

Anas A. Hamoui

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Employment

2004 - present **Assistant Professor**
Integrated Circuits and Systems Group,
Department of Electrical & Computer Engineering,
McGill University, Montreal, Canada.
Research: Integrated Circuits & Systems in Nanometer CMOS Technologies
(Analog/RF, Digital, and Mixed-Signal Design).

Education

2004 **Ph.D. in Electrical Engineering**
Advisor: Prof. Ken Martin
Electronics Group,
Department of Electrical & Computer Engineering,
University of Toronto, Toronto, Canada.
Thesis: "Delta-Sigma Data Converters for Broadband Digital Communications"

1998 **M.Eng. in Electrical Engineering**
Advisor: Prof. Nicholas Rumin
Microelectronics & Computer Systems Laboratory,
Department of Electrical & Computer Engineering,
McGill University, Montreal, Canada.
Thesis: "Current, Delay, and Power Analysis of Submicron CMOS Circuits"

1996 **B.Eng. (Honours) in Electrical Engineering**
Department of Electrical & Computer Engineering,
Kuwait University, Kuwait.
Major: Electronics and Telecommunications; GPA: 4.0/4.0

Awards/Honours AWARDS FOR PROFESSORSHIP:

2004 - 2005
2005 - 2006

- **"Professor of the Year" Award for 2 consecutive years**
Elected by the Electrical-Computer-Software Engineering Student Society,
Department of Electrical & Computer Engineering, McGill University.

AWARDS FOR PROFESSIONAL ACTIVITIES:

2007

- **Outstanding Chapter Award**, IEEE Solid-State Circuits Society, 2007.
Citation: "In honor of an outstanding record of consistent leadership and initiative in organizing activities that have contributed to the growth and vitality of the IEEE Solid-State Circuits Society".

AWARDS/HONOURS FOR GRADUATE & UNDERGRADUATE STUDIES:

2001

- **ADI Outstanding Student Designer Award**, Analog Devices Inc. (ADI), USA.

Awards/Honours

(*contd.*)

AWARDS/HONOURS FOR GRADUATE & UNDERGRADUATE STUDIES: (*contd.*)

- 2002 • **Henderson Research Fellowship in Electrical Engineering**, University of Toronto.
 - 2001 • **Ontario Graduate Scholarship in Science & Technology**, Ontario, Canada.
 - 1999 & 2000 • **NSERC Post-graduate Scholarship**,
Natural Sciences and Engineering Research Council (NSERC) of Canada.
 - 1998 • **University of Toronto Doctoral Fellowship**, University of Toronto.
 - 1997 • **J. B. Porter Graduate Scholarship**, McGill University.
 - 1996 • **Award of Excellence for Outstanding University Achievements**,
Association of Professional Engineers, Kuwait.
 - 1994 & 1995 • **University Award for Outstanding Academic Achievements**, Kuwait University.
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Research Experience

2006 - present

Adjunct Professor,
Research Center in Applied Engineering & Sciences,
State University of Morelos, Mexico.
Research: MEMS for energy scavenging and optical switching.

2002 - 2003

Research Associate,
Department of Electrical and Computer Engineering, University of Toronto.
Supervisor: Prof. Adel Sedra
Research and technical review for the 5th edition of the well-known book *Microelectronic Circuits* by A. S. Sedra and K. C. Smith (Oxford University Press).

1998 - 2004

Research Assistant,
Electronics Group,
Department of Electrical and Computer Engineering, University of Toronto.
Supervisor: Prof. Ken Martin
Research Area: mixed-signal integrated-circuits for broadband data communications.

1996 - 1998

Research Assistant,
Microelectronics and Computer Systems (MACS) Laboratory,
Department of Electrical and Computer Engineering, McGill University.
Supervisor: Prof. Nicholas Rumin
Research Area: timing and power analysis of VLSI digital circuits and systems.

Summer 1995

Engineering Trainee,
VLSI Systems and Design Methodologies Division
Interuniversity Micro-Electronic Centre (IMEC), Leuven, Belgium.
Project: implementation of a mobile spread-spectrum transceiver.
Primary Task: realization of the transceiver's RF front-end.

Publications

- **Number of refereed journal articles:** 9 articles.
- **Number of refereed conference papers:** 23 papers.

Please refer to page 8 for a complete list of my publications.

Research Funding

- Canadian Institutes of Health Research (CIHR)**
2009-2013
Amount: \$370,776
Program: Operating Grant
Project: Neural Encoding in the Visual Cortex:
Engineering Principles for Advanced Neural Prosthetics
- Natural Sciences and Engineering Research Council (NSERC) of Canada**
2009-2014
Amount: \$145,000
Program: Discovery Grant
Project: Mixed-signal nanometer integrated circuits
for next-generation wireless communication systems
- Accelerate Quebec - Mathematics of Information Technology & Complex Systems (MITACS)**
2009
Amount: \$30,000
Program: Quebec's Graduate Research Internship Program
Project: DreamWafer Intelligent Rapid Prototyping Platform for Electronic Systems
Sponsor Industry: Gestion TechnoCap Inc.
- Canadian Foundation for Innovation (CFI)**
2009
Amount: \$3,909,000 (*with M. Sawan and 8 others*)
Program: Regional Leading Edge Fund (LEF) / New Initiatives Fund (NIF)
Project: Design, Test, Assembly and Packaging Platform
for the Construction of Innovative Microsystems
- Fonds Québécois de la Recherche: Nature & Technologies (FQRNT)**
2008-2014
Amount: \$2,475,000 (*with M. Sawan and 25 others*)
Program: Regroupement Stratégiques (Research Centers)
Project: Regroupement Stratégique en Microsystèmes du Québec (ReSMIQ).
- Natural Sciences and Engineering Research Council (NSERC) of Canada**
2007
Amount: \$130,855
Program: Research Tools & Instruments Grant
Project: Characterization Platform for Broadband Data Converters
in High-Speed Wireless Communications.
- Fonds Québécois de la Recherche: Nature & Technologies (FQRNT)**
2005-2008
Amount: \$93,132
Program: Etablissement de Nouveaux Chercheurs
Project: Mixed-Signal Architectures and High-Speed Integrated Circuits
for Wireless Digital Communications.
- Natural Sciences and Engineering Research Council (NSERC) of Canada**
2005
Amount: \$119,750 (*with M. El-Gamal*)
Program: Research Tools & Instruments Grant
Project: A Load-Pull Measurement System
for the Characterization of RF Integrated Circuits.
- Natural Sciences and Engineering Research Council (NSERC) of Canada**
2004-2009
Amount: \$110,000
Program: Discovery Grant
Project: Mixed-Signal Analog/Digital Integrated Circuits and Systems
for Broadband Wireless Communications.

Research Funding

(*contd.*)

2004

McGill University

Amount: \$75,000

Program: Research Start-Up Grant

Project: Analog and Mixed-Signal Integrated Circuits
for High-Speed Data Communications and Signal Processing.

Teaching Interests

- Circuit and System Analysis
 - Electronic Circuits
 - Analog Integrated-Circuit Design
 - Analog Filters
 - Digital Integrated-Circuit and VLSI System Design
 - Integrated Circuits for Digital Communications
 - Data-Conversion System Design
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Teaching Experience**Course Instructor****Department of Electrical & Computer Engineering****McGill University**

2005 - *present*

- ECSE334 Introduction to Microelectronic Circuits

2006 - *present*

- ECSE434 Microelectronics Laboratory

2009 - *present*

- ECSE548 Introduction to VLSI Systems

2009 - *present*

- ECSE648 VLSI Design

Course Instructor**Department of Electrical & Computer Engineering****University of Toronto**

2001

- ECE331 Electronic Circuits (4 credits, ~ 75 students)

Teaching Assistant**Department of Electrical & Computer Engineering****University of Toronto**

1999, 2000

Courses: ECE231 Introductory Electronics (Prof. D. Johns)

ECE354 Electronic Circuits (Prof. K. Martin)

Teaching Assistant,**Department of Electrical & Computer Engineering****McGill University**

1997, 1998

Course: ECE548 VLSI Systems (Prof. N. Rumin)

**Professional
Activities****• IEEE Circuits & Systems Society:**

2008 - *present*

- Biomedical-Circuits Technical Committee.

2008 - *present*

- Analog Signal Processing Technical Committee.

2009 - *present*

- Education and Outreach Technical Committee

Professional

Activities

(contd.)

2004 - present

2002 - 2004

- **IEEE Solid-State Circuits Society:**
 - Co-Chair, Montreal Chapter.
 - Educational-Activities Chair, Toronto Chapter.
- **Technical Reviewer of National Research Projects for:**
 - **NSERC** (Natural Sciences & Engineering Research Council of Canada): discovery grants.
 - **FQRNT** (Fonds Québécois de la Recherche sur la Nature et les Technologies): “Établissement de nouveaux chercheurs” grants.
 - **CMC Microsystems**, National Design Network: allocation review committee for fabrication and integration support.

JOURNAL EDITORSHIP

Dec. 2010

- **Guest Editor**, special issue of the *IEEE Transactions on Biomedical Circuits and Systems* on the 2010 IEEE International Solid-State Circuits Conference (ISSCC).
- **Guest Editor**, special issue of the *Analog Integrated Circuits and Signal Processing International Journal* on the 2009 IEEE International Conference on Electronics, Circuits & Systems (ICECS).

2010 - present

- **Associate Editor**, *IEEE Transactions on Circuits and Systems I: Regular Papers (TCASI)*

2009 - present

- **Associate Editor**, *IEEE Transactions on Biomedical Circuits and Systems (TBioCAS)*

2008 - present

- **Editorial Board member**, *Analog Integrated Circuits and Signal Processing International Journal*, Springer.

ORGANIZATION OF IEEE INTERNATIONAL CONFERENCES

2009

- **Chair, Technical Program Committee (TPC):**
IEEE International Conference on Electronics, Circuits & Systems (*ICECS*)

2008 - 2009

- **Chair, Special-Sessions:**
IEEE North-East Workshop on Circuits & Systems (*NEWCAS*)

2007

- **Chair, Publicity:**
IEEE North-East Workshop on Circuits & Systems (*NEWCAS 2007*)

2007

- **Chair, Publicity:**
IEEE Midwest Symposium on Circuits & Systems (*MWCAS 2007*)

2007 - present

- **Steering Committee member:**
IEEE International Conference on Electronics, Circuits & Systems (*ICECS*)

2007 - present

- **Review Committee member:**
IEEE International Symposium on Circuits & Systems (*ISCAS*)

2009 - present

- **Technical Program Committee member:**
IEEE Bio-Medical Circuits & Systems Conference (*BioCAS*)

2007 - present

- **Technical Program Committee member:**
IEEE International Conference on Electronics, Circuits & Systems (*ICECS*)

2008 - present

- **Technical Program Committee member:**
IEEE North-East Workshop on Circuits & Systems (*NEWCAS*)

2006 - present

- **Technical Program Committee member:**
IEEE International Conference on Microelectronics (*ICM*)

2006

- **Co-Organizer (with Franco Maloberti) of Special Session** on “Advances in $\Delta\Sigma$ Data Converters”, IEEE International Conference on Electronics, Circuits & Systems (*ICECS*).

2004 - present

- **International Scientific Advisory Committee member:**
IEEE International Conference on Information & Communication Technologies (*ICTTA*).

Invited Papers

- A. A. Hamoui and F. Maloberti, "Delta-sigma modulators for power-efficient A/D conversion in high-speed wireless communications," presented at:
 - IEEE International Conference on Electronics, Circuits, and Systems (ICECS)

Dec. 2006

Invited Seminars

- A. A. Hamoui, "Delta-Sigma Data Conversion in Broadband Digital Communications", presented at:
 - McGill University
 - University of Calgary
- A. A. Hamoui, " $\Delta\Sigma$ Analog-to-Digital Converters for Broadband Communication Receivers: Architectures and Circuits", presented at:
 - InterDigital Inc., Montreal, Canada.
 - IEEE Solid-State Circuit Society, Ottawa Chapter, Canada.
 - Skyworks Inc., Ottawa, Canada.
 - Texas Instruments Inc., Dallas, USA.
 - Cirrus Logic Inc., Austin, USA.
 - Texas A&M, University, College Station, USA.

Jun. 2003

Jul. 2003

Jan. 2006

Oct. 2004

Jun. 2004

Apr. 2004

Apr. 2004

Apr. 2004

Invited Talks

- A. A. Hamoui, "Hands-on Approach to Teaching Circuits & Systems in Undergraduate Education," invited talk presented at the *IEEE Workshop on Future Directions in Circuits & Systems Education*.

May 2008

Professional Affiliations

- **Fonds Québécois de la Recherche sur la Nature et les Technologies (FQRNT):**
 - **Microsystems Strategic Alliance of Quebec (ReSMIQ):**
 - Executive Committee (2007 - present)
 - Board of Directors (2006 - 2007)
 - **RF Electronics Strategic Alliance of Quebec (CREER)**
- **Mathematics of Information Technology & Complex Systems (MITACS) research network:**
 - **Centre for Applied Mathematics in Bioscience and Medicine (CAMBAM)**

2004 - present

2008 - present

2010 - present

University Services

- **McGill University:**

2010 - present

2007 - present

2007 - present

2007 - present

2006 - present

2004 - 2006

- Department of Electrical & Computer Engineering:

- Graduate Area Representative

- Teaching Assignments & Teaching Loads Committee

- Undergraduate Laboratory Infrastructure Planning Committee

- Timetable Coordination Committee (*Committee Chair: 2008-present*)

- Undergraduate Recruitment Committee

- Space Committee

- Faculty of Engineering:

2010 - present

- Committee for the development of a new program on bioengineering.

1996 - 1998

- Senate and Board-of-Governors Committees

1997 - 1998

- Electrical-Engineering Graduate Student Society (*President*)

- **University of Toronto:**

2001 - 2003

- Academic Board of the University of Toronto

2002 - 2003

- Dean-of-Engineering Advisory Search Committee
for the Chair of the Department of Electrical & Computer Engineering.

1999 - 2002

- Council of the School of Graduate Studies

1999 - 2003

- Electrical-Engineering Graduate Course Union (*President*)

Personal Data

Citizenship

- Canadian

Languages

- Fluent in Arabic, English, and French (spoken & written)

List of Publications **BOOKS**

- [B1] A. A. Hamoui and K. Martin, *Delta-Sigma Data Converters in Low-Voltage CMOS for Broadband Digital Communications*, Dordrecht, Netherlands: Springer, to be published in 2011.

THESES (refereed)

- [B2] A. A. Hamoui, "Delta-sigma data converters for broadband digital communications," Ph. D. Thesis, University of Toronto, Toronto, June 2004.
- [B3] A. A. Hamoui, "Current, delay, and power analysis of submicron CMOS circuits," M.Eng. Thesis, McGill University, Montreal, July 1998.

BOOK CONTRIBUTIONS

- [B4] A. S. Sedra and K. C. Smith, *Microelectronic Circuits*, 5th ed. New York, NY: Oxford, 2003. Contributed to this well-known and widely-adopted textbook by writing the SPICE sections (including device models, circuit macromodels, and design examples) at the end of each chapter.

Patent Applications

- [P1] J. Varona, M. Tecpoyotl-Torres, A. A. Hamoui, "Integrated Micromirror and Thermal Actuator". Mexican patent application Mx/a/2008/014210.
- [P2] J. Varona, M. Tecpoyotl-Torres, A. A. Hamoui, "Enhanced Horizontal and Vertical Thermal Actuator". Mexican patent application Mx/a/2008/014209.

JOURNAL ARTICLES (refereed)

- [J1] M. Taherzadeh-Sani and A. A. Hamoui, "Area and Power Optimization of High-Order Gain Calibration in Digitally-Enhanced Pipelined ADCs," *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, vol. 18, no. 4, pp. 652-657, Apr. 2010.
- [J2] P. M. Chopp and A. A. Hamoui, "Design Constraints for Image-Reject Frequency-Translating Delta-Sigma Modulators," *IEEE Transactions on Circuits and Systems - II*, vol. 56, no. 12, pp. 896-900, Dec. 2009.
- [J3] P. M. Chopp and A. A. Hamoui, "Analysis of clock-jitter effects in continuous-time $\Delta\Sigma$ modulators using discrete-time models," *IEEE Transactions on Circuits and Systems - I*, vol. 56, no. 6, pp. 1134-1145, Jun. 2009.
- [J4] J. Varona, M. Tecpoyotl-Torres, J. Ecobedo-Alatorre, A. A. Hamoui, and J. Sanchez-Mondragon, "Polysilicon thermal micro-actuators for heat scavenging and power conversion," *SPIE Journal of Micro/Nanolithography, MEMS, and MOEMS (JM3)*, vol. 8, no. 2, Jun. 2009.
- [J5] J. Varona, M. Tecpoyotl-Torres, and A. A. Hamoui, "Design of MEMS Vertical-Horizontal Chevron Thermal Actuators," *Elsevier Journal of Sensors and Actuators A: Physical*, vol. 153, no. 1, pp. 127-130, May 2009.
- [J6] A. A. Hamoui and F. Maloberti, "Power-Efficient Delta-Sigma A/D Converters for High-Speed Wireless Communications," accepted for publication in *Springer International Journal of Analog Integrated Circuits and Signal Processing*, 2008.
Invited paper with review.

List of Publications

(contd.)

JOURNAL ARTICLES (refereed) *contd.*

- [J7] M. Taherzadeh-Sani and A. A. Hamoui, "Digital Background Calibration of Capacitor-Mismatch Errors in Pipelined ADCs," *IEEE Transactions on Circuits and Systems - II*, vol. 53, no. 9, pp. 966-970, Sept. 2006.
- [J8] A. A. Hamoui and K. Martin, "High-order Multibit Modulators and Pseudo Data-Weighted-Averaging in Low-Oversampling $\Delta\Sigma$ ADCs for Broad-Band Applications," *IEEE Transactions on Circuits and Systems - I*, vol. 51, no. 1, pp. 72-85, Jan. 2004. **This is a special issue devoted to the "Advances on Analog-to-Digital and Digital-to-Analog Converters"**.
- [J9] A. A. Hamoui and N. C. Rumin, "An analytical model for current, delay, and power analysis of submicron CMOS logic circuits," *IEEE Transactions on Circuits and Systems*, vol. 47, pp. 999-1007, Oct. 2000.

CONFERENCE PAPERS (refereed)**• Papers in the Conferences of the IEEE Solid-State Circuits Society (SSCS):**

- [C1] M. Taherzadeh-Sani and A. A. Hamoui, "Digital background calibration of a 0.4pJ/step 10-bit pipelined ADC without a PN Generator in digital 90-nm CMOS," in *IEEE Asian Solid-State Circuits Conference (A-SSCC)*, Nov. 2008. pp.53-56.
- [C2] J. Varona, M. Tecpoyotl-Torres, and A. A. Hamoui, "Polysilicon vertical actuator powered with waste heat," in *IEEE Custom Integrated Circuits Conference (CICC)*, Sept. 2008, pp. 519-522.
- [C3] A. A. Hamoui *et al.*, "Behavioral modeling of opamp gain and dynamic effects for power optimization of delta-sigma modulators and pipelined ADCs," in *IEEE International Symposium on Low Power Electronics and Design (ISLPED)*, Oct. 2006, pp. 330-333.
- [C4] A. A. Hamoui and K. Martin, "A 1.8-V 3-MS/s 13-bit $\Delta\Sigma$ A/D converter with pseudo data-weighted-averaging in 0.18- μm digital CMOS," in *IEEE Custom Integrated-Circuits Conference (CICC)*, Sept. 2003, pp.119-122.
- [C5] J. Varona, A. A. Hamoui, and K. Martin, "A low-voltage fully-monolithic $\Delta\Sigma$ -based class-D audio amplifier," in *IEEE European Solid-State Circuits Conference (ESSCIRC)*, Sept. 2003, pp. 545-548.

• Papers in the Conferences of the IEEE Circuits & Systems (CAS) Society:

- [C6] M. Tariqus Salam, M. Sawan, D. K. Nguyen, and A. A. Hamoui, "Epileptic low-voltage fast-activity seizure-onset detector," in *IEEE Biomedical Circuits and Systems conference (BioCAS)*, Nov. 2009, pp. 169-172.
- [C7] J. Varona, E. Saenz, S. Fiscal, and A. A. Hamoui, "Design and fabrication of a novel microgripper based on electrostatic actuation," in *IEEE International Midwest Symposium on circuits and systems (MWSCAS)*, Aug. 2009, pp. 827-832.
- [C8] M. Tariqus Salam, M. Sawan, A. A. Hamoui, and D. K. Nguyen, "Low-power CMOS-based epileptic seizure onset detector," in *IEEE Northeast Workshop on Circuits and Systems (NEWCAS)*, Jun. 2009, pp. 1-4.

List of Publications

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• Papers in IEEE CAS Conferences: contd.

- [C9] A. A. Hamoui and F. Maloberti, "Digitally-enhanced high-order $\Delta\Sigma$ modulators," in *IEEE International Conference on Electronics, Circuits, and Systems (ICECS)*, Aug. 2008, pp. 1115-1118.
- [C10] P. Peev, B. De Vuyst, P. Rombouts, A. A. Hamoui, "An anti-aliasing filter inspired by continuous-time $\Delta\Sigma$ modulation," in *IEEE International Conference on Electronics, Circuits, and Systems (ICECS)*, Aug. 2008, pp. 854-857.
- [C11] A. A. Hamoui and F. Maloberti, "Digitally-enhanced 2nd-order $\Delta\Sigma$ modulator with unity-gain signal transfer function," in *IEEE International Symposium on Circuits & Systems (ISCAS)*, May 2008, pp. 1664-1667.
- [C12] F. Ali and A. A. Hamoui, "Continuous-time $\Delta\Sigma$ modulators with noise-transfer-function enhancement," in *IEEE International Symposium on Circuits & Systems (ISCAS)*, May 2008, pp. 1428-1431.
- [C13] M. Taherzadeh-Sani and A. A. Hamoui, "Power optimization of pipelined ADCs with high-order digital gain calibration," in *IEEE International Conference on Electronics, Circuits, and Systems (ICECS)*, Dec. 2007, pp. 661-664.
- [C14] P. M. Chopp and A. A. Hamoui, "Discrete-time modeling of clock jitter in continuous-time $\Delta\Sigma$ modulators," in *IEEE International Symposium on Circuits & Systems (ISCAS)*, May 2007, pp. 497-500.
- [C15] A. A. Hamoui and F. Maloberti, "Delta-sigma modulators for power-efficient A/D conversion in high-speed wireless communications," in *IEEE International Conference on Electronics, Circuits, and Systems (ICECS)*, Dec. 2006, pp. 123-127. **Invited paper.**
- [C16] M. Taherzadeh-Sani and A. A. Hamoui, "Digital background calibration of interstage-gain and capacitor-mismatch errors in pipelined ADCs," in *IEEE International Symposium on Circuits & Systems (ISCAS)*, May 2006, pp. 1035-1038.
- [C17] M. Taherzadeh-Sani and A. A. Hamoui, "Analysis of dynamic-element-matching (DEM) in pipelined ADCs," in *IEEE International Symposium on Circuits & Systems (ISCAS)*, May 2006, pp. 5263-5266.
- [C18] A. A. Hamoui and K. Martin, "Delta-sigma modulator topologies for high-speed high-resolution A/D converters," in *IEEE Midwest Symposium on Circuits & Systems (MWSCAS)*, Aug. 2002, pp. I 356-359.
- [C19] A. A. Hamoui and K. Martin, "Linearity enhancement of multibit $\Delta\Sigma$ modulators using pseudo data-weighted averaging," in *IEEE International Symposium on Circuits & Systems (ISCAS)*, May 2002, pp. III 285-288.
- [C20] A. A. Hamoui and N. C. Rumin, "An analytical current, delay, and power model for the submicron CMOS inverter," in *IEEE International Conference on Electronics, Circuits, and Systems (ICECS)*, Sept. 1999, pp. 1547-1551.

List of Publications

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• ***MEMS Conference Papers:***

- [C21] J. Varona, M. Tecpoyotl-Torres, A. A. Hamoui , and J. Sánchez-Mondragón, “A two-layer MEMS micromirror for optical scanning and spatial light modulation” in *Proc. of Optical Society of America (OSA) 92nd Annual Meeting - Frontiers in Optics (FiO)*, Oct. 2008.
- [C22] J. Varona, M. Tecpoyotl-Torres, J. Ecobedo-Alatorre, and A. A. Hamoui, “Design and fabrication of a MEMS thermal actuator for 3D optical switching applications”, in *Digest of the IEEE Lasers and Electro-Optics Society (LEOS) Summer Topical Meetings*, July 2008, pp. 31-32.
- [C23] J. Varona, M. Tecpoyotl-Torres, A. A. Hamoui, “Modeling of MEMS Thermal Actuation with External Heat Source,” in *IEEE Electronics, Robotics and Automotive Mechanics Conference (CERMA)*, Sept. 2007, pp. 591 - 596