

# **Curriculum Vitae**

**GORDON W. ROBERTS**

**May 18, 2017**

Department of Electrical & Computer Engineering  
McGill University  
3480 University Street, Montreal,  
Quebec, Canada H3A 0E9

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# Personal Data

**Name:** Gordon Walter Roberts

**Date of Birth:** November 3, 1959

**Place of Birth:** Toronto, Ontario, Canada

**Nationality:** Canadian

**Home Mailing Address:** 139 Percival Avenue  
Montreal-West, Quebec  
Canada H4X 1T7

**Home Telephone No.:** (514) 439-8657

**Office Telephone No.:** (514) 398-6029

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# Employment

Jan. 01/ present: McGill University, Dept. of Electrical & Computer Engineering.

*Full Professor*

Jan 15/ 22: McGill University, Dept. of Electrical & Computer Engineering.

*James McGill Professor (Tier 1 Canada Research Chair Renewal)*

Jan 08/ 14: McGill University, Dept. of Electrical & Computer Engineering.

*James McGill Professor (Tier 1 Canada Research Chair Renewal)*

July 04/ April 05: DFT Microsystems Canada, Inc.

*Chief Technical Officer (Leave of Absence, McGill University)*

Nov. 02/ Jun 04: DFT Microsystems Canada, Inc.

*Chief Executive Officer (Leave of Absence To Start McGill Spin-Off)*

Jan 01/ 07: McGill University, Dept. of Electrical & Computer Engineering.

*James McGill Professor (Tier 1 Canada Research Chair)*

June 95/07: McGill University, Dept. of Electrical Engineering.

*Director, Microelectronics and Computer System Laboratory*

June 95/Dec 00: McGill University, Dept. of Electrical & Computer Engineering.

*Associate Professor*

Sept 96/Aug 97: Mitel Semiconductor Limited, Kanata, Ontario, Canada

*Analog Integrated Circuit Designer*

June 92/present: Professional Engineer

*Registered in Province of Ontario.*

Sept 89/Aug 95: University of Toronto, Dept. of Electrical Engineering.

*Adjunct Professor*

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Sept 89/May 95: McGill University, Dept. of Electrical Engineering.

*Assistant Professor*

May 83/ Sept 83, May 84/Sept 84: Northern Telecom Canada Limited, Bramalea, Ontario.

*Failure Analysis Engineer*

## Academic Record

### Degrees:

1985/89: Ph.D. - University of Toronto, Dept. of Elec. Eng., Electronics Group.

Thesis: Generalization and Applications of the Intermediate Function Technique

Supervisor: Dr. A.S. Sedra

1983/85: M.A.Sc. - University of Toronto, Dept. of Elec. Eng., Electronics Group.

Thesis: Switched-Capacitor State-Space Filters

Supervisors: Drs. A.S. Sedra and W.M. Snelgrove

1978/83: B.A.Sc. - University of Waterloo, Electrical Engineering.

Co-Op Engineering Program

### Awards:

#### *Teaching Awards:*

2009-2016 Education Award, *bourse d'enseignement en genie*, Ministère de l'Éducation, du Loisir et du Sport, Quebec Government.

2000-2001 Principal's Prize for Excellence in Teaching, University-Wide Award, McGill University.

1994-1995 Teaching Award, Department of Electrical Engineering, McGill University.

1993-1994 Outstanding Departmental Teacher Award, Department of Electrical Engineering, McGill University.

1992-1993 Engineering Class of 51' Award for Outstanding Teaching, Faculty of Engineering, McGill University.

1992-1993 Overall Best Teacher Award, Department of Electrical Engineering, McGill University.

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1987-1988 Outstanding Teaching Assistant Award, University of Toronto.

***Research Awards:***

2015 Renewal of the James McGill Professorship of Electrical and Computer Engineering, McGill University (2015-2022) (*The James McGill Professorship Award is equivalent to a CRC tier 1 award*).

2008 Renewal of the James McGill Professorship of Electrical and Computer Engineering, McGill University (2008-2014) (*The James McGill Professorship Award is equivalent to a CRC tier 1 award*).

2007 Engineering Council Outstanding Performance Award, National Semiconductor Corporation.

2006 Best Panel Award - Moderator, "Analog Test Resource Partitioning - Is Convergence on the Horizon?" 2005 VLSI Test Symposium, IEEE Computer Society.

2004 Elected as a Fellow of the IEEE for contributions to the design and test of analog and mixed-signal integrated circuits, and education

2001 Recipient of the James McGill Professorship of Electrical and Computer Engineering, McGill University (2001-2007) (*The James McGill Professorship Award is equivalent to a CRC tier 1 award*).

2001-2003 Distinguished Lecturer of the IEEE Circuits and Systems Society.

2000 Best Paper Award, IEEE International Test Conference.

2000 Best Tutorial Award, Test Technology Technical Council of the IEEE Computer Society.

1999 NSERC Synergy Award given to the Canadian Microelectronics Corporation and McGill University and other academic institutions; Prof. Roberts served on its technical advisory board at the time.

1998-2000 Distinguished Lecturer of the IEEE Computer Society.

1994 Honorable Mention Award for Best Paper, IEEE International Test Conference.

1993 Honorable Mention Award for Best Paper, IEEE International Test Conference.

***Student Awards Under Prof. Roberts Direct Supervision:***

2015 V. Hippoman, J. Jarnik and A. MacDonald, Recipient of the 1<sup>st</sup> Prize, Senior Undergraduate Projects, "Solar Streetlight," supervisor G. W. Roberts, Undergraduate Poster Competition, April 2015.

2011 A. Chowdhury, Recipient of the Best Student Paper Award for paper entitled: "Performance Investigation Of A 1-Bit Periodic  $\Delta\Sigma$  Phase-Signal Generator For Mixed-Signal Embedded Test," by A. Chowdhury and G. W. Roberts, Proceedings of the International Conference on Electronic Measurement & Instruments, Chengdu, China, August 2011.

2008 C. Taillefer, Recipient of the 2<sup>nd</sup> Place Best Student Paper Award, for the paper "Delta-Sigma Analog-to-Digital Conversion via Time-Mode Signal Processing," by C. Taillefer and G. W. Roberts, IEEE 2007 International

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2006	Symposium on Circuits and Systems, New Orleans, USA, May 2007. M. Safi-Harb, Recipient of the Best Student Paper Award, for the paper entitled: “Embedded narrow pulse measurement in digital CMOS,” by M. Safi-Harb and G. W. Roberts, IEEE 2006 Instrumentation and Measurement Technology Conference (International Award).
2006	M. Safi-Harb, second place in the Operational Chip Design Category of the 2006 IEEE DAC/ISSCC Student Design Contest for the paper entitled: “Increasing the Time Dynamic Range of Pulse Measurement Techniques in Digital CMOS,” by M. Safi-Harb and G. W. Roberts (International Award).
2004	M. Hafed, Recipient of the Inaugural 2004 Network of Centers of Excellence (NCE) Young Innovator Award (National Award).
2003	M. Shafi-Harb, Recipient of the 2003 Annual Micronet Workshop Best Paper Award for the paper entitled: “Low power sigma-delta ADCS for ADSL Applications in 0.18 micron CMOS Technology” (National Award).
2002	M. Hafed, Recipient of the D. W. Ambridge Prize (awarded to an outstanding Ph.D. candidate in any field of Science and Engineering at McGill University) for the thesis entitled: <u>Analog and Mixed-Signal Test Methods Using On-Chip Embedded Test Cores</u> , <i>Ph.D. Thesis</i> , McGill University, November 2002 (University-wide Award).
2000	M. Hafed, Recipient of the 2000 Annual Workshop Micronet Best Paper Award for the paper entitled: “A Complete Mixed-Signal Test System” (National Award).

***Leadership Awards or Recognition:***

2015	Outstanding Contribution Award, IEEE Philadelphia Section/ IEEE International Test Conference.
2014	Meritorious Service Award, IEEE International Test Conference.
2010	Meritorious Service Award, IEEE Computer Society.
2006	Continuing Service Award, IEEE Computer Society.
2005	Certificate of Appreciation, IEEE Computer Society.
2004	Outstanding Contribution Award, IEEE Computer Society.
2004	Golden Core Member, IEEE Computer Society.
2002	Certificate of Appreciation, Area Editor, IEEE Design & Test Magazine.
2001	Certificate of Appreciation, IEEE Computer Society.
1997	Certificate of Appreciation, Associate Editor, IEEE Circuits and Circuits Society.
1996	Certificate of Appreciation, Board Member, IEEE Circuits and Circuits Society.

***Award Nominations:***

2000-2001	Steacie Award, Outstanding Research Contribution by Individual Under 40 years of Age, McGill University Nominee.
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1995-1996	Engineering Class of 51' Award for Outstanding Teaching, Faculty of Engineering, McGill University.
1991-1992	Engineering Class of 51' Award for Outstanding Teaching, Faculty of Engineering, McGill University.

## **Professional Appointments:**

### ***Offices Held:***

Member of the Test Technical Board of Cypress Semiconductor, 2013-2016.  
 Member of the Board of Directors, The Canadian Microsystems Corporation, 2005-2007.  
 President and Chief Executive Officer of DFT MicroSystems Canada, Inc., 2002 (Nov) -2004 (July).  
 Association of Professional Engineers of Ontario, 1995-present.  
 Member of the Board of Directors, DFT MicroSystems, Inc., 2001-2004.  
 Member of the Board of Directors, The Canadian Microelectronic Corporation, 1999-2005.  
 Member of the Technical Board of Advantest America, 2002-2003.  
 Member of the Association of Professional Engineers of Ontario, 1995-present.  
 Steering committee of the IEEE International Test Conference, 2001-present.  
 Distinguished Lecturer, IEEE Circuits and Systems Society, 2000-2002.  
 Distinguished Lecturer, IEEE Computer Society, 1996-1999.  
 IEEE Press Liaison for the Circuits and Systems Society, 1997-2000.  
 Board of Governors of the IEEE Circuits and Systems Society, 1993-1995.

### ***Committee Memberships:***

Founding member of the Canadian Printable Electronics Industry Association, 2014-16.  
 Member of the technical program committee for the IEEE International Test Conference (ITC), 1997-2011, 2013-2016; Program Chair in 2003; Vice-General Chair, 2008, 2012; General Chair, 2009, 2013.  
 Member of the technical program committee for the IEEE Design Automation Conference, 2005-2007.  
 Member of the technical program committee for the IEEE Custom Integrated Circuits Conference, 2001-2014; Chair of the reliability, debug and test subcommittee, 2003-2005. 2008. Exhibits Chair 2011-2012.  
 Member of the analog signal processing committee for the IEEE Circuits and Systems Society, 1995-present; Chair, 1999.  
 Chair of the analog signal processing technical program committee for the IEEE International Symposium on Circuits and Systems (ISCAS), 1999.  
 Chair of the VLSI technical program committee for ISCAS, 1998.  
 Judge for the best paper competition for the 2001-2005, 2008-2014 IEEE ITC; 2000 IEEE VLSI Test Symposium.  
 Judge for the student best paper competition at the 1999 ISCAS.  
 Judge for the Vision 2020 best paper award, 2012, 2014, 2015.  
 Member of the technical program committee for the IEEE European Design & Test Conference, 1995.

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External referee for the NSERC, Catalyst Foundation and NSF Grant Committees: 1992-present.

Member of the senate committee on Technology Transfer, McGill University, 2003-2006.

Canadian Microelectronic Corporation (CMC):

Nomination Committee for Board of Directors, 2003-2005.

Technical Advisory Committee (TAC), 1994-2003.

Steering Committee, 1998-1999.

Awards Committee, 1993; 1995; Chair 2001.

Standing Committee on Test and Measurement Strategy, 1994-1998.

### **Editorial Responsibilities:**

Guest Editor, IEEE, Design & Test of Computers, 2014

Guest Editor, IEEE Transactions of Circuits and Systems-II: Analog and Digital Signal Processing, March 1999.

Associate Editor, IEEE, Design & Test of Computers, July/96 - July/00.

Associated Editor, IEEE Transaction on Circuits and Systems, July/95 - July/97.

Reviewer for the following list of internationally recognized electrical engineering journals:

Transactions on Circuits and Systems, IEEE.

Proceedings on Circuits and Systems, IEE.

Design and Test Magazine, IEEE.

Electronic Letters, IEE.

International Symposium on Circuits and Systems (ISCAS), IEEE.

International Test Conference (ITC), IEEE.

Midwest Symposium on Circuits and Systems, IEEE.

Analog Integrated Circuits and Signal Processing, Kluwer Academic Publishers.

European Design & Test Conference.

### **Courses Taught:**

#### ***Undergraduate:***

- 1) First-level undergraduate course in Electronic Circuits; maximum enrollment of 100 students; taught each year since 1998 – present.
- 2) Second level undergraduate course in Electronic Circuits; maximum enrollment of 120 students; taught each year since 1990 – 1997.
- 3) Introduction to Mixed-Signal Testing; maximum enrollment of 30 students; new course beginning 2000. Texas Instruments donated \$1,000,000 worth of equipment. CFI program provide an additional tester values at \$1.8 million CDN.

#### ***Graduate:***

- 1) graduate level course in Analog Microelectronic Circuits; maximum enrollment of 30 students; taught once a year beginning Sept. 1990.



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- 2) graduate level course in Analog Signal Processing for Integrated Circuits; maximum enrollment of 20 students; taught once a year beginning Jan. 1991.
  - 4) graduate level course in VLSI Design; maximum enrollment of 8 students; taught each year since 1991.
  - 5) graduate level course in VLSI Testing; maximum enrollment of 6 students; taught each year since 1999.
  - 6) graduate level course in Analog VLSI and Neural Networks; maximum enrollment of 20 students; taught only once between Jan - April, 1990.

***Industrial:***

- 1) Acted as the lead academic for the Strategic Microelectronic Consortium Bridgecamp held at McGill University 1998, 1999 and presently schedule for 2001. Prof. Roberts gave 14 lectures on advanced analog CMOS IC design and supervised laboratory IC work.
- 2) Gave numerous tutorials (>10) at IEEE conferences worldwide on topics related to IC design and test. Winner of the Best Tutorial Award, Test Technology Technical Council of the IEEE Computer Society, 2000.
- 3) Taught numerous specialized courses at the following companies at various locations around the world: Texas Instruments, Teradyne, Lucent Technologies, IBM, Agere Technologies, Agilent Technologies, Intel, Advantest America, Inc., National Semiconductor, General Electric, Medtronic, Qualcomm and Practical Engineering.
- 4) Served/serving on test technical boards of Advantest America, Cypress Semiconductors and Canadian Microelectronics/Microsystems Corporation; provide technical and management advice about design and test technology.

**Student Theses Supervised:**

Degree	Successfully Completed	In Progress
Ph. D.	13	6
M. Eng.	44	3
B Eng. (Honors Thesis)	36	1
B. Eng. (Senior Project)	112	6
<b>TOTAL</b>	<b>205</b>	<b>16</b>

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# **Invited Talks/Tutorials/Expert Panels**

## **(2007-2015)**

1. Principles of subsampling and it's application to low-cost mixed-signal testing, Invited Tutorial, Ciena Corporation, Ottawa, Canada, June 2016.
2. G. W. Roberts, "Analog/Mixed-Signal Test Technology and Its Impact on Semiconductor System Design," Invited for keynote presentation at the 2015 Texas Analog Center of Excellence Symposium, Dallas, Texas, 19th Oct. 2015.
3. G. W. Roberts, "Analog IPs in a commoditized and fragmented market: Challenge or Opportunity?," IEEE International Workshop on Test and Validation of High Speed Analog Circuits (Panel Discussion), Anaheim, California, Oct. 9, 2015.
4. G. W. Roberts, "Two Decades of Mixed-Signal Test – looking back and one decade ahead," Invited for keynote presentation at the IEEE International Mixed-Signal Test Workshop, Paris, France, 24<sup>th</sup> June 2015.
5. G. W. Roberts, "Design For Testability: Mixed-Signal and Analog Considerations," invited presentation at Huawei, Shanghai, China, Nov. 21, 2014.
6. G. W. Roberts, "Adaptive Manufacturing Test Methods," invited presentation at Texas Instruments, Shanghai, China, Nov. 20, 2014.
7. G. W. Roberts, "Test-Time Reduction Methods For Mixed-Signal Circuit Manufacturing," invited presentation at Texas Instruments, Shanghai, China, Nov. 20, 2014.
8. G. W. Roberts, "Design For Testability: Mixed-Signal and Analog Considerations," invited presentation at Texas Instruments, Shanghai, China, Nov. 18, 2014.
9. G. W. Roberts, "Firing line questions on: Teaching an Old Dog New Tricks: Views on the Future of Mixed-Signal IC Design, B. Murmann," International Test Conference, Seattle, Washington, USA, Oct. 22, 2014.
10. G. W. Roberts, "Firing line questions on: Low-Cost Back-End Signal Interleaved Signal Acquisition Using Free Running Undersampling Clocks and Mixing Signals," A. Chatterjee," International Test Conference, Seattle, Washington, USA, Oct. 21, 2014.
11. G. W. Roberts, "Measuring attoFarad Capacitances in A Production Environment," invited presentation at Cypress Semiconductors, Santa Clara, California, USA, Oct. 10, 2014.
12. G. W. Roberts, "Adaptive Manufacturing Test Methods," invited presentation at Texas Instruments, Dallas, Texas, Aug. 28, 2014.
13. G. W. Roberts, "Test-Time Reduction Methods For Mixed-Signal Circuit Manufacturing," invited presentation at Texas Instruments, Dallas, Texas, Aug. 27, 2014.
14. G. W. Roberts, "Design For Testability: Mixed-Signal and Analog Considerations," invited presentation at Texas Instruments, Dallas, Texas, Aug. 27, 2014.

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15. G. W. Roberts, "General Principles of Time-Mode Signal Processing," invited presentation at Cypress Semiconductors, Santa Clara, California, USA, Jul. 11, 2014.
  16. G. W. Roberts, "Test Engineering Psychology And The Means To Rise Above It," invited presentation at Cypress Semiconductors, Santa Clara, California, USA, Jan. 17, 2014.
  17. G. W. Roberts, "Reducing The Analog-Digital Productivity Gap Using Time-Mode Signal Processing," invited presentation at Silicon Laboratories, Austin, Texas, USA, Dec. 13, 2013.
  18. G. W. Roberts, "Reducing The Analog-Digital Productivity Gap Using Time-Mode Signal Processing," Invited keynote presentation, 2013 International Conference on Analog VLSI Circuits, Montreal, Canada, Oct. 2013.
  19. G. W. Roberts, "Challenges of SerDes and DDR Defect Testing and AC Spec Measurements," panel presentation at IEEE International Test Conference, Anaheim, California, USA, Nov. 12, 2013.
  20. G. W. Roberts, "Clock and Serial Data Communications Channel Measurements," half-day tutorial presentation at IEEE International Test Conference, Anaheim, California, USA, Sept. 8, 2013.
  21. G. W. Roberts, "Post-Silicon Validation and Test in Huge Variance Era," panel presentation at IEEE VLSI Test Symposium, Berkeley, California, USA, May 1, 2013.
  22. G. W. Roberts, "Analog Test Using Digital Signals," Cypress Semiconductors, Santa Clara, California, USA, Apr. 11, 2013.
  23. G. W. Roberts, "Time-Mode Analog Signal Processing," invited presentation at the Best Practice Forum of the Information Technology Association of Canada, Montreal, Quebec, Canada, Mar. 13, 2013.
  24. G. W. Roberts, "Time-Mode Analog Signal Processing," invited presentation at the Best Practice Forum of the Information Technology Association of Canada, Toronto, Ontario, Canada, Mar. 14, 2013.
  25. G. W. Roberts, "Time-Mode Signal Processing Will Reduce The Analog-Digital Design Gap," invited presentation at the University of Tokyo, Tokyo, Japan, Dec. 11, 2012.
  26. G. W. Roberts, "Time-Mode Signal Processing and Its Impact On Analog/Mixed-Signal Testing," invited presentation at the IEEE Custom Integrated Circuits Conference, San Jose, California, USA, Sept. 12, 2012.
  27. G. W. Roberts, "Managing Process Variance in Analog Designs," panel presentation at IEEE International Test Conference, Anaheim, California, USA, Nov. 8, 2012.
  28. G. W. Roberts, "Time-Mode Signal Processing and Its Impact On Analog/Mixed-Signal Testing," invited presentation at the Southwest DFT Conference, Austin, Texas, USA, May 3, 2012.
  29. G. W. Roberts, "Challenges In Large Volume Production Of Analog/Mixed-Signal Circuits," invited full-day tutorial presentation at the IEEE Design, Automation & Test Conference in Europe, Dresden, Germany, Mar. 12, 2012.
  30. G. W. Roberts, "Time-Mode Signal Processing and Its Impact on Analog/Mixed-Signal/RF Testing," invited keynote presentation at the IEEE Asian Test Symposium, New Delhi, India, Nov. 22, 2011.
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31. G. W. Roberts, "Time-to-Digital and Digital-To-Time Converters and Other Useful Applications Of Time-Based Signal Processing," invited presentation at the University of Iowa, Iowa, USA, Nov. 18, 2010.
  32. G. W. Roberts, "Time-to-Digital and Digital-To-Time Converters and Other Useful Applications Of Time-Based Signal Processing," invited half-day tutorial presentation at the IEEE Custom Integrated Circuits Conference, Santa Clara, California, USA, Sept. 2009.
  33. G. W. Roberts, "Time-to-Digital and Digital-To-Time Converters and Other Useful Applications Of Time-Based Signal Processing," invited presentation at the University of Massachusetts, Massachusetts, USA, Apr. 10, 2010.
  34. G. W. Roberts, A Brief Overview of Mixed-Signal Production Test For The Beginner," invited presentation at the 2008 IEEE International Test Conference, San Jose, CA, Nov. 2008.
  35. G. W. Roberts, "Test Methods For Sigma-Delta Data Converters and Related Devices," half-day tutorial at the 21st Annual Symposium on Integrated Circuits and Systems Design, SBCCI 2008, Gramado, Brazil, Sept. 1-4, 2008.
  36. G. W. Roberts "Time-Domain Signal Processing Techniques" invited keynote presentation at the IEEE CASS/ACM/SBC/SBMicro 21st Symposium on Integrated Circuits and Systems Design, Gramado, RS, Brazil, Sept., 2008.
  37. G. W. Roberts, "The Problem With Analog/Mixed-Signal Test – Not Enough Feedback," invited keynote presentation at Texas Instruments, Dallas, Texas, Aug. 8, 2008.
  38. G. W. Roberts, "The Problem With Analog/Mixed-Signal Test – Not Enough Feedback," invited keynote presentation at IEEE International Test Conference, Austin, Texas, Oct. 23, 2007.
  39. G. W. Roberts, "Make Analog Testing As Robust As Digital," panel presentation at IEEE VLSI Test Symposium, Berkeley, California, USA, May 8, 2007.

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# Publications

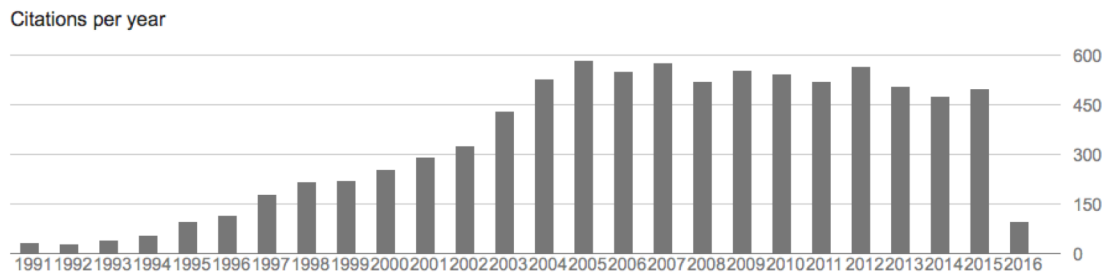
## MOST SIGNIFICANT RESEARCH CONTRIBUTIONS

(Names in bold style indicate that they are or were a student/trainee under Prof. Roberts' supervision).

Prof. G. Roberts is involved in two separate but related areas of scholarly engineering activity; specifically, the design and synthesis of analog and mixed-signal integrated circuits using nanometer technologies, and methods to verify and test mixed-signal integrated circuits in large volume manufacturing. He has published over 200+ articles in leading Institute Of Electrical and Electronic Engineers (IEEE) journals and conferences. Over his 25<sup>+</sup>-year career at McGill University, he has made a significant contribution to the field of electronic engineering. According to Google Scholar his h-index is a respectable 39 and his i10-index is 95. An h-index of 39 indicates that 39 papers are cited at least 39 times. Further analysis reveals that 50 papers are cited with more than 25 citations and 9 papers have over 100 citations. To further illustrate his impact on the field of electrical engineering, Fig. 1 below display the number of citations his work has garnered every year since 1991. It is notable to note that since 2004 his work has consistently received more than 450 citations each year.

Prof. Roberts has co-written seven textbooks, of which, the most significant one is: *An Introduction to Mixed-Signal Test and Measurement* by Oxford University Press, now in its second edition (2011) and is also translated into Chinese. This textbook provides the framework for test researchers to understand the general problem facing test engineering and how past test problems were solved. For the most part, test engineering is a system design endeavor, as it requires a multifaceted understanding of electronics, signal processing, robotics, mechanics and material science, combined with a sound understanding of economics. As the first introductory textbook of this kind, it has helped accelerate student understanding of this multi-billion dollar field and has helped to focus research around important industrial problems.

Prof. Roberts made major contributions to the world-renown textbook on Microelectronic Circuits by Sedra and Smith. A textbook that has been used in the undergraduate electronics curriculum at McGill University for over 25 years, and continues to this day. Through a collaborative effort with Sedra and Roberts, a companion book on *SPICE* was developed and marketed with the main course textbook. This book continues to be used in undergraduate programs around the world. Today, some of the SPICE material has



**Fig. 1: Number of Paper Citations Per Each Year Since 1991 As Reported By Google Scholar June 2016.**

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been pulled into the main textbook of Sedra and Smith for various marketing reasons. It is fair to say that Prof. Roberts contributed to this portion of this highly successful textbook and has influenced the education of over 1 million students worldwide (as indicated by Oxford University Press Web Site).

The four most significant research publications in terms of the number of citations as listed by Google Scholar by Prof. Roberts are the following:

- [1] G. W. Roberts and A.S. Sedra, "All current-mode frequency selective circuits." Electronics Letters, Vol. 25, No. 12, pp. 759-761, June 1989 (citation count of 385).
- [2] G. W. Roberts and A. S. Sedra, "A general class of current amplifier-based biquadratic filter circuits," IEEE Trans. on Circuits and Systems -- I: Fundamental Theory and Applications, vol. CAS-39, No. 4, pp. 257-263, April 1992 (citation count of 143).
- [3] **M. F. Toner** and G. W. Roberts, "A BIST Scheme for an SNR, Gain Tracking, and Frequency Response Test of a Sigma-Delta ADC," IEEE Trans. on Circuits and Systems -- II: Analog and Digital Signal Processing, Vol. 42, No. 1, pp. 1-15, Jan. 1995. Also appears in the 25<sup>th</sup> and 35<sup>th</sup> Anniversary Compendium of Papers from the International Test Conference, 1970 – 1994, 1970-2004 (citation count of 159).
- [4] **D. Perry** and G. W. Roberts, "The Design of Log-Domain Filters Based On the Operational Simulation of LC Ladders," IEEE Trans. on Circuits and Systems -- II: Analog and Digital Signal Processing, Vol. 43, No. 11, pp. 763-774, Nov. 1996 (citation count of 139).

Prof. Roberts has other works that have citations higher than these but these are not listed here, as they are either textbooks or research works that he was not the lead author. It is interesting to note that ref. [2] and [3] above is listed by the editorial board of the IEEE Transactions of Circuits and Systems to be ranked among the top-cited papers in their transactions since 1990 (see <http://tcas2.polito.it/editor/top-cited-TCAS-II.htm>). An extended version of ref. [1] also appeared in a related journal of the Transactions of Circuits and Systems and is also ranked to be in the top-cited papers since 1990 (see <http://tcas1.polito.it/editor/top-cited-TCAS-I.htm>). In addition, the next three papers can be found in the 25<sup>th</sup> and/or 35<sup>th</sup> Anniversary Compendium of Papers from the International Test Conference, 1970 – 1994, 1970-2004. All three papers were awarded a best paper or honorable mention paper prize, as indicated below:

- [4] **M. Hafeed, N. Abaskharoun,** and G. W. Roberts, "A Stand-Alone Integrated Test Core For Time And Frequency Domain Measurements," Proc. IEEE International Test Conference, Atlantic City, NJ, pp. 1031-1040, October 2000. **Best Paper Award. Also awarded 2000 Micronet Workshop Best Paper Award.**
- [5] **A. K. Lu** and G. W. Roberts, "An analog multi-tone signal generator for built-in self-test applications," Proceedings of the IEEE International Test Conference, Washington, pp. 650-659, Oct. 1994. **Awarded Honorable Mention Best Paper Award.**
- [6] **M. F. Toner** and G. W. Roberts, "Towards Built-In-Self-Test for SNR testing of a mixed-signal IC," IEEE International Symposium on Circuits and Systems, Chicago, Illinois, pp. 1599-1602, May, 1993. **Awarded Honorable Mention Best Paper Award.**

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Other significant contributions include the following student papers with awards:

- [7] **A. Chowdhury, Recipient of the Best Student Paper Award** for paper entitled: "Performance Investigation Of A 1-Bit Periodic  $\Sigma\Delta$  Phase-Signal Generator For Mixed-Signal Embedded Test," by A. Chowdhury and G. W. Roberts, Proceedings of the International Conference on Electronic Measurement & Instruments, Chengdu, China, August 2011.
- [8] **C. Taillefer, 2007 Recipient of the 2<sup>nd</sup> Place Best Student Paper Award**, for the paper "Delta-Sigma Analog-to-Digital Conversion via Time-Mode Signal Processing," by C. Taillefer and G. W. Roberts, IEEE 2007 International Symp. on Circuits and Systems, New Orleans, May 2007.
- [9] **M. Safi-Harb, 2006 Recipient of the Best Student Paper Award**, for the paper entitled: 'Embedded narrow pulse measurement in digital CMOS,' by M. Safi-Harb and G. W. Roberts, IEEE 2006 Instrumentation and Measurement Technology Conference (International Award).
- [10] **M. Safi-Harb**, second place in the Operational Chip Design Category of the **2006 IEEE DAC/ISSCC Student Design Contest** for the paper entitled: "Increasing the Time Dynamic Range of Pulse Measurement Techniques in Digital CMOS," by M. Safi-Harb and G. W. Roberts.
- [11] **M. Hafeed, Recipient of the Inaugural 2004 Network of Centers of Excellence (NCE) Young Innovator Award**.
- [12] **M. Shafi-Harb, Recipient of the 2003 Annual Micronet Workshop Best Paper Award** for: "Low power sigma-delta ADCS for ADSL Applications in 0.18 micron CMOS Technology".
- [13] **M. Hafeed, Recipient of the 2000 Annual Workshop Micronet Best Paper Award** for the paper entitled: "A Complete Mixed-Signal Test System."
- [14] **M. Hafeed, Recipient of the D. W. Ambridge Prize** (awarded to an outstanding Ph.D. candidate in any field of Science and Engineering at McGill University) for the thesis entitled: Analog and Mixed-Signal Test Methods Using On-Chip Embedded Test Cores, *Ph.D. Thesis*, McGill University, November 2002.

Finally, the following lists of McGill University patents provided the technical base for a McGill start up company called DFT Microsystems, Inc located in downtown Montreal, just off Phillip's square. DFT Microsystems Inc. provides instrumentation solutions for high-speed timing applications (pico-second measurements and generation) in high-volume production.

- [15] G. W. Roberts and C. Tam, Method and Device For Use In DC Parametric Tests, US Patent #6,727,834, McGill University, Filed: May 1, 2003, Granted: April 27, 2004.
- [16] G. W. Roberts and A. Chan, Timing Measurement Device Using A Component-Invariant Vernier Delay Line," US Patent #6,850,051, McGill University, Filed: March 26, 2002, Granted: Feb. 1, 2005.
- [17] G. W. Roberts, and M. Hafeed, Integrated Excitation/Extraction System for Analog Test and Measurement, US Patent 6,931,579, McGill University, Filed: April 28, 2000, Granted: Aug. 16, 2005.

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- [18] G. W. Roberts, S. Laberge, M. Hafed, Programmable DC Voltage Generator, US Patent 6,914,548, McGill University, Filed: April 28, 2000, Granted: July 5, 2005.

Six-million dollars US of venture capital was raised in 2002 by Prof. Roberts to seed the start of this company, of which McGill is a partner. Today, DFT Microsystems now called Introspect Technology Inc. has revenues that exceed 1 million dollars CDN and employs over 15 people, of which, the main technical/executive team are former graduate students of Prof. Roberts.

## OTHER RESEARCH CONTRIBUTIONS

### *Papers in Refereed Journals:*

- [19] **Y. Li** and G. W. Roberts, "Design of High-Order Delay-Locked Loops with a Fast-Settling-Zero-Overshoot Step Response and Large Jitter-Rejection Capabilities," submitted to the IEEE Transactions on Circuits and Systems I, Jan. 2017.
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- [238] G. Roberts and M. Yang, McGill University report of Invention filed on June 19, 2015 No. 16024 entitled "A Method to Realize Ultra-High Gain Voltage Amplifiers for General Purpose Analog Signal Processing."

***Graduate Theses Supervised:***

- [1] Ashish Ravichander, TBD, *M. Eng. Thesis*, McGill University, Start Date: Sept. 2016, End Date: TBD.
  - [2] Mahmood A. Mohammed, TBD, Doctoral Supervised Graduate Student, McGill
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- University, Start Date: Sept. 2016, End Date: TBD.
- [3] Ahmed Emara, TBD, Doctoral Supervised Graduate Student, McGill University, Start Date: 09/2016, End Date: TBD.
  - [4] Wolfgang. Heger, TBD, *M. Eng. Thesis*, McGill University, Start Date: Sept. 2016, End Date: TBD.
  - [5] Young Gouk Cho, TBD, *M. Eng. Thesis*, McGill University, Start Date: Jan. 2015.
  - [6] Yan Li , Design of High-Order Delay-Locked Loops for Frequency Selectivity, *M. Eng. Thesis*, McGill University, Jan. 2017. Start Date: Sept. 2014, End Date: Jan. 2017.
  - [7] Ming Yang, Synthesis of Ultra-High Gain Operational Transconductance Amplifiers Using a Generalized Controller-Based Compensation Method, *M. Eng. Thesis*, McGill University, April 2016, Start Date: Sept. 2013, End Date: August 2016.
  - [8] Ali Shoukry, Top-Down Design Methodology from a Transfer Function Perspective for a Class of Integrator-Based Controller-Compensated High Order Amplifiers, *M. Eng. Non-Thesis*, McGill University, Start Date: May 2013, End Date: August 2015.
  - [9] Sohyel. Z. Shalmani, Doctoral Supervised Graduate Student, École de technologie supérieure, Jointly Supervised, Prof. Ghyslain Gagnon, Start Date: 09/2013, End Date: TBD.
  - [10] Mohammad. Shahidzadeh Mahani, Doctoral Supervised Graduate Student, McGill University, Start Date: 09/2013, End Date: TBD.
  - [11] Dong An, Doctoral Supervised Graduate Student, McGill University, Start Date: 01/2013, End Date: TBD.
  - [12] Adam Gordon, Printed Electronics, *M. Eng. Thesis*, McGill University, Start Date: Sept. 2012.
  - [13] Steven Bielby, An Embedded Probabilistic Test Instrument For Built-in-Self-Test Methods, *M. Eng. Thesis*, McGill University, April 2015. Start Date: Sept. 2012.
  - [14] Moataz Abdelfattah, Doctoral Supervised Graduate Student, McGill University, Jointly Supervised, Prof. Chodavarapu. Start Date: 09/2010, End Date: TBD.
  - [15] Omar Abdelfattah, Design of High-Frequency Phase-Locked Loops for Wide Tuning-Range and Sub-1V Operation in Modern CMOS, Doctoral Supervised Graduate Student, McGill University, Jointly Supervised, Prof. Shih. Start Date: 09/2010, End Date: 12/2015.
  - [16] T-T. Hung, Doctoral Supervised Graduate Student, McGill University, Jointly Supervised, Prof. Shih. Start Date: 09/2010, End Date: TBD.
  - [17] S. Lin, Three-Dimension Integrated Circuit Design and Through-Silicon Via Characterization, *M. Eng. Thesis*, McGill University, Aug. 2012. Start Date: Jan 2009.
  - [18] M. Macedo, Calibration and High Speed Techniques for CMOS Analog-to-Digital Converters, *M. Eng. Thesis*, McGill University, Aug. 2012. Start Date: Jan 2009.
  - [19] G. Gal, Design of Fractional-N Phase Locked Loops For Frequency Synthesis From 30 To 40 GHz, *M. Eng. Thesis*, McGill University, Aug. 2012. Start Date: Jan 2009.
  - [20] M. Ali-Bakhshian, Digital Processing of Analog Information Adopting Time-Mode Signal Processing, *Ph. D. Thesis*, McGill University, Aug. 2012. Start Date: Sep. 2006. (Senior IC Design Engineer, Synopsys, Toronto)
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- [21] P. Chopp, Doctoral Supervised Graduate Student, McGill University, Concurrent Supervision after the death of Prof. Anas Hamoui, Frequency-Translating Delta-Sigma Modulation for Bandpass Analog-to-Digital Conversion of High-Frequency Signals, Start Date: 01/01/2011, End Date: April 2012. (Senior IC Design Engineer, Synopsys, Toronto)
  - [22] A. Chowdhury, A Probabilistic Test Instrument Using  $\Sigma\Delta$  Phase Signal Generation Technique for Mixed Signal Embedded Test, McGill University, April 2012. Start Date: Jan 2009.
  - [23] H. Hashemi, TBD, *M. Eng. Thesis*, McGill University, Start Date: Jan 2009.
  - [24] A. Ameri, Time-Mode Reconstruction IIR Filters for  $\Sigma\Delta$  Phase Modulation Applications, *M. Eng. Thesis*, McGill University, June 2011. Start Date: Jan 2008.
  - [25] T-Y. Tsai, Programmable Phase/Frequency Generator for System Debug and Diagnosis, *M. Eng. Thesis*, McGill University, July 2011. Start Date: Jan 2008.
  - [26] M. Oulmane, Integrated Solutions for Timing Jitter Measurement, *Ph. D. Thesis*, McGill University, October 2011. Start Date: Sep. 2001.
  - [27] S. Aouini, Extending Test Signal Generation Using Sigma-Delta Encoding Beyond The Voltage/Amplitude Domain, *Ph. D. Thesis*, McGill University, April. 2011. Start Date: Sep. 2006. (Senior IC Design Engineer, Ciena Corporation, Ottawa)
  - [28] K. Chuai, High-Order Phase-locked Loop Design and Test for Time-Mode Signal Processing Applications, *M. Eng. Thesis*, McGill University, July 2010. Start Date: Jan 2008.
  - [29] M. Guttman, Sampled-Data IIR Filtering Via Time-Mode Signal Processing, *M. Eng. Thesis*, McGill University, Feb. 2010. Start Date: Jan 2007.
  - [30] E. Yoo, Investigating CMOS Amplifier Design Using the Degrees of Design Freedom Method, *M. Eng. Thesis*, McGill University, June 2009. Start Date: Jan 2007.
  - [31] T. Alhajj, TCSIM: A Top-Down Approach To Mixed-Signal Circuits and Systems Design, *M. Eng. Thesis*, McGill University, February 2008. Start Date: Sept 2004.
  - [32] S. Hong, A Study of Time Amplifier and Time Amplifier-Based Time-to-Voltage Converter for Data Converter Applications, *M. Eng. Thesis*, McGill University, January 2008. Start Date: Sept 2003.
  - [33] C. Taillefer, "Analog-to-Digital Conversion Via Time-Mode Signal Processing," *Ph.D. Thesis*, McGill University, September 2007. Start Date: Sept. 2003.
  - [34] D. An, "A Pipelined Metastability-Free Time-To-Voltage Converter With Adjustable Resolution," *M. Eng. Thesis*, McGill University, August 2007. Start Date: Sept. 2004.
  - [35] M. Safi-Harb, "A Time-Based Approach For Multi-GHz Embedded Mixed-Signal Characterization And Measurement," *Ph.D. Thesis*, McGill University, April 2007. Start Date: Sept. 2003.
  - [36] S. Aouini, "A Programmable Analog Gaussian Noise Generator For Test Applications," *M. Eng. Thesis*, McGill University, August 2006. Start Date: Sept. 2003.
  - [37] P. Salib, Test Core for On-Chip Metal-Oxide-Semiconductor Capacitance Measurement, *M.Eng. Thesis*, McGill University, August 2005. Start Date: Sept. 2001.
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- [38] P. Levine, High-resolution Time Measurement and Calibration for On-Chip test Systems, *M.Eng. Thesis*, McGill University, July 2004. Start Date: Sept. 2002. (Assistant professor, University of Waterloo).
- [39] M. Hafed, Analog and Mixed-Signal Test Methods Using On-Chip Embedded Test Cores, *Ph.D. Thesis*, McGill University, November 2002. Start Date: Sept. 1999. (Mixed-Signal IC Designer, DFT MicroSystems Canada, Montreal, Canada). Recipient of the D. W. Ambridge Prize (awarded to an outstanding Ph.D. candidate in any field of Science and Engineering at McGill University).
- [40] M. Shafi-Harb, Low-Power Low-Voltage High-Speed Delta-Sigma Analog-to-Digital Converters, *M.Eng. Thesis*, McGill University, March 2003. Start Date: Sept. 2000. (Ph.D. Candidate, McGill University).
- [41] C. Taillefer, Reducing Measurement Uncertainty in a DSP-Based Mixed-Signal Test Environment *M.Eng. Thesis*, McGill University, March 2003. Start Date: Sept. 2000. (Ph.D. Candidate, McGill University).
- [42] C. Fayomi, Circuit Techniques for Low-Voltage Deep Submicron CMOS Analog-To-Digital Converters *Ph.D. Thesis*, Ecole Polytechnique de Montreal, August 2003. Start Date: Sept. 1997. (Assistant Professor, University of Montreal du Quebec).
- [43] A. Chan, Circuits for Time and Frequency Domain Characterization of Jitter, *M.Eng. Thesis*, McGill University, November 2002. Start Date: Sept. 2000. (Mixed Signal IC Designer, DFT MicroSystems Canada, Montreal, Canada).
- [44] B. Pishdad, Nyquist-Rate Analog-to-Digital Conversion with Calibration, *M.Eng. Thesis*, McGill University, November 2002. Start Date: Sept. 2000. (Mixed-Signal IC Designer, DFT MicroSystems Canada, Montreal, Canada).
- [45] C. Tan, A DC Parametric Measurement System, *M.Eng. Thesis*, McGill University, November 2002. Start Date: Sept. 2000. (Mixed-Signal IC Designer, DFT MicroSystems Canada, Montreal, Canada).
- [46] S. Laberge DC Voltage Generation Using Periodic Bit-Stream Modulation, *M.Eng. Thesis*, McGill University, June 2002. Start Date: Sept. 2000. (Mixed-Signal IC Designer, DFT MicroSystems Canada, Montreal, Canada).
- [47] G. Duerden, The Development of Bipolar Log-Domain Filters in a Standard CMOS Process, *M.Eng. Thesis*, McGill University, June 2002. Start Date: Sept. 1999. (Mixed-Signal IC Designer, DFT MicroSystems Canada, Montreal, Canada).
- [48] Y. Wu, Monolithic Nyquist-Rate ADC With Digital Calibration, *M.Eng. Thesis*, McGill University, November 2001. Start Date: Sept. 1998. (Mixed-Signal IC Designer, Maxim, USA).
- [49] N. Chandra, A Top-Down Design Approach To Delta-Sigma Modulator Design, *M.Eng. Thesis*, McGill University, November 2001. Start Date: Sept. 1999. (Mixed-Signal IC Designer, General Electric, USA).
- [50] N. Abaskharoun, Circuits For On-Chip Sub-Nanosecond Signal Capture And Characterization, *M.Eng. Thesis*, McGill University, June 2001. Start Date: Sept. 1999. (Mixed-Signal IC Designer, Analog Devices, USA).
- [51] A. Aga, Monolithic Reconstruction Filters For Delta-Sigma Applications, *M.Eng. Thesis*, McGill University, June 2001. Start Date: Sept. 1999. (Mixed-Signal IC Designer, Marvell, USA).
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- [52] B. Dufort, Analog Signal Generation Using Delta-Sigma Modulation Techniques, *Ph.D. Thesis*, McGill University, 1999. Start Date: 1996 (Mixed-Signal IC Designer, Philips, New York, USA).
  - [53] A. Hematy, Digitally Programmable Analog Log-Domain Filters, *M.Eng. Thesis*, McGill University, November 1998. Start Date: Sept. 1996. (Mixed-Signal IC Designer, Maxim, USA)
  - [54] A. Hajjar, An Integrable Mixed-Signal Test System, *M.Eng. Thesis.*, McGill University, November, 1998. Start Date: Sept. 1996. (Mixed-Signal IC Designer, Maxim, USA)
  - [55] M. El-Gamal, Generalized Log-Domain Integrator Structure & Its Application to the Synthesis of High-Frequency and Low-Voltage Log-Domain Filters, *Ph.D. Thesis*, McGill University, 1998. Start Date: Jan. 1995. (Assistant Professor McGill University,)
  - [56] V. Leung, Analysis and Compensation of Log-Domain Filter Deviations due to Transistor Nonidealities, *M.Eng. Thesis*, McGill University, 1998. Start Date: Sept. 1996. (Analog IC Designer, Analog Devices, USA).
  - [57] C.-H. Leong, New Architectures for High-Order Bandpass Sigma-Delta Modulation in Digital-to-Analog Converters, *M.Eng. Thesis*, McGill University, 1998. Start Date: Sept. 1996. (Mixed-Signal IC Designer, Maxim, USA)
  - [58] L. Louis, A Study of Delta-Sigma Modulators for Analog-to-Digital Conversion, *M.Eng. Thesis*, McGill University, 1998. Start Date: Sept. 1996. (Analog IC Designer, Analog Devices, USA).
  - [59] J. Abcarius, High-Speed/Low-Cost Delta-Sigma Modulation Techniques for Analog-to-Digital Conversion, *M.Eng. Thesis*, McGill University, 1998. Start Date: Sept. 1996. (Mixed-Signal IC Designer, Maxim, USA)
  - [60] B. Veillette, On-Chip Characterization of Charge-Pump Phase-Locked Loops, *Ph.D. Thesis*, McGill University, 1998. Start Date: Sept. 1994. (Mixed-Signal IC Designer, Philips, New York, USA).
  - [61] M. F. Toner, MADBIST: A Scheme for Built-In Self-Test of Mixed Analog-Digital Integrated Circuits, *Ph.D. Thesis*, McGill University, 1996. Start Date: Sept. 1992.
  - [62] E. Hawrysh, Digital Architectures For Analog Signal Generation, *M.Eng. Thesis*, McGill University, 1996. Start Date: Sept. 1994.
  - [63] X. Haurie, The Design of High-Order Delta-Sigma Modulators and Oscillators, *M.Eng. Thesis*, McGill University, 1996. Start Date: Sept. 1993.
  - [64] R. Wodnicki, A CMOS Foveated Image Sensor, *M.Eng. Thesis*, McGill University, 1996. Start Date: Sept. 1993.
  - [65] B. Veillette, A Study of Delta-Sigma Oscillator Circuits, *M.Eng. Thesis*, McGill University, 1995. Start Date: Sept. 1993.
  - [66] D. Perry, The Design of Log-Domain Filters Based On the Operational Simulation of LC Ladders, *M.Eng. Thesis*, McGill University, 1995. Start Date: Sept. 1993.
  - [67] P. Sinn, A Performance Comparison of Switched-Current Structures, *M.Eng. Thesis*, McGill University, 1994. Start Date: Sept. 1991.
  - [68] I. Song, Design of Switched-Current Filters Using Bilinear Integrators, *M.Eng. Thesis*, McGill University, 1994. Start Date: Sept. 1991.
  - [69] A. K. Lu, Analog Signal Generation Using Delta-Sigma Modulation, *M.Eng. Thesis*, McGill University, 1994. Start Date: Sept. 1992.
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- [70] A. Bishop, An Adaptive Phase-Locked-Loop for a Video CODEC, *M.Eng. Thesis*, McGill University, 1992. Start Date: Sept. 1990.

***Undergraduate Thesis/Senior-Level Projects***

- [1] Andrew Lyons and Naaf Anowar, Print Electronic Component Evaluation, Senior ECSE 456 Undergraduate Project Report, Dec. 2016.
- [2] Chen Shen, Power Supply in Printed Electronics Circuit, Senior ECSE 499 Final Undergraduate Thesis Report, Dec. 2016.
- [3] Ling Kun Yang and Yutian Zheng, CAD For Printed Electronic Applications, Senior ECSE 456 Undergraduate Project Report, Dec. 2016.
- [4] Yannis Issiakhem, Wireless Sensor System Using Printed Electronics and Flexibles Substrates, Senior ECSE 499 Undergraduate Thesis Report, Dec. 2016.
- [5] Hongxuan (Baylor) Ge and Qice (Henry) Wang, Statistical Analysis of Test Data of Printed Electronics Manufacturing, Senior ECSE 456 Final Undergraduate Project Report, Dec. 2016.
- [6] Marc-Oliver Aidamouni , Victorio Morello and Jordan Benabou, Usable Light Tool Mobile Application, Senior ECSE 456 Final Undergraduate Project Report, Dec. 2016.
- [7] Alexandre Rekik and Rodrigo Mendoza Arbizu, Wireless Sensor System Using Printed Electronics and Flexible Substrates, Senior ECSE 456 Undergraduate Project Report, Dec. 2016.

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**Present-Day Student Count (since 2011)**

<b>Ph. D.</b>		<b>M. Eng.</b>	
<b>Graduate</b>	<b>On-Going</b>	<b>Graduate</b>	<b>On-Going</b>
1. Omar Abdelfattah, 2. Mohammad Ali-Bakhshian, 3. Philipp. Chopp, 4. Mourad Oumane, 5. Sadok Aouini	1. Mahmood A. Mohammed, 2. Ahmed Emara, 3. Sohyel. Z. Shalmani, 4. Mohammad Mahani, 5. Dong An 6. Moataz Abdelfattah 7. T-T. Hung	1. Ming Yang 2. Ali Shoukry 3. Steven Bielby 4. S. Lin, 5. M. Macedo, 6. G. Gal, 7. A. Chowdhury 8. A. Ameri, 9. T-Y. Tsai	1. Wolfgang. Heger 2. Young Gouk Cho 3. Yan Li 4. Adam Gordon
<b>5</b>	<b>7</b>	<b>9</b>	<b>4</b>

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**Present-Day Student Count (since 1989)**

<b>Ph. D.</b>		<b>M. Eng.</b>	
<b>Graduate</b>	<b>On-Going</b>	<b>Graduate</b>	<b>On-Going</b>
1. Omar Abdelfattah, 2. Mohammad Ali-Bakhshian, 3. Philipp Chopp, 4. Mourad Oumane, 5. Sadok Aouini 6. Chris .Taillefer 7. Mona Safi-Harb 8. Mohammad Hafed 9. Chris Fayomi 10. Benoit Dufort 11. Mourad El Gamal 12. Benoit Veillette 13. Michael Toner	1. Mahmood A. Mohammed, 2. Ahmed Emara, 3. Sohyel. Z. Shalmani, 4. Mohammad Mahani, 5. Dong An 6. Moataz Abdelfattah 7. T-T. Hung	1. Ming Yang 2. Ali Shoukry 3. Steven Bielby 4. Shudong Lin, 5. Marco Macedo, 6. George Gal, 7. Azhar Chowdhury 8. Ali Ameri, 9. Tsung-Yen Tsai 10. Kun Chuai 11. Michael Guttman 12. Euisoo Yoo 13. Tarek Alhajj 14. Simon Hong 15. Dong An 16. Sadok Aouini 17. Philip Salib 18. Peter Levine 19. Mona Safi-Harb 20. Chris Taillefer 21. Antonio Chan 22. Bardia Pishdad 23. Clarence Tan 24. Sebastien Laberge 25. Geoff Duerden 26. Yang Wu 27. Naven Chandra 28. Nasmy Abaskharoun 29. Arshan Aga 30. Arman Hematy 31. Ara Hajjar 32. Vince Leung 33. Choon Leong 34. Loai Louis 35. John Abcarius 36. Evan Hawrysh 37. Xavier Haurie 38. Robert Wodnicki 39. Beniot Veillette 40. Doug Perry 41. Peter Sinn 42. Irene Song 43. Albert Lu 44. Andy Bishop	1. Wolfgang. Heger 2. Young Gouk Cho 3. Yan Li 4. Adam Gordon 5. Ashish Ravichander
<b>13</b>	<b>7</b>	<b>44</b>	<b>4</b>



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# Research Funding

(text with strike through it is an unsuccessful grant application)

## Requested Research Funding:

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
2017/18	\$224,994	Flexible-Hybrid & Printed Detection and Monitoring System for Primary Nocturnal Enuresis	NSF/ Small Business Innovation Research (SBIR) grant
	TBD (LOI)	Ultra low power consumption wireless pressure micro sensor technology for brain injury.	CIHR-NSERC Collaborative Health Research Project
	\$60,000	Capteur de pression implantable à très faible consommation d'énergie (E. Harvey, J. Barralet and G. W. Roberts)	FQRNT / Team grant
	\$35 Million	Prototyping for Advanced Micro/Nano Systems Leading to Next Generation Manufacturing – CMC lead	CFI

## Current Research Funding:

2017/18	\$47,000x5 (\$235,000)	Design and Test Infrastructure For The Low Cost Manufacture of Print Electronics On Flexible Substrates	NSERC Discovery
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## Past Research Funding:

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
2017/16	\$36,000	Design-For-Manufacturing Techniques For Print Electronics Technology With Emphasis On Disposable Wearable Personal Health Monitors	NSERC Discovery
	\$227,294	Analog, RF and SPIC Testing On A	NCE - Mitacs

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	\$79,000	Low-Speed Tester Design-For-Test Techniques For 60 GHz ISM Radio Applications	NSERC Discovery
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
2016/15	\$40,000	Design-For-Test Techniques For 60 GHz ISM Radio Applications	NSERC Discovery
	\$20,000	Low-Cost Manufacturing Methods For Bio-Signal Monitoring and Detection Systems Using Printed Electronics	James McGill Chair
	\$15,000	Reducing The Analog-Digital Productivity Gap	Unrestricted Funds, Silicon Laboratories
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
2015/14	\$40,000	Design-For-Test Techniques For 60 GHz ISM Radio Applications	NSERC Discovery
	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
	\$15,000	Reducing The Analog-Digital Productivity Gap	Unrestricted Funds, Silicon Laboratories
	\$5,000	New Methods For Testing Bluetooth LE	Unrestricted Funds, Cypress Semiconductor
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
2014/13	\$40,000	Design-For-Test Techniques For 60 GHz ISM Radio Applications	NSERC Discovery
	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
	\$15,000	Low-Cost Silicon Photonic Interconnects (O. Liboiron-Ladouceur, W. Gross and G. Roberts)	McGill University
	\$1,650,000	<del>Research to Commercialization in Advanced Microsystems (RCAM): Bridging the Gap (PI. G. Cowan + 8 others)</del>	<del>NSERC CREATE</del>
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
2013/12	\$40,000	Design-For-Test Techniques For 60 GHz ISM Radio Applications	NSERC Discovery
	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair

	\$10,000	Education Award, bourse d'enseignement en genie, Ministère de l'Éducation, du Loisir et du Sport	Quebec Gov.
	\$727,500	National Microelectronics and Photonics Testing Collaboratory	NSERC – MRSP
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>2012/11</b>	\$40,000	Design-For-Test Techniques For 60 GHz ISM Radio Applications	NSERC Discovery
	\$87,500 (\$16,000)	Pollution and Particle Sensors For Environment-Aware Vehicles (W-T. Ng, G.W. Roberts and others)	NSERC – NCE (Auto21)
	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
	\$10,000	Education Award, bourse d'enseignement en genie, Ministère de l'Éducation, du Loisir et du Sport	Quebec Gov.
	\$727,500	National Microelectronics and Photonics Testing Collaboratory	NSERC – MRSP
	\$149,874	<del>Time-Mode Signal Processing For 60 GHz Radio Circuits</del>	<del>NSERC-RTI</del>
	\$85,063	<del>An Experimental Platform for Ultra-High Bit Rate Wireless, Wireline, and Optical Systems Research</del>	<del>NSERC-RTI</del>
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>2011/10</b>	\$33,404	On-Chip Instrumentation For Analog/Mixed-Signal Silicon Debug, Diagnosis and Manufacturing Test	NSERC Discovery
	\$87,500 (\$14,500)	Pollution and Particle Sensors For Environment-Aware Vehicles (W-T. Ng, G.W. Roberts and others)	NSERC – NCE (Auto21)
	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
	\$10,000	Education Award, bourse d'enseignement en genie, Ministère de l'Éducation, du Loisir et du Sport	Quebec Gov.
	\$2,248,631	<del>National Microelectronics and Photonics Testing Collaboratory – 3-yr Renewal</del>	<del>NSERC – MRSP</del>
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>2010/11</b>	\$33,404	On-Chip Instrumentation For Analog/Mixed-Signal Silicon Debug, Diagnosis and Manufacturing Test	NSERC Discovery
	\$87,500 (\$17,500)	Pollution and Particle Sensors For Environment-Aware Vehicles (W-T. Ng, G.W. Roberts and others)	NSERC – NCE (Auto21)

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\$40,000 US	BIST For Mixed-Signal Circuits	Texas Semiconductor, Inc.
\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
\$20,000 (in-kind)	Acoustic Sensors For Bridge Monitoring in Remote Locations (Z. Zilic, G. W. Roberts, + others)	Canadian Microsystems Corporation
\$25,000,000	National Collaboratory For Verification, Validation and Testing Microelectronics, Photonics and Systems (B. Barge, G. W. Roberts + others)	CFI
\$10,000	Education Award, bourse d'enseignement en genie, Ministère de l'Éducation, du Loisir et du Sport	Quebec Gov.

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
2009/10	\$33,404	On-Chip Instrumentation For Analog/Mixed-Signal Silicon Debug, Diagnosis and Manufacturing Test	NSERC Discovery
	\$87,500 (\$17,500)	Pollution and Particle Sensors for Environment-Aware Vehicles (W-T. Ng, G.W. Roberts and others)	NSERC – NCE (Auto21)
	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
	\$122,500	High-Speed bandpass serial data link (PI: R. Abhari and G. Roberts)	I2I
	\$25,000,000	National Collaboratory For Verification, Validation and Testing Microelectronics, Photonics and Systems (B. Barge, G. W. Roberts + others)	CFI
	\$10,000	Education Award, bourse d'enseignement en genie, Ministère de l'Éducation, du Loisir et du Sport	Quebec Government

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
2008/09	\$33,404	On-Chip Instrumentation For Analog/Mixed-Signal Silicon Debug, Diagnosis and Manufacturing Test	NSERC Discovery
	\$87,500 (\$17,500)	Electrical Power Management and Safety System (W-T. Ng, G.W. Roberts and others)	NSERC – NCE (Auto21)
	\$40,000 US	BIST For Mixed-Signal Circuits	Texas Semiconductor, Inc.

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	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
	\$25,000,000	National Collaboratory For Verification, Validation and Testing Microelectronics, Photonics and Systems ( <u>B. Barge</u> , G. W. Roberts + others)	CFI
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>2007/08</b>	\$33,404	On-Chip Instrumentation For Analog/Mixed-Signal Silicon Debug, Diagnosis and Manufacturing Test	NSERC Discovery
	\$87,500 (\$17,500)	Electrical Power Management and Safety System (W-T. Ng, G.W. Roberts and others)	NSERC – NCE (Auto21)
	\$40,000 US	BIST For Mixed-Signal Circuits	Texas Semiconductor, Inc.
	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
	\$20,000 (in-kind)	Acoustic Sensors For Bridge Monitoring in Remote Locations (Z. Zilic, G. W. Roberts, + others)	Canadian Microsystems Corporation
	\$25,000,000	National Collaboratory For Verification, Validation and Testing Microelectronics, Photonics and Systems ( <u>B. Barge</u> , G. W. Roberts + others)	CFI
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>2006/07</b>	\$33,404	On-Chip Instrumentation For Analog/Mixed-Signal Silicon Debug, Diagnosis and Manufacturing Test	NSERC Discovery
	\$87,500 (\$17,500)	Electrical Power Management and Safety System (W-T. Ng, G.W. Roberts and others)	NSERC – NCE (Auto21)
	\$40,000 US	BIST For Mixed-Signal Circuits	Texas Semiconductor, Inc.
	\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
	\$25,000,000	National Collaboratory For Verification, Validation and Testing Microelectronics, Photonics and Systems ( <u>B. Barge</u> , G. W. Roberts + others)	CFI
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>2005/06</b>	\$33,404	On-Chip Instrumentation For Analog /	NSERC

\$87,500 (\$17,500)	Mixed-Signal Diagnostic Purposes Electrical Power Management and Safety System (W-T. Ng, G.W. Roberts and others)	Discovery NSERC – NCE (Auto21)
\$40,000 US	BIST For Mixed-Signal Circuits	Texas Semiconductor, Inc.
\$20,000	Design and Test of Sub-Micron CMOS Integrated Circuits	James McGill Chair
\$25,000,000	National Collaboratory For Verification, Validation and Testing Microelectronics, Photonics and Systems (B. Barge, G. W. Roberts + others)	CFI
\$20,000	Mixed-Signal Design-For-Test Methodologies	James McGill Chair

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
<b>2004/05</b>	\$33,404	On-Chip Instrumentation For Analog / Mixed-Signal Diagnostic Purposes	NSERC Discovery
	\$30,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (PMC-Seirra)	IOR (Industrial)
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Gennum)	IOR (Industrial)
	\$60,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	MICRONET
	\$60,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	NSERC- eMPOWR
	\$25,000,000	National Collaboratory For Verification, Validation and Testing Microelectronics, Photonics and Systems (B. Barge, G. W. Roberts + others)	CFI
	\$20,000	Mixed-Signal Design-For-Test Methodologies	James McGill Chair

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
<b>2003/04</b>	\$33,404	On-Chip Instrumentation For Analog / Mixed-Signal Diagnostic Purposes	NSERC Discovery
	\$30,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (PMC- Seirra)	IOR (Industrial)
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	IOR (Industrial)

		(Gennum)	
	\$70,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	MICRONET
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	NSERC-eMPower
	\$25,000,000	National Collaboratory For Verification, Validation and Testing Microelectronics, Photonics and Systems (B. Barge, G. W. Roberts + others)	CFI
	\$20,000	Mixed-Signal Design-For-Test Methodologies	James McGill Chair
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>2002/03</b>	\$33,400	On-Chip Instrumentation For Analog/Mixed-Signal Silicon Debug, Diagnosis and Manufacturing Test	NSERC Discovery
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Zarlink)	IOR (Industrial)
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (PMC-Seirra)	IOR (Industrial)
	\$25,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Gennum)	IOR (Industrial)
	\$134,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	MICRONET
	\$30,000	High-Speed Mixed-Signal Testing	Lucent Technologies
	\$80,000	Equipment Loan (G. W. Roberts + 6 others)	Canadian Micro. Corporation
	\$20,000	Mixed-Signal Design-For-Test Methodologies	James McGill Chair
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>2001/02</b>	\$33,400	On-Chip Instrumentation For Analog/Mixed-Signal Silicon Debug, Diagnosis and Manufacturing Test	NSERC Discovery
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Mitel)	IOR (Industrial)
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (PMC-Seirra)	IOR (Industrial)
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	IOR (Industrial)

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	(Gennum)	
\$118,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	MICRONET
\$30,000	High-Speed Mixed-Signal Testing	Lucent Technologies
\$67,500	Mixed-Signal Testing	Aglient Technologies
\$80,000	Equipment Loan (G. W. Roberts + 6 others)	Canadian Micro. Corporation
\$20,000	Mixed-Signal Design-For-Test Methodologies	James McGill Chair

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
<b>2000/01</b>	\$33,400	Mixed-Signal Test Solutions For Systems-On-Chip	NSERC Operating
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Mitel)	IOR (Industrial)
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (PMC-Seirra)	IOR (Industrial)
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Gennum)	IOR (Industrial)
	\$113,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	MICRONET
	\$30,000	High-Speed Mixed-Signal Testing	Lucent Technologies
	\$83,000	Equipment Loan (D. Plant, G. W. Roberts + 5 others)	Canadian Micro. Corporation

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
<b>1999/00</b>	\$30,030	Testing Strategies for the Improved Manufacturability of Wireless Communication ICs and Systems	NSERC Operating
	\$20,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Mitel)	IOR (Industrial)
	\$15,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Nortel)	IOR (Industrial)
	\$15,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (PMC-Seirra)	IOR (Industrial)

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\$15,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits (Gennum)	IOR (Industrial)
\$95,000	Design and Test of Sub-Micron CMOS & Bipolar Analog Integrated Circuits	MICRONET
\$108,000	Equipment Loan ( <u>G. W. Roberts</u> + 4 others)	Canadian Micro. Corporation

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
<b>1998/99</b>	\$30,030	Testing Strategies for the Improved Manufacturability of Wireless Communication ICs and Systems	NSERC Operating
	\$20,000	Current-Mode Analog Filters, Data Converters and PLLs (Mitel)	IOR (Industrial)
	\$15,000	Current-Mode Analog Filters, Data Converters and PLLs (Nortel)	IOR (Industrial)
	\$15,000	Current-Mode Analog Filters, Data Converters and PLLs (Gennum)	IOR (Industrial)
	\$50,000	Current-Mode Analog Filters, Data Converters and PLLs	IOR (NSERC)
	\$33,300	Current-Mode Analog Filters, Data Converters and PLLs	MICRONET
	\$80,000	Equipment Loan ( <u>G. W. Roberts</u> + 6 others)	Canadian Micro. Corporation

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
<b>1997/98</b>	\$30,030	Testing Strategies for the Improved Manufacturability of Wireless Communication ICs and Systems	NSERC Operating
	\$20,000	Current-Mode Analog Filters, Data Converters and PLLs (Mitel)	IOR (Industrial)
	\$15,000	Current-Mode Analog Filters, Data Converters and PLLs (Gennum)	IOR (Industrial)
	\$35,000	Current-Mode Analog Filters, Data Converters and PLLs	IOR (NSERC)
	\$33,300	Current-Mode Analog Filters, Data Converters and PLLs	MICRONET
	\$93,850	Built-In Self Test for Mixed-Signal ICs ( <u>G.W. Roberts</u> and J. Rajski)	NSERC Strategic

<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
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<b>1996/97</b>	\$28,250	Analog Circuit Design for Mixed - Signal Applications	NSERC Operating
	\$15,000	Current-Mode Analog Filters and Data Converters	IOR (NSERC)
	\$20,000	Current-Mode Analog Filters and Data Converters	IOR (Industrial)
	\$35,300	Current-Mode Analog Filters and Data Converters	MICRONET
	\$93,850	Built-In Self Test for Mixed-Signal ICs ( <u>G.W. Roberts</u> and J. Rajski)	NSERC Strategic
	\$80,000	Equipment Loan ( <u>G. W. Roberts</u> + 6 others)	Canadian Micro. Corporation

<u><b>Year</b></u>	<u><b>Amount</b></u>	<u><b>Research Project</b></u>	<u><b>Agency</b></u>
<b>1995/96</b>	\$21,293	Analog Circuit Design for Mixed - Signal Applications	NSERC Operating
	\$20,000	Current-Mode Analog Filters and Data Converters	IOR (NSERC)
	\$10,000	Current-Mode Analog Filters and Data Converters	IOR (Industrial)
	\$20,000	Mixed Digital Analog Testing ( <u>A. Ivanov</u> and G. W. Roberts)	IOR (NSERC)
	\$10,000	Mixed Digital Analog Testing ( <u>A. Ivanov</u> and G. W. Roberts)	IOR (Industrial)
	\$40,400	Current-Mode Analog Filters and Data Converters	MICRONET
	\$46,000	Mixed Digital Analog Testing ( <u>A. Ivanov</u> and G. W. Roberts)	MICRONET
	\$125,913	Equipment Loan ( <u>T. H. Szymanski</u> , G. W. Roberts + 5 others)	Canadian Micro. Corporation
	\$20,000	MACS Laboratory ( <u>N. C. Rumin</u> and G. W. Roberts + 4 others)	NSERC Infrastructure
	\$93,850	Built-In Self Test for Mixed-Signal ICs ( <u>G.W. Roberts</u> and J. Rajski)	NSERC Strategic
	\$8,400	Creation of a High-Speed Bipolar Technology Framework for CMC	Contract

<u><b>Year</b></u>	<u><b>Amount</b></u>	<u><b>Research Project</b></u>	<u><b>Agency</b></u>
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<b>1994/95</b>	\$21,000	Analog Circuit Design for Mixed-Signal Applications	NSERC Operating
	\$20,000	VLSI Design Laboratory ( <u>N.C. Rumin</u> and G. W. Roberts + 12 other investigators)	NSERC Infrastructure
	\$40,375	Current-Mode Analog Filters and Data Converters	MICRONET
	\$39,100	Mixed Digital Analog Testing ( <u>A. Ivanov</u> and G. W. Roberts)	MICRONET
	\$80,630	Equipment Loan ( <u>G. W. Roberts</u> and 7 others)	Canadian Micro. Corporation
	\$101,500	G.R.I.A.O. ( <u>E. Cerny</u> and G. W. Roberts + 23 other investigators)	FCAR Centres de Recherche
	\$93,850	Built-In Self Test for Mixed-Signal ICs ( <u>G.W. Roberts</u> and J. Rajski)	NSERC Strategic
<b><u>Year</u></b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
<b>1993/94</b>	\$21,000	Analog Circuit Design for Mixed-Signal Applications	NSERC Operating
	\$148,400	Equipment Loan ( <u>G. W. Roberts</u> and 5 others)	Canadian Micro. Corporation
	\$39,600	Programmable and Current-Mode Analog Filters	MICRONET
	\$42,300	Mixed Digital Analog Testing ( <u>V. K. Agarwal</u> and G. W. Roberts + 1 other investigator)	MICRONET
	\$28,000	Networking ( <u>V. K. Agarwal</u> and G. W. Roberts + 9 other investigator)	MICRONET
	\$20,000	VLSI Design Laboratory ( <u>N.C. Rumin</u> and G. W. Roberts + 12 other investigators)	NSERC Infrastructure
	\$15,000	Built-In Self Test for Mixed-Signal IC's	BNR Individual Grant
	\$15,000	Performance Estimation for Analog VLSI using Hierarchy	BNR Individual Grant
	\$10,000	Mixed Functional and Structural Testing in	BNR Individual

a Parallel Testing Environment			Grant
<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
1992/93	\$101,500	G.R.I.A.O. ( <u>E. Cerny</u> and G. W. Roberts + 23 other investigators)	FCAR Centres de Recherche
	\$17,285	Filter Theory and Analog Circuit Design	NSERC Operating
	\$43,000	Programmable and Current-Mode Analog Filters	MICRONET
	\$43,000	Mixed Digital Analog Testing ( <u>V. K. Agarwal</u> and G. W. Roberts + 1 other investigator)	MICRONET
	\$28,000	Networking ( <u>V. K. Agarwal</u> and G. W. Roberts + 9 other investigator)	MICRONET
	\$141,000	Equipment Loan ( <u>N.C. Rumin</u> , G. W. Roberts + 5 other investigators)	Canadian Micro. Corporation
	\$101,500	G.R.I.A.O. ( <u>E. Cerny</u> and G. W. Roberts + 23 other investigators)	FCAR Centres de Recherche
	\$20,000	VLSI Design Laboratory ( <u>N.C. Rumin</u> and G. W. Roberts + 12 other investigators)	NSERC Infrastructure
<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
1991/92	\$17,285	Filter Theory and Analog Circuit Design	NSERC Operating
	\$43,000	Programmable and Current-Mode Analog Filters	MICRONET
	\$46,000	Mixed Digital Analog Testing ( <u>V. K. Agarwal</u> and G. W. Roberts + 1 other investigator)	MICRONET
	\$28,000	Networking ( <u>V. K. Agarwal</u> and G. W. Roberts + 9 other investigator)	MICRONET
	\$93,370	Equipment Loan ( <u>V.K. Agarwal</u> , G. W. Roberts + 6 other investigators)	Canadian Micro. Corporation
	\$9,000	Analog Circuit Design For Mixed-Signal Applications	BNR Individual Grant
<u>Year</u>	<u>Amount</u>	<u>Research Project</u>	<u>Agency</u>
1990/91	\$17,285	Filter Theory and Analog Circuit Design	NSERC

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			Operating
	\$27,000	Programmable and Current-Mode Analog Filters	MICRONET
	\$31,000	Mixed Digital Analog Testing ( <u>V. K. Agarwal</u> and G. W. Roberts + 1 other investigator)	MICRONET
	\$24,000	Networking ( <u>V. K. Agarwal</u> and G. W. Roberts + 9 other investigator)	MICRONET
	\$12,000	Analog Circuit Design For Mixed-Signal Applications	BNR Individual Grant
	\$10,000	Test for Mixed-Signal IC's	BNR Individual Grant
<b><u>Year</u></b> <b>1989/90</b>	<b><u>Amount</u></b>	<b><u>Research Project</u></b>	<b><u>Agency</u></b>
	\$30,000	VLSI Design for High Precision Analog Processing of Video Signals ( <u>G. W. Roberts</u> and M. Blostein)	BNR Individual Grant
	\$10,000	Research Start-up Grant	McGill University

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