Mario J. Badr

Contact Information

The Edward S. Rogers Department of Electrical and Computer Engineering
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University of Toronto

Research Interests

Many-core/multi-core/heterogeneous architectures, synchronization, cache coherence, interconnection networks, analytical models, computer systems performance analysis.

Education

Ph.D., Computer Engineering — September, 2013 - Present
University of Toronto — *Toronto, Ontario, Canada*
Dissertation: "Novel Evaluation Methodologies for Future Architectures"
Advisor: Natalie Enright Jerger

M.A.Sc, Computer Engineering — January 2014
University of Toronto — *Toronto, Ontario, Canada*
Thesis: "Synthetic Traffic Models that Capture Cache Coherence Behaviour"
Advisor: Natalie Enright Jerger

B.A.Sc, Electrical Engineering — May 2011
University of Toronto — *Toronto, Ontario, Canada*

Industry Experience

Qualcomm Research Silicon Valley — Santa Clara, California, USA
Intern (C++, OpenCL, Hexagon, CMake) — *May, 2015 - August, 2015*
Used the Multicore Asynchronous Runtime Environment (MARE) to develop a heterogeneous application with multiple domain-specific kernels. Provided feedback to the MARE team on performance issues and bottlenecks.

Environment Canada — Toronto, Ontario, Canada
Intern (Java, XML) — *June, 2009 - August, 2010*
Implemented new features and bug fixes for the NinJo workstation, a tool for meteorologists. Notable projects include upgrading the visualization framework for lightning strikes to be faster and use significantly less memory, incorporating storm cell data for Canada, and helping to create a configurable view of weather data for a given storm cell.

Awards & Scholarships

Ontario Graduate Scholarship - *$15,000* — *2017*
Awarded for excellence in graduate studies.

Electrical & Computer Engineering Teaching Assistant Award — *2016*
Awarded by student vote and department review to the top three teaching assistants for the Fall semester.

Roberto Padovani Intern Scholarship - *$5,000* — *2015*
Awarded to seven Qualcomm Research interns across the globe for outstanding technical contributions made during their internship.

Thomas Noakes & Queen Elizabeth II Graduate Scholarship - *$15,000* — *2015*
Awarded for excellence in science and technology.

Teaching Assistant Teaching Excellence Award - *$200* *2015*
Awarded to four recipients across the three University of Toronto campuses based on nominations, references, and teaching philosophy.

Journal Publications

Joshua San Miguel, Karthik Ganesan, **Mario Badr**, and Natalie Enright Jerger. *The EH Model: Analytical Exploration of Energy-Harvesting Architectures.* In IEEE Computer Architecture Letters (CAL), November 2017.

Conference Publications

Joshua San Miguel, **Mario Badr**, and Natalie Enright Jerger. *Load Value Approximation.* In Proceedings of the International Symposium on Microarchitecture (MICRO), December 2014. (acceptance rate: 19%)

Mario Badr and Natalie Enright Jerger. *SynFull: Synthetic Traffic Models Capturing a Full Range of Cache Coherence Behaviour.* In Proceedings of the International Symposium on Computer Architecture (ISCA), June 2014. (acceptance rate: 18%)

Workshop Publications

Mario Badr and Natalie Enright Jerger. *Fast and Accurate Performance Analysis of Synchronization.* In Proceedings of the 9th International Workshop on Programming Models and Applications for Multicores and Manycores (PMAM), February 2018. (acceptance rate: 53%)

Mario Badr and Natalie Enright Jerger. *A Look at Computer Architecture Evaluation Methodologies.* In the 2nd Workshop on Pioneering Processor Paradigms (WP3), February 2018.

Tushar Kumar, Aravind Natarajan, Wenjia Ruan, **Mario Badr**, Dario Suarez Gracia, Calin Cascaval. *Abstract Representation of Shared Data for Heterogeneous Computing.* In the 30th International Workshop on Languages and Compilers for Parallel Computing (LCPC), October 2017. (acceptance rate: 65%)

Ajaykumar Kannan, **Mario Badr**, Parisa Khadem Hamedani and Natalie Enright Jerger. *Offloading to the GPU: An Objective Approach.* In the 3rd International Workshop on Parallelism in Mobile Platforms (PRISM), June 2015.

Presentations

Mario Badr and Natalie Enright Jerger. *Fast and Accurate Performance Analysis of Synchronization.* At the 9th International Workshop on Programming Models and Applications for Multicores and Manycores (PMAM), February 2018.

Mario Badr and Natalie Enright Jerger. *A Look at Computer Architecture Evaluation Methodologies.* At the Second Workshop on Pioneering Processor Paradigms (WP3), February 2018.

Mario Badr, Natalie Enright Jerger, Riken Gohil, Radhika Jagtap, and Matteo Andreozzi. *Generating Synthetic Traffic for Heterogeneous Architectures* At the ARM Research Summit, September 2017.

Mario Badr and Natalie Enright Jerger. *SynFull: Traffic Models Capturing Cache Coherence Behaviour.* At the International Symposium on Computer Architecture (ISCA), June 2014.

Invited Talks

Panelist: *Retrospective Vision: A Blessing or a Curse?* At the Second Workshop on Pioneering Processor Paradigms (WP3), February 2018.

Software Artifacts

SimSync *Apache License 2.0*
A tool for analyzing the performance of multi-threaded applications on multi- and many-core processors. SimSync focuses on the impact of synchronization on the performance of each thread. Available: *https://github.com/mariobadr/simsync-pmam*

SynFull *MIT License*
Implementation of a statistical simulation methodology for design-space exploration of Networks-on-Chip. Includes R scripts for creating models and an executable to generate synthetic traffic. Available: *https://github.com/mariobadr/synfull-isca*

Teaching Experience

Engineering Communication and Design Teaching Assistant
APS111, APS112, APS112T *1st Year Undergraduates, T-Program*
Facilitated tutorials for group projects with a focus on the engineering design process including how to: define the problem, develop solutions, and objectively compare designs. Taught the fundamentals of the design process in the Fall semester (APS111), providing feedback on written work and group dynamics. Continued to provide feedback and refine fundamentals in the Winter Semester (APS112) where students worked on a client-facing project. Also participated in the summer-session for students who were struggling with their course load (i.e., T-Program, APS112T).

Computer Programming Teaching Assistant
APS105, APS105T, APS106T, ECE244, ECE297 *1st & 2nd Year Undergraduates, T-Program*
Taught computer programming using the C (APS105, APS105T, APS106T) and C++ languages (ECE244, ECE297). Fundamental topics for both C and C++ included data structures, recursion, sorting, input/output, memory management on the stack and heap. Additional C++ topics included value versus reference semantics and object-oriented programming. The fundamentals learned were applied in a design project (ECE297), where I mentored student groups in implementing an application similar to Google Maps. The majority of teaching took place in tutorials (10-80 students) and computer labs.

In addition to tutorials and labs, I have also delivered lectures and developed course materials. For APS105, I delivered the 2013 Exam Jam review session. For ECE244, I delivered two lectures on recursion using an in-depth maze example with a step-by-step visualization of the maze traversal. For ECE297, I proposed, developed, and delivered optional tutorials on software design.

Computer Organization & Architecture Teaching Assistant
ECE352, ECE552 *3rd & 4th Year Undergraduates, Graduates*
Supervised and helped students implement a simple von Neumann processor using verilog in a computer lab setting (ECE352). Also taught computer architecture concepts (e.g., caches, pipelining, register renaming, prefetching) in the lab. Delivered tutorials on Amdahl's Law, quantitative analysis, cache coherence, and memory consistency.

University Service

Appointed Graduate Representative 2015-2016
Executive Committee of Faculty Council - Faculty of Applied Science & Engineering

Graduate Representative 2015-2016
Faculty Council - Faculty of Applied Science & Engineering

President 2015-2016
Electrical and Computer Engineering Graduate Students' Society

Department Steward 2013-2014
Canadian Union of Public Employees

Social Event Coordinator 2012-2013
Electrical and Computer Engineering Graduate Students' Society

Professional Development

Teaching in Higher Education 2015
One semester course
Learned more about teaching theories and styles and was observed by peers while teaching a tutorial on Computer Architecture. Developed a course syllabus for a fictitious course.

Teaching Engineering in Higher Education 2015
One semester course
Studied concepts and research on curriculum, teaching, and learning in engineering education.

Prospective Professors in Training 2014-2015
Thirteen Seminars, One semester course
Began preparations for becoming a professor in academia and prepared an academic dossier.

Mini-MBA 2015
Ten Classes
Gained an understanding of fundamental business concepts and participated a case competition.

Oral Presentation Skills 2014
Five Classes
Examined presentation structure and the use of visual aids. Exchanged feedback with peers.

Prewriting Strategies for Developing and Organizing Your Ideas 2014
Four Classes
Learned several new strategies for developing and organizing ideas before the writing process.

NSERC Proposal Workshop 2014
Three Classes
Examined features of good and bad proposal writing, and exchanged feedback with peers.

Teaching Fundamentals Certificate 2012-2013
Six Workshops
Improved my teaching skills with workshops on pedagogy, research, academic integrity, and students in difficulty.