

Mohamed Omar Abdelgawad

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Summary

- ◆ 13 journal papers, 7 conference papers, and 5 conference presentations.
- ◆ 3 US patent applications.
- ◆ More than 15 awards and scholarships on the national, provincial and university levels, including best poster and leadership awards.
- ◆ Extensive teaching and undergraduate supervision experience.

Education

PhD in Mechanical Engineering *December, 2009*
University of Toronto, Canada.
Thesis title: Digital Microfluidics for Integration of Lab-on-a-Chip Devices.
Supervisor: Prof. Aaron Wheeler

MASc in Mechanical Engineering *August, 2003*
Concordia University, Montreal, Canada
Thesis title: Numerical Simulation of Transient Performance of Viscous Micropumps.
Supervisor: Prof. Ibrahim Hassan

Bachelor of Engineering *August, 1998*
Department of Mechanical Engineering, Assiut University, Egypt
Thesis title: Design and Manufacturing of an Evaporative Air Cooler

Research Experience

Post Doctoral Fellow *January, 2009 – present*
Department of Surgery, University of Toronto
Project title: High-Speed Electromechanical Characterization of Biological Cells for Bladder Cancer Diagnosis.

- Developing a lab-on-a-chip device for bladder cancer detection using cell mechanical properties as a biomarker.
- Developed new method to fabricate circular microchannels in PDMS to facilitate on device micropipette cell aspiration.

Research Assistant *August, 2005 – December, 2009*
Wheeler Microfluidics Laboratory, Department of Chemistry, University of Toronto.

- Designed an interface between digital and channel microfluidics to prepare biological samples for Separations.

- Developed a new technique for droplet manipulation in 3D: “All Terrain Droplet Actuation” or ATDA that was highlighted in *Nature*.
- Modeled droplet actuation in digital microfluidics devices using COMSOL.
- Developed two new microfabrication techniques for microfluidics devices.
- Trained on microfabrication techniques in standard clean-rooms.

Research Assistant

September, 2004-August, 2005

Microfluidics and Biochips Laboratory (Lab director: Prof. Dongqing Li)
Department of Mechanical Engineering, University of Toronto.

- Worked on dielectrophoretic manipulation of cells in micro geometries.
- Trained on microfabrication using soft lithography.

Research Engineer (part time)

April, 2003 – August, 2003

Hardt Equipment Manufacturing Inc., Montreal, Canada.

- Was responsible for thermal design of the Inferno-3000 rotisserie oven.
- Modeled the combustion process inside the burner using FLUENT.
- Optimized the internal thermal design of the oven furnace.

Research Assistant

May, 2001 – September, 2003

Concordia University, Montreal, Canada

- Modeled fluid flow in single and multi-rotor viscous micropumps using FLUENT finite volume package.

Publications

Patents

1. I. Barbulovic-Nad, H. Yang, M. Abdelgawad, and A. R. Wheeler, Exchangeable, Pre-Loaded Substrates for Digital Microfluidics, United States full utility patent application 12/285,326.
2. N. Mousa, M. J. Jebrail, M. Abdelgawad, R. F. Casper, and A. R. Wheeler, Method of Estrogen Extraction From Small Volumes Using Digital Microfluidics, United States full utility patent application 12/379,704.
3. M. Abdelgawad, M. W. L. Watson, and A. R. Wheeler, A Digital-to-Channel Interface for In-Line Sample Processing and Chemical Separations, US Patent Application, filed on October 11th 2008.

Journal Papers

1. N. A. Mousa, M. J. Jebrail, H. Yang, M. Abdelgawad, P. Metalnikov, J. Chen, A. R. Wheeler, and R. F. Casper, Estrogen Extraction from Microdrop Clinical Samples by Digital Microfluidics, *Science Translational Medicine*, accepted on July 20th, 2009.

2. M. Abdelgawad, P. Park, and A. R. Wheeler, Optimization of Device Geometry in Single-Plate Digital Microfluidics, *Journal of Applied Physics*, 105, 094506, 2009.
3. M. Abdelgawad, M. W. L. Watson, and A. R. Wheeler, Hybrid Microfluidics: A Digital-to-Channel Interface for In-Line Sample Processing and Chemical Separations, *Lab on a Chip*, vol. 9, n. 8, pp. 1046-1051, 2009.
 - Featured on the front cover of the April, 2009 issue (vol. 9, n.8) of *Lab on a Chip*.
4. H. Yang, V. N. Luk, M. Abdelgawad, I. Barbulovic-Nad, A. R. Wheeler, A World-to-Chip Interface for Digital Microfluidics, *Analytical Chemistry*, vol. 81, n. 3, pp. 1061-1067, 2009.
5. M. Abdelgawad and A. R. Wheeler, The Digital Revolution: A New Paradigm of Microfluidics, *Advanced Material*, vol. 21, pp. 920-925, 2009.
6. M. Abdelgawad, M.W.L. Watson, E.K.W. Young, J. Mudrik, M.D. Ungrin, and A. R. Wheeler, Soft-lithography: Masters on Demand, *Lab on Chip*, vol. 8, pp. 1379 – 1385, 2008.
 - Highlighted as “Breaking News” on New Scientist website on Sept. 23rd 2008.
 - Listed in ten most accessed articles on Lab-on-a-Chip website in August 2008.
7. M. Abdelgawad, S. Freire, H. Yang, and A. R. Wheeler, All-Terrain Droplet Actuation, *Lab on Chip*, vol. 8, pp. 672-677, 2008.
 - Highlighted in *Nature* vol. 452, pp.668-669, 2008.
 - Highlighted in *Analytical Chemistry*, vol. 80, n. 13, pp. 4788, 2008
 - Highlighted in *Chemical and Engineering News* (the trade magazine for the American Chemical Society).
 - Reported as a news story in *Chemical Technology*, vol. 2008, n. 5.
 - Most accessed paper on Lab-on-a-Chip website in April 2008.
8. M. Abdelgawad and A. R. Wheeler, Low-Cost, Rapid-Prototyping of Digital Microfluidics Devices, *Microfluidics and Nanofluidics*, vol. 4, n. 4, pp. 349-355, 2008.
9. M. Abdelgawad and A. R. Wheeler, Rapid Prototyping in Copper Substrates for Digital Microfluidics, *Advanced Materials*, vol. 19, 133-137, 2007.
10. M.W.L. Watson, M. Abdelgawad, G. Ye, N. Yonson, J. Trottier, and A. R. Wheeler, Micro-Contact Printing-Based Fabrication of Digital Microfluidic Devices, *Analytical Chemistry*, vol. 78, n. 22, pp. 7877-7885, 2006.
11. M. Abdelgawad, I. Hassan, N. Esmail, and P. Phutthavong, Numerical Investigation of Multistage Viscous Micropump Configurations, *Journal of Fluids Engineering*, vol. 127, n. 4, pp. 734-742, 2005.
12. M. Abdelgawad, I. Hassan, and N. Esmail, Transient Behavior of the Viscous Micropump, *Microscale Thermophysical Engineering*, vol. 8, n. 4, pp. 361-381, 2004.
13. I. Hassan, P. Phutthavong, and M. Abdelgawad, Microchannel Heat Sinks: An Overview of The State-of-The-Art, *Microscale Thermophysical Engineering*, vol. 8, n.3, pp. 183 – 205, 2004.

Conference Papers

1. H. Yang, V. Luk, M. Abdelgawad, I. Barbulovic-Nad, and A. R. Wheeler, Exchangable Pre-Loaded “Skin Depot” for Digital Microfluidics, microTAS 2008, San Diego, California, 12-16 October, 2008.
2. A.R. Wheeler, M. Abdelgawad, M.W. Watson, Hybrid-Digital-Channel Microfluidics for Pre-processing and Separations, microTAS 2008, San Diego, California, 12-16 October, 2008.
3. Sergio L.S. Freire, M. Abdelgawad, Hao Yang and Aaron Wheeler, 3D Droplet Actuation in Digital Microfluidics Devices: Towards Integration with Mass Spectrometry, microTAS 2007, Paris, France, 7-11 October 2007.
4. M. Abdelgawad and A. R. Wheeler, 3D Droplet Actuation in Digital Microfluidics Devices, Transducers'07, Lyon, France, 10-14 June, 2007.
5. M. Abdelgawad, I. Hassan, N. Esmail, and P. Phutthavong, Multistage Viscous Micropumps, ASME 2nd International Conference on Microchannels and Minichannels, Rochester, NY, USA, June 2004.
6. M. Abdelgawad, I. Hassan, P. Phutthavong, and N. Esmail, Towards a Better Understanding of Viscous Micropumps: Transient Performance, Eurotherm Seminar No.75-Microscale Heat Transfer2, University of Reims, France, July 2003.
7. P. Phutthavong, M. Abdelgawad, and I. Hassan, Heat Transfer and Fluid Flow in Microchannel Heat Sinks: An Overview of the Current State-of-The-Art, 3rd International Conference on Heat and Mass Transfer, Banff, Canada, May 2003.

Conference Presentations

1. 6th International Meeting on Electrowetting, Los Angeles, California, 20th – 22nd August, 2008. Poster title: “Optimization of Device Geometry in Single-Plate Digital Microfluidics Devices”. **Received Best Poster award** (offered to best three posters in the meeting).
2. Microfluidics and Nanofluidics 2008, Cancun, Mexico, 21st-24th Feb., 2008. Presentation title: “Master-Printing: An Ultra-Rapid Prototyping Technique for Fabricating Microfluidic Devices”.
3. Transducers'07, Lyon, France, 10-14 June, 2007. Poster title: “3D Droplet Actuation in Digital Microfluidics Devices”.
4. The 56th Canadian Chemical Engineering Conference, Sherbrooke, Quebec, 15-18 October, 2006. Presentation title: “Rapid Prototyping in Copper Substrates for Digital Microfluidics”.
5. The 3rd International Conference on Heat and Mass Transfer, Banff, Alberta, May 2003. Presentation title: “Heat Transfer and Fluid Flow in Microchannel Heat Sinks: An Overview of the Current State-of-The-Art”.

Conference Abstracts (name of presenter in italic)

1. *N. A. Mousa*, M. J. Jebrail, H. Yang, M. Abdelgawad, P. Metalnikov, R.F. Casper, and A.R. Wheeler, Estrogen Extraction From Microdrop Clinical Samples by Digital Microfluidics, The 5th International Conference on Microtechnologies in Medicine and Biology (MMB 2009), Quebec City, Canada. 1-3 April, 2009.

2. *M. W. L. Watson, M. Abdelgawad, and A. R. Wheeler*, Hybrid Microfluidics for Pre-Processing and Separations, 23rd International Symposium on Microscale Bioseparations (MSB 2009), Boston, MA USA. 1-5 February, 2009.

Other Conferences Attended

1. Ontario on a Chip, Toronto, Canada, 15th May, 2008.
2. Ontario on a Chip, Toronto, Canada, 1st Nov., 2007.
3. 5th International Meeting on Electrowetting, Rochester, New York, 31 May – 2 June, 2006.
4. ASME 3rd International Conference on Microchannels and Minichannels, Toronto, Canada, 13-15 June, 2005.

Awards and Scholarships

Research

NSERC post doctoral fellowship	Winter, 2009
Best Poster award, 6th International Meeting on Electrowetting	Summer, 2008
Ontario Graduate Scholarship	Summer, 2007
Ontario Graduate Scholarship, as an international student	Summer, 2006
Lachlan Gilchrist Fellowship	Fall, 2005
6th International Meeting on Electrowetting travel award	Summer, 2008
Transducers-07 Conference Travel Award	Summer, 2007

Academic

University of Toronto Fellowship	Fall, 2004
Power Corporation of Canada Graduate Fellowship	Fall, 2002
Concordia University Partial Tuition Scholarship	Fall, 2002
Concordia University Graduate Fellowship	Fall, 2001
Concordia University International Fee Remission Award	Fall, 2001
First class honors from Syndicate of Egyptian Engineers	1998
Dr. Mahmoud Hassan Saadawi Award, Assiut University	1997
Dr. Ramadan Mohamed Sadek Award, Assiut University	1996
Dr. Aboelwafa Megahed Award, Assiut University	1994

Community service and leadership

Muslim Students' Association at UofT scholarship	Fall, 2007
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Supervisory Experience

1. Chun Wu (B.Sc candidate, Engineering Science): Fabrication of circular PDMS microchannels for Lab on a Chip applications (summer research project 2008). Manuscript in preparation.
2. Philip S. Park (B.Sc candidate, Chemical Physics): Numerical simulation of droplet actuation in digital microfluidics devices using COMSOL multiphysics (summer research project, summer 2007). Research published in *Journal of Applied Physics* (paper#2 in publications list)
3. Jared Mudrik (B.Sc candidate, Chemistry): Rapid master fabrication from printed circuit boards for channel microfluidics. Research published in *Lab on a Chip* (paper#6 in publications list).
4. Aaron Ming (B.Sc candidate, Engineering Science): Automatic control of droplet actuation in digital microfluidic devices (4th year thesis, Fall 2007 and winter 2008)
5. Anthony Wong (B.Sc candidate, Microbiology): Automatic control of droplet actuation in digital microfluidic devices (summer research project, 2006).
6. George Ye (B.Sc. candidate, Engineering Science): Testing PDMS as a dielectric coating in digital microfluidic devices (summer research project, 2006).
7. Neal Yonson (B.Sc candidate, Chemistry) and Justin Trottier (B.Sc. candidate, Engineering Science): Microcontact printing-based fabrication of digital microfluidics devices (4th year thesis, Fall 2005 and winter 2006). Research published in *Analytical Chemistry* (paper#9 in publications list).
8. Patricia Phutthavong (B.Sc. candidate, Mechanical Engineering) : Heat transfer and fluid flow in microdevices (undergraduate research project, winter and summer 2002). Research published in *Microscale Thermophysical Engineering* (paper#12 in publications list).

Teaching Experience

University of Toronto

Sept. 2004 - present

- Coordinator for Prospective Professors in Training (PPIT) program, which aims at preparing senior graduate students for careers in academia.
 - Helped design program outline and decide which topics to be covered for each seminar.
 - Contacted and confirmed speakers for each seminar
 - Managed program website on Blackboard
- Tutor: MIE414 Applied Fluid Mechanics for 4th year Mech. Eng. students (Fall 2006, 2007, and 2008; class size: 30~60 students; course coordinator: Prof. Axel Guenther).
 - Solved examples on the board every tutorial and helped students with their assignments during office hours.
 - Helped design and run a microfluidic lab experiment for the first time.

- Lab instructor: MIE312 Fluid Mechanics for 3rd year Mech. Eng. Students (Fall 2005; class size: 125 students; course coordinator: Prof. Pierre Sullivan)
- Tutor and Marker: MIE100 Dynamics for 1st year Eng. Students (winter 2005, 2006, 2007, 2008 and summer 2005 and 2006; class size: 45 students courses coordinators: Prof. Leslie Sinclair and Prof. Pierre Sullivan)
 - Solved examples on the board every tutorial and helped students with their assignments during office hours.
 - Designed 2 quizzes per semester and marked biweekly quizzes.

Concordia University

May 2001 - August 2003

- Tutor: ENGR251 Thermodynamics-I for 2nd year Eng. Students (Fall 2001 and 2002; class size: ~40 students course coordinator: Prof. Ibrahim Hassan)
- Tutor and Marker: ENGR361 Fluid Mechanics-I for 3rd year Mech. Eng. students (summer 2001, 2002, 2003; class size: ~50 students; course coordinator: Prof. Ibrahim Hassan)
- Lab instructor: MECH352 Heat Transfer-1 for 3rd year Mech. Eng. students (winter 2002 and 2003; class size: 64 students; course coordinator Prof. Wahid Ghaly)
 - Ran 4 laboratory experiments to demonstrate steady state conduction, transient conduction, radiation, and fin performance.
 - Marked students lab reports.

Assiut University

October 1998 – April 2001

- Tutor and Marker for Fluid Mechanics, Thermodynamics, Mechanics of Machines I and II, and Mechanical Vibrations.
 - Class size ranged from 20 students to 90 students.
 - Tasks included solving examples during tutorials, helping students during office hours, and marking midterms.
 - Supervised many graduation projects for 4th year students.

Professional Development

- Entrepreneurship 101: 26 hours non-credit course designed to introduce members of the research community to starting and growing a technology based business. Lectures covered a variety of related topics including protecting intellectual property, securing funding, defining markets, preparing a business plan, and hiring employees.
- Prospective Professors in Training (PPIT): one year program at University of Toronto preparing senior graduate students for Academic careers. Program includes a half credit course (MIE3002 Teaching Engineering in Higher Education) and biweekly seminars on how to apply for academic jobs, prepare for the job interview, negotiate your job offer, start a research program, and prepare for different academic challenges facing new professors.

- Teaching Assistants Training Program (TATP): a program offered at university of Toronto oriented toward new teaching assistants to prepare them for teaching duties. Program includes 5 seminars and in-class evaluation of teaching style.
- Graduate Teaching Assistants Professional Development: a 10 hours program offered at Concordia University for professional development of teaching assistants.
- Instructor preparation program: a 30 hours program offered at Assiut University to prepare new graduates for teaching duties.

Community Involvement

Academic Officer *May, 2009 - Present*
Egyptian Student Association (ESA), University of Toronto

- Edited a biweekly Newsletter aimed at informing ESA members of events of interest.
- Wrote an Academic Tips section in the News letter. Sample topics included: “Journal Impact Factors”, “Your *h*-index: What it means and how to calculate it”, and “ How to choose your Graduate adviser”.
- Organized a book campaign to collect used books from University of Toronto community and send it to Universities in Egypt.

Communication Officer *April, 2008-April, 2009*
University of Toronto Family Housing Tenants Association

- Advocated for tenants rights with university administration.
- Communicated residents' complaints to rest of the executives.

Events Committee coordinator *June, 2006-May, 2007*
Muslim Student Association (MSA), University of Toronto

- Coordinated the following tasks during the month of Ramadan (25th September – 23rd October, 2006)
 - Serving free daily dinners to 150 students to break their fast.
 - Fundraising and managing a budget of \$15,000.
 - Coordinating and assigning tasks to more than 30 volunteers.
- Organized a ski trip for 75 students in collaboration with 5 different universities with a total participation of 400 students.
- Designed and conducted an online survey (110 participants) to improve performance of my committee.
- Organized many social events (BBQ's, sport tournaments, coffee breaks)

Secretary *April, 2005-May, 2006*
Association of Mechanical and Industrial Graduate Students (AMIGAS), University of Toronto.

- Helped organizing many student activities (BBQ's, one day trips, and new students' orientation).

Head of Housing Committee

June 2005-August 2006

Muslim Students' Association (MSA), University of Toronto, Canada

- Webmaster of the MSA housing website (updated the housing database regularly).
- Provided advice to new students coming to study at University of Toronto.

Founder and President

Fall and Winter, 1998

Al-Rowaad (The Pioneers) Student Group, Assiut University, Egypt

- Edited a bi-weekly newspaper aimed at student life.
- Edited a 10-pages brochure on services offered by the university to new students.
- Organized different student activities (trips, student gatherings).

Computer Skills

- COMSOL Multiphysics finite element package.
- FLUENT CFD package with GAMBIT as grid generator.
- AutoCAD for chip design.
- TecPlot for data graphing, plotting, and solution visualization.
- Designer and Webmaster for the research group website.