marcilio. “Efficient Compilation Techniques for Large Scale Feature Models 2009
5. M.A. V. Nelson. “A Problem-oriented approach to Description and Analysis of Geographic Requirements,” 2003.
6. T.P. Nelson. “Formal verification of Projection-based Software Systems,” 2003.
7. J. Dong. “Design Component Contracts: Modeling and Analysis of Pattern-based Composition” 2002
8. L.C.M. Nova. “A Formalization of an Extended Object Model Using Views,” 2000.
9. K. Lichtner. “A Framework for Machine-Assisted Software Architecture Validation,” 2000.
10. D.M. German. “Hadez, A Framework for the Specification and Verification of Hypermedia Applications,” 2000.
11. P.J. Bumbulis. “Combining Formal Techniques and Prototyping in User Interface Construction and Verification,” 1996.
12. L.M.F. Carneiro-Coffin, “Jasminum: Joining ADVs and State Machines in a Notation for User Interface Modelling,” PhD thesis, 1994.
13. R.G. deV Smit. “A Formatter-Independent Structured Document Preparation System,” 1987.

-
14. S.T. Vuong. "Formal Techniques for Protocol Specification and Validation - Toward an Integrated System," 1983.
 15. A. von Staa. "Data Transmission and Modularity Aspects of Programming Languages." 1975. (with W.M. Gentleman)
 16. H.J. Boom. "Optimization Analysis for Programming Languages that have Pointer Variables," 1974.
 17. R.J. Collens. "A Computer System for Balanced Incomplete Block Designs," 1973.
 18. T.C. Wilson. "A Graph-Theoretic Approach to Some Problems in Compiler Code Optimization," 1972.
 19. R.B. Maguire. "Methods for Producing Visual Displays of Linear Graphs," 1973
 20. C.R. Zarnke. "A Software Development Language," 1971.
 21. H.C. Williams. "A Generalization of the Lucas Functions," 1969 (with R.C. Mullin).

MPhil Thesis

1. A.M. Grenzebach. "Data Management - Techniques and Considerations," 1972.

MMath Theses

1. Kuen F. 2010
2. Wang Yi 2010
3. Chodos D. 2007
4. Malyk W. 2006
5. Kalili B. 2003
6. Lu Morgan 2005
7. Zhang P. 2004
8. D.B. Brown. "A Views-Based Design Framework for Web Applications," 2002.
9. M.F. Luo. "An Object-oriented Framework for Community Information Systems," 2001
10. C.J. Pal. "A Probabilistic Approach to Image Feature Extraction, Segmentation and Interpretation," 2000
11. T. Su. "A Distributed Data Consistency Framework for Internet-Based Applications," 1998
12. J. Dong. "A Transformational Process-based Approach to Object-oriented Design," 1997.
13. Y. Xu. "ADVs as Domain Transformers in the Design of an E-mail System," 1997.
14. J.Q. Huang. "A Tool to Assist in the Application of Design Patterns," 1997.
15. S.B. Wachsberg. "Efficient Information Access for Wireless Computers," 1996 (with J.W. Wong)
16. J.Y.E. Giguere. "A Model for Database Support in Rapid Application Development Environments," 1996.
17. R.W. Horman. "Towards a General Theoretical Foundation of Software Architecture," 1995.
18. K. Lichtner. "An Information Filtering Facility for Usenet News," 1995.
19. C.M. Durance. "An Approach to Application Software Portability Across User Interface Toolkits," 1990.
20. T.M. Stepien. "A Communication System for Local Area Networks," 1988.
21. P.J. Bumbulis. "A Practical Non-Correcting Syntax Error Recovery Algorithm," 1987.

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22. M. Murphy. "Specification, Verification and Semi-Automatic Implementation of Protocols Using Petri Nets," 1984.
 23. P.A. Lim. "Structured Programming in Financial Accounting Systems," 1981.
 24. Wm. R. White. "A Study of Some Aspects of Computer-Communication Protocols," 1976.
 25. R. Tilley. "Algorithms for the Growth of Filaments," 1969.
 26. L.O. James. "Error-Correcting Codes," 1969.
 27. C.J.P. Lucena. "A Study on Numerical Methods for Interpolation and Function Approximation," 1969.
 28. G.M. Calnek. "A Testing and Grading System for Student Software Programs, 1970
 29. R.S.K. Shirley. "A System for Teaching Machine and Assembly Language Programming Using a Graphic Display," 1967.

M.Math ESSAYS SUPERVISED

1. Kaastra M. 2003
2. Wang Y. 2003
3. C. H. Tsou 2001
4. W. Li 1999
5. T.M. Francis 1997 – "A Viewpoint on Legacy Systems"
6. D. Smith 1994
7. L. Rao 1993
8. D.G.K. Fairman 1993
9. D.P. Mulders 1989 – "Network Security: A Review of Measures and Mechanisms"
10. S.R. Taulbee 1989 – "Computer Contagions and their Impact on the Business Environment"
11. J. Alvarez 1985 – "Style and Portability in COBOL – 8x"
12. Y.S. Leo 1984 – "Portability Issues Associated with Fortran Programming"
13. P. Gallop 1984 – "The Invariant Technique for the Verification of Petri Net Specifications"
14. Yang Hong-zhi 1982 (with K.O. Geddes)
15. F. Newbery 1980 – "The Computer Criminal and How to Avoid Him"
16. P.M. Rattee 1979 (with K.D. Fryer)
17. M.M.N. Nicholas 1979 (with K.D. Fryer)
18. D.M. Deschambault 1979 – "Calculators for a Small Planet" (with K.D. Fryer)
19. F. C-K Li 1977 – "Problem Set for Educational Database System"
20. L.E. Snikkar 1977 (with K.D. Fryer and P.J. Ponzio)
21. S. Singh 1977 (with K.D. Fryer)
22. A.M. Moore 1977
23. J.H. Lau 1977
24. A. Gall 1977
25. G.W. Crandlemire 1976
26. D.J. Laurenson 1976

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27. K.A. Kamel 1976
 28. N.D. Diamond 1976
 29. E.A. Diamond 1976
 30. M.W. Davidson 1976 (with K.D. Fryer)
 31. K-L P. Chan 1976
 32. J.K. Peacock 1975
 33. N.J. Viire 1975
 34. A.S. Swanston 1975 (with K.D. Fryer)
 35. C. Raheb 1975 (with P.J. Ponzio)
 36. L.C. Musselman 1975 (with K.D. Fryer)
 37. E.F. Lyons 1975
 38. R.W. Link 1975
 39. B. Lapcevic 1975 (with K.D. Fryer)
 40. T.J. Griffiths 1975 (with K.D. Fryer)
 41. I. Mijares 1974 (with R.W. Peebles)
 42. J. Budz 1974
 43. G. Bouwers 1974
 44. A.C. Zoltan de Torres 1972
 45. T.T. Luu 1972
 46. J.C. Gordon 1972
 47. X.N. Dam 1972 (with D.E. Morgan)
 48. J.J. Bedford 1972
 49. E.W.A.B. Witkowski, "The Verification and Synthesis of Protocols," 1971.
 50. J. Tom 1971
 51. K.R. Price 1971
 52. C.L. Lucchesi 1971
 53. D.P. Jones 1971
 54. M.S.S. Elwakkad 1971
 55. R.S.C. Braga 1971 (with M.A. Malcolm)
 56. D.D. Lane 1970
 57. B.J. Murphy 1969
 58. R.B. Maguire 1969
 59. P.A. Didur 1969
 60. C.R. Zarnke 1967
 61. A.M. Grenzebach 1967

CURRENT GRANTS & GRANTS HELD

Community Trends Platform –Ontario Local Poverty Reduction Fund \$299,976

Building a Web-based Information Platform for Dynamic Online Quality of Life Indicators United Way Perth Huron \$21,000

New technologies to optimize assessment of mobility, activity and health in the frail elderly TVN (\$60,000)

An Open-Data Cloud Platform for Watershed Modeling and Decision Support Adding Value to Watershed Data from Storage through Analysis to Visualization – Communtech (FedDEv) \$109,500

An Open-Data Cloud Platform for Watershed Modeling and Decision Support Adding Value to Watershed Data from Storage through Analysis to Visualization – Greenland Internationals Consulting \$20,000.

Dreamcatcher: A Web-based/Mobile Information System for Aboriginal Land Management, Consultation, and Preservation of History, Culture and Traditional Ecological Knowledge, SSHRC Partnership Development Grant \$198,822 with D. McCarthy University of Waterloo. 2013 -2016.

Next Generation Web Approaches and Tools, Ontario Research Fund Research Excellence Program - \$2,096,538 with Paulo Alencar University of Waterloo, Carlos Lucena, Pontifical Catholic University of Rio de Janeiro, 2010-2014.

Next Generation Web Approaches and Tools, - \$300,000, JOMICA Investments with Paulo Alencar University of Waterloo, Carlos Lucena, Pontifical Catholic University of Rio de Janeiro, 2010-2014.

Next Generation Web Approaches and Tools, - \$2,687,000, Centre for Community Mapping with Paulo Alencar University of Waterloo, Carlos Lucena, Pontifical Catholic University of Rio de Janeiro, 2010-2014.

Next Generation Web Approaches and Tools, - \$225,000, iAnywhere with Paulo Alencar University of Waterloo, Carlos Lucena, Pontifical Catholic University of Rio de Janeiro, 2010-2014.

2013-2014. SSHRC (\$42,330) Resource Development in the Kamilaroi Region of New South Wales, Australia: The Potential Use of the Collaborative Geomatics Informatics Tool (Principal Investigator [PI]: L.J.S. Tsuji)

2011-2014. SSHRC (\$258,620) Land Use Planning and Resource Development at the Community Level in the Mushkegowuk Territory: the Use of Traditional Environmental Knowledge (TEK) and Western Science as Complementary Forms of Knowledge. (PI: L.J.S. Tsuji)

2009-2013. SSHRC (\$242,435) Traditional Environmental Knowledge (TEK) and Western Science as Complementary Forms of Knowledge: Explaining and Predicting Sea-Level Change due to Glacial Isostatic Adjustment (GIA) and Global Warming in the Hudson Bay Region, Canada, and the Use of Collaborative Geomatics to Monitor Sea-Level Change in the Western James Bay Region, Canada (PI: L.J.S. Tsuji)

2011 – 2012 Health Canada (\$300,552) Crush the Crave (P.I. B. Baskerville)

2011 -2012 Ontario Ministry of Tourism (\$48,125) Built Heritage Mobile Application Project (P.I. Robert Shipley)

2011-2012 Ontario Ministry of Tourism (\$50,000) Built Heritage Mobile Application Project (P.I. Robert Shipley)

2011-2012 Heritage Canada (\$200,000) Built Heritage Mobile Application Project (P.I. Robert Shipley)

2011-2012. SSHRC (\$77,009) Youth outreach in the Mushkegowuk Territory of sub-arctic Ontario, Canada: Collaborative geomatics. (PI: L.J.S. Tsuji)

2010-2011. SSHRC (\$87,000) Collaborative geomatics in remote First Nations communities: tracking environmental change and fostering continuous learning in the Mushkegowuk Territory (PI: Daniel McCarthy; Co-Investigator [CI]: L.J.S. Tsuji)

2010-2011. Ontario Ministry of Culture (\$50,000) Dreamcatcher informatics/Mushkegowuk cultural map service. (PI: Daniel McCarthy; CI: L.J.S. Tsuji)

2009-2010. SHRC (\$87,475) World biosphere regions and collaborative geomatics: networking tools for fostering sustainability, local economic development and continuous learning in the Mushkegowuk Territory (PI: Daniel McCarthy; CI: L.J.S. Tsuji)

An Architecture, Meta-Model and Easy-to-use Toolkit for the Creation of Web-based Geomatics Information - \$448,500, NSERC CRD with Dan Berry, Paulo Alencar, Dominic Covvey, Steve Murphy Dan McCarthy, all of the University of Waterloo, and Carlos Lucena, Pontifical Catholic University of Rio de Janeiro 2010-2012

I Teach Heart – Heart and Stoke Foundation, \$50,000, with Femida Gwadry-Sridhar, Lawson Health Sciences Centre, 2008-2010.

World biosphere regions and collaborative geomatics: networking tools for fostering sustainability, local economic development and continuous learning in the Mushkegowuk Territory – SSHRC, \$87,075, 2009 with Daniel McCarthy (PI).

TEK and Western Science as Complementary Forms of Knowledge: Explaining and Predicting Sea-Level Change due to Glacial Isostatic Adjustment (GIA) and Global Warming in the Hudson Bay Region, Canada and the Use of Collaborative Geomatics – SSHRC, \$242,000, 2009 with L.S. Tsuji (PI)

Caledon Community Map - Caledon Countryside Alliance, \$13,000, June/October 2009

Mennonite Heritage Project - Canadian Heritage, Canadian Culture Online Initiative, \$332,783, June 2008 – September 2009

Monitoring the Moraine - Citizen's Environment Watch, \$20,000.00, October 2008 - September 2009

News Atlas - Family Service Toronto, \$15,000.00, September 2009 – September 2011

STS SLA - Federation of Ontario Cottagers Associations, \$14,286, September 2008 - August 2009

Mennonite Heritage Project - Kitchener-Waterloo Community Foundation, \$10,000.00, July 2007-June 2008

Ontario Stream Information Systems - Lake Simcoe Watershed, \$15,000.00, April 2009 – March 2009

Mapping and Planning System (MAPS) - Mississaugas of the New Credit First Nation, \$40,000, April –July 2009

Ontario Drinking Water Stewardship Tracking System- Ontario Ministry of the Environment, \$92,500, January – August 2009

Invasives Tracking System - Ontario Federation of Anglers & Hunters, \$120,000, April 2009-February 2010

Playscape - Opportunities Waterloo Region, \$7,175.00, July - August 2009.

Helper Project - Ray of Hope, \$5,160.00 July – December 2009

IW:Science & KM:Land Project - United Nations University, \$100,000.00 September 2009 – November 2010

Extension to the VAC System - Volunteer Action Centre K-W (VAC), \$16,240.00, April 2009 – October 2010

Waterloo Region Arts Portal - Region of Waterloo, \$10,290.00, March – June 2009

Phase IV – Performance Indicators Monitoring System (PIMS) Ontario Tobacco Research Unit \$100,000 2007

Phase III- Budget Support for Performance Indicators Monitoring System (PIMS) Ontario Tobacco Research Unit \$75,000 2007

Phase II- Performance Indicators Monitoring System (PIMS) Ontario Tobacco Research Unit \$90,850 2007

Infrastructure Support Trillium Foundation 2006 \$96,000

Monitoring the Moraine – Citizens Environment Watch 2006 \$40,000

Moraine Restoration and Stewardship System project Ontario Ministry of Natural Resources 2006 – 2007 \$163,220

Performance Indicators Monitoring System (PIMS) Ontario Tobacco Research Unit \$46,254 2006

Improving a Diabetes Management Program by Integrating Technology Health Technology Exchange \$119,000 2006-2007

Improving a Diabetes Management Program by Integrating Technology Micohealth \$11,500 2006-2007

Natural Language Generation Tools and Methodologies for Personalized Telehealth Systems NSERC CRD \$40,000 2006 – PI Chrysanne DiMarco, co-PIs Bray, Covvey, Cowan, DiCiccio, Hovy, Lipa

Natural Language Generation Tools and Methodologies for Personalized Telehealth Systems Bell University Labs \$40,000 2006 – PI Chrysanne DiMarco, co-PIs Bray, Covvey, Cowan, DiCiccio, Hovy, Lipa

Natural Language Generation Tools and Methodologies for Tailored Documents NSERC CRD \$100,000 2006 – with Chrysanne Dimarco (PI)

Natural Language Generation Systems for Creation of Tailored Patient Bell University Labs \$100,000 2005 – with Chrysanne Dimarco (PI)

NSERC/Strategic – “Evolutionary Concern-Based Extensions: A Flexible and Modular Approach for the Design, Composition and Customization of High-Integrity Component-Oriented Web Application Families” \$476,007 2005-2008 – with Paulo Alencar (PI)

Volunteer Action Centre - Volunteer Action Centre Project \$22,050 2005

Victorian Order of Nurses - CareNet: Caregiver Resource Network \$25,000 2005-2006 with Covvey (PI)

HRSDC – Serving New Immigrants Using a Next Generation Community Learning Network Project NOW (Newcomers Online Waterloo) - \$399,987 2005 – 2008 with C.Matyas (WPL)

MOHLTC - Rapid Visualization Environment (RaVE) for Health Data “\$25,000 2005

HKPR Regional Hospital Group A Web-Based Tool for Defining Bandwidth Requirements of PACS Networks \$25,000 2005

NSERC/CRD – “Next-Generation Declarative Enterprise Frameworks based on Advanced Separation of Concerns” \$362,324 2004-2006

CITO/Precarn – “Point of View Intelligent Middleware,” \$150,000, 2004.

Rogers Cable Inc – “An Easy-to-use Web-based Multimedia Platform Incorporating State-of-the-Art Multimedia Data Compression” \$250,000 2003-2005

IBM Eclipse Innovation Grant – “Development and Dissemination of a Design Methodology for Eclipse Plug-ins” \$24,841 2003

IBM – “Hypermedia Content Management,” \$98,000 2003-2005

Bell University Labs – “Dynamic Self Organizing Process-based Enterprise Identity Management: Architecture and Frameworks,” \$333,200 2003-2005

CITO – “Advanced Models and Implementations for Active Approaches to Hypermedia Documentation Use and Maintenance,” \$216,000 2003-2004

NSERC Strategic Grant – “Prophylactic Program Design: An Approach to Next Generation Legacy Web-based Software Applications,” \$474,000 2001-2004

Strategic Skills Initiative, MEOL, Province of Ontario – “EP3 The Education Program for Photonics Professionals,” \$317,660 2002-2004

HRDC – “WINning Community Learning Spaces,” \$299,963 2001 – 2004

HRDC – “Employment Support Network,” \$125,210, 2001

IBM Canada – “Issues and Models in Documentation,” \$150,000, 1998-2001

CSER Grant – “Issues and Models in Documentation,” \$294,000, 1999- 2002

NSERC Strategic Grant – “Component-based Software Systems - A Development Approach Using Viewpoints,” \$445,000, 1998- 2001.

CITO “Systems from Off-the-shelf Software Components – Issues in Design, Implementation and Standardization,” \$53,000 1999

Telecommunications Access Partnership Grant – “Waterloo Information Network,” \$50,000 1998

Map Connections – “Waterloo Community Network,” \$10,000 1998

Bell Emergis – “Waterloo Community Network,” \$50,000, 1998

IBM Canada – “Investigation of Computer Interface Builders,” \$25,000, 1997.

ITRC Grant for “Pattern Languages,” \$150,000, 1996-97.

IBM Canada – “Investigate design patterns,” \$25,000, 1996.

Creation of Software Engineering Laboratory \$76,119, 1995-96.

NSERC IOR Grant “Methods and Tools to Support the Design of Highly Interactive Software Systems” \$315,000, 1995-97.

Investigator in Environment Canada Grant for Environmental Information Systems \$250,000, 1994.

SHRC Grant for Retraining of Software Professionals \$660,000, 1994-98.

ITRC Grant for Script Languages, User Interfaces and Reusability \$154,000, 1994-95.

Investigator in ITRC Grant for Flexible Text Support in A Software Development Workbench \$370,000, 1993-94.

Investigator in Tri-Council Research Grant on Environmental Issues \$2,100,000, 1993-95.

WATCOM International - Script languages and databases \$100,000, 1993-95.

IBM Canada - Investigate tagged documents for software engineering \$25,000, 1993-95.

NSERC - Infrastructure Support for the Institute for Computer Research \$1,408,000, 1992-95.

NSERC - Infrastructure Support for the Institute for Computer Research \$1,600,000, 1989-92.

Bell Canada - Investigate implementation of X.500 prototypes Research Grant \$112,000, 1988.

NEC Canada - Investigate file servers in LANs for portable computers Equipment \$100,000, 1988-89.

WATCOM Group - Investigate use of Educational Software in distance education Software \$50,000, 1987-89.

Toshiba Canada - Investigate portable computers and networks in distance education Equipment \$252,500, Research grant \$60,000, 1987-89.

WATCOM Group - Investigate use of Educational Software in portable computing environment Software \$125,000, 1985-88.

IBM Canada - Investigate LANs for portable computers Equipment \$150,000, 1986-88.

Hewlett Packard Canada - Investigate LANs for portable computers Equipment \$2,100,000, 1985-88.

Bell Canada - Investigate connection of LANs to public data network Equipment \$120,000 and Research Grant \$50,000, 1986.

Grant for Project Aries - The University of Waterloo Portable Computing Project - Phase II, URIF Grant Ministry of Colleges and Universities (Ontario) (\$254,667-1987/88).

Grant for Project Aries - The University of Waterloo Portable Computing Project - Phase I, URIF Grant Ministry of Colleges and Universities (Ontario) (\$1,160,000-1986/87).

Grant for Software Studies with J.W. Graham Dept of Industry, Trade and Commerce (\$27,500 - 1982).

CIDA Contract for CIDA/COMBRA II Project (\$325,600 - September 1974 to August 1981).

Principal Investigator on Traffic Studies for CANUNET - Department of Communications (\$20,000.00).

Department of Communications: "Simulation Study of Uses of Computer Networks," with W.M.Gentleman 1971-72 \$34,000.00 1972-73 \$38,000.

IBM Fellowship Grant 1971-72 \$15,000.00

IBM Fellowship Grant 1970-71 \$15,000.00

IBM Fellowship Grant 1969-70 \$15,000.00

IBM Fellowship Grant 1968-69 \$13,000.00

DRB Grant 1973-74 \$3,500.00

DRB Grant 1972-73 \$4,000.00

DRB Grant 1971-72 \$6,000.00

DRB Grant 1970-71 \$8,000.00

DRB Grant 1969-70 \$8,500.00

DRB Grant 1968-69 \$7,600.00

NRC Participant in CNPq-Brazil Exchange - 1970

NRC Participant in CNPq-Brazil Exchange - 1969

NSERC Grant 1988-90 \$12,000.00/year

NSERC Grant 1987 \$12,000.00/year

NSERC Grant 1986 \$11,579.00/year

NSERC Grant 1985 \$20,677.00/year

NSERC Grant 1982-84 \$24,770.00/year

NRC Grant 1979-82 \$18,000.00/year

NRC Grant	1976-79	\$20,000.00
NRC Grant	1973-76	\$24,000.00/year
NRC Grant	1972-73	\$17,000.00
NRC Grant	1971-72	\$15,400.00
NRC Grant	1970-71	\$10,000.00
NRC Grant	1969-70	\$9,000.00
NRC Grant	1968-69	\$10,780.00
NRC Grant	1967-68	\$4,500.00
NRC Grant	1966-67	\$2,500.00
NRC Grant	1965-66	\$3,000.00

GRANT APPLICATIONS

BOARD MEMBERSHIPS

2nd Vice-President, Canadian Information Processing Society.

Member, Board of Directors Educational Computing Organization of Ontario (ECOO) 1983 to 1985

Manager, Brazil-CIDA Agreement (1974-81)

Chairman, Subcommittee on Utilization of Computer Networks, CANUNET Advisory Committee

National Director, Canadian Information Processing Society

Secretary, Canadian Information Processing Society

Vice-President, Grand Valley Chapter, Canadian Information Processing Society

President, Grand Valley Chapter, Canadian Information Processing Society

EDITORIAL BOARD MEMBERSHIPS

Utilitas Mathematicae

Aequationes Mathematicae

Caribbean Journal of Mathematics

South African Computer Journal

Scientia Journal

CONSULTING ACTIVITIES

Consultant to Science Council of Canada on Computing & Economics

Consultant for CABLEDATA; an ARPA Contractor

Consultant for Organization of American States

Consultant, Department of Communications, Government of Canada

Consultant, IBM Corporation

Consultant to CIDA on Brazil-Canada Agreement

Consultant, IBM (Venezuela)

Consultant, University of Calabria, Cosenza Italy

Consultant, IBM (Brazil)

Consultant, Government of Canada National Revenue

Consultant, Gulf Oil (Canada)

Consultant, Saskatchewan Telecommunications

Consultant, Public Service Commission Government of Canada

Consultant, Department of Supply and Services Government of Canada

Consultant, IBM (General Systems Division)

Consultant on Computer Networks - Grand Valley State College (1984)

Consultant on Computer Selection - Hamilton Board of Education (1984)

Consultant to Apple Canada as expert witness in the Apple Trial (1986)

Consultant to the Kuwait Foundation for the Advancement of Science,
Member of the Selection Panel for the Kuwait Prize in Basic Science (Computer Science) (1986).

Consultant to Fasken and Calvin on various aspects of litigation in the area of computer technology (1987).

Consultant to Apple Canada as expert witness in the Apple Trial (1986)

IBM Consulting Scholar (1988 – 1996)

Consultant to Fasken and Calvin on various aspects of litigation in the area of computer technology (1987).

Advisor to the Victorian Order of Nurses (VON) on information and communications technology planning (2005 -)

Consultant to the Ontario Medical Association on various aspects of the OntarioMD portal strategy (2005).

Consultant to the Smart Systems for Health Agency on various aspects of integration of the OntarioMD portal and portal team into SSHA. (2006)

COMMITTEE MEMBERSHIPS

ACM Curriculum Committee on Computer Science

Microtechnology Consultative Committee, Ministry of Education Government of Ontario (1982).

Special Advisory Committee on the CAD/CAM Centre, Ministry of Industry and Trade, Government of Ontario (1982).

Ministry of Education OAC Curriculum Committee on Computer Technology (1984).

Ministry of Education OAC Curriculum Committee on Computer Science (1985 - 86).

Programme Committee, Grand Valley Chapter, Canadian Information Processing Society

National Research Council of Canada, Grants Committee on Computer Science (1971-73).

Department of Communications Advisory Committee on CANUNET, (Canadian Universities Computer Network).

Computer Science Curriculum Committee, Ontario Department of Education.

ACM Awards committee from 2001 to 2003 and during that time chaired the committee judging the participants at the Intel International Science and Engineering Fair (ISEF).

JOURNAL REFEREEING ACTIVITIES

Computer Networks and ISDN Systems

Software Practice and Experience

Electronic Publishing, Organization, Dissemination and Design

Communications of the ACM

IEEE Software

Software Engineering for Large-scale Multi-Agent Systems 2003 (SELMAS03)

International Journal of Technology, Knowledge and Society

IEE Software

Scientia

Elsevier Information Science

Elsevier Computers in Biology and Medicine