

# MAHDI HAJIAGHAYI

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## OBJECTIVE

Seeking a full-time position in a cutting-edge communication company to enrich and apply my theoretical and practical knowledge of digital communication and wireless networks.

## EDUCATION

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**University of Toronto** Toronto, ON  
**Ph.D.** in Electrical and Computer Engineering 2007–Exp. Jun. 2012  
Thesis project: Protocol design & resource management in cooperative multi-channel networks

**University of Alberta** Edmonton, AB  
**M.Sc.** in Electrical and Computer Engineering 2005–07  
Thesis: Space-time code design for multi-antenna systems (MIMO)

**Sharif University of Technology** Tehran, Iran  
**B.Sc.** in Electrical Engineering and Petroleum Engineering (dual degree) 2000–05

## PROFESSIONAL EXPERIENCE

**Strategic Research Intern, Nokia Research Center, Helsinki, Finland** Aug–Dec 2011

- Worked in the 3GPP LTE-advanced standardization group in the radio system lab.
- Contributed to identify use-cases and requirements of device-to-device (D2D) communication and proximity-based services from the commercial, social and public safety perspectives.
- Proposed an efficient resource and interference management solution for LTE-based D2D network.
- Investigated the issue of synchronization and timing and channel control signals in D2D.
- Compared different technologies such as Bluetooth and Wi-Fi with LTE-based D2D communication in terms of power usage, coverage range and TX/RX architecture.
- Studied the LTE-advanced standard and its architecture, control and user planes in TDD/FDD modes

**Research Assistant, Wireless Computing Lab, University of Toronto** 2007–present

- Investigated the resource management problem in advanced multiple access technologies particularly OFDMA used in emerging wireless communication systems.
- Studied enhanced network topologies including cooperative network and network coding for capacity improvement.
- Exploited limited feedback system in practical cooperative OFDM networks and employed superior clustering methods.
- Applied cross-layer design approaches to fully utilize the benefits of cooperative networks using various convex and non-convex optimization forms and techniques such as mixed-integer programming, geometric programming, multi-objective optimization and some innovative approaches, for instance, time-sharing and dual-decomposition methods.
- Designed adaptive resource (power and spectrum) allocation models with low complexity to improve QoS (e.g. throughput, lifetime, and error rate) in cooperative networks.
- Investigated optimal relay processing matrix to maximize the total throughput for a multi-channel relaying scenario using matrix algebra and statistical analysis.
- Created simulation framework in C/C++ and MATLAB to model statistical wireless channels used to evaluate the performance of proposed resource allocation algorithms.

- Research Assistant**, ICORE wireless Comm. Lab, University of Alberta 2005–07
- Studied different space-time codes which realize the benefits of a MIMO system.
  - Investigated the detection and estimation schemes for MIMO coherent and non-coherent receivers under different channel statistics using advanced stochastic analysis.
  - Proposed new structures of unitary matrices adopted in various space-time codes and precoding matrices, leading to a better performance with lower error probability.
  - Employed evolutionary optimization approaches to utilize transmit-power in MIMO.
  - Developed a simulation platform in MATLAB/C++ to evaluate our proposed codes.

- IT Specialist, and Software Programmer**, AICTC and Gata Co. 2002–04  
Advanced Information and Communication Centers, Tehran, Iran
- Designed and customized, as part of a team, a set-top-box (STB) platform for Iranian home users, offering many interactive services such as VoD, VoIP and E-shopping.
  - Developed a set of multimedia applications for this platform under Linux Environment.
  - Submitted a complete feasibility study and price analysis of Telematic in self-made vehicles, to the Ministry of Technology.

- PCB Designer, and Hardware Programmer**,  
Autonomous Robotic Vehicle Project (ARVP), University of Alberta 2006-07  
CEDRA Rescue Robot Team, Sharif University of Technology 2004-05
- Designed a customized battery-charger to safely charge a 12 cell NiMH battery pack.
  - Constructed an intelligent motor driver using Pspice/Protel, and programmed it with C.
  - Devised an integrated system consisting of several critical sensors such as pressure and thermal sensors, IMU and digital compass for an under-water autonomous Robot.

- Teaching Assistant**, Electrical and Computer Engineering Department 2007–present
- ECE241, “Digital Logic Lab”, University of Toronto, Falls 2009-10-11.
  - ECE302, “Stochastic and Random Process”, University of Toronto, Spring 2010
  - ECE316, “Communication Systems”, University of Toronto, Spring 2008.
  - EE390, “Introduction to Communication Systems”, University of Alberta, Spring 2007

## **PROFESSIONAL SKILLS**

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- **Computer Skills:**
  - Operating systems: Linux and Windows
  - High-level programming languages: MATLAB, Maple, C/C++, Java
  - FPGA programming: Verilog and VHDL
  - Circuit and PCB design: Protel, Pspice, Orcad and Cadence
  - Network Programming: Ns (Network Simulator), Opnet
  - Web development: HTML and XML
  - Typesetting: TEX, LATEX, Microsoft office
- **Communication and Interpersonal:** Received excellent teaching ratings at the University of Toronto; facilitated interactions between incoming ECE undergraduate students and their program and the ECE environment.

- **Mathematical Skills:** Advanced knowledge of convex optimization, probability and stochastic processes, statistical analysis, system modeling and analysis, financial risk modeling and pricing, time series analysis, matrix analysis.

## ACHIEVEMENTS AND AWARDS

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- **DCA scholarship award**, University of Toronto 2011-12
- **Ontario graduate scholarship**, University of Toronto 2009-11
- **Ted Rogers fellowship award**, ECE department, University of Toronto 2007-10
- International tuition award, University of Toronto 2007
- Provost doctoral award, University of Alberta (received but declined) 2007
- University of Minnesota fellowship award, (received but declined) 2005
- Included in top 10% of electrical engineering students, Sharif University 2005
- Qualified within the top 60 students in the country eligible to take two engineering programs simultaneously, Sharif University of Technology 2003
- Ranked 8th among 200,000 applicants in the national university's entry exam, locally called "Conquer", Iran 2000

## ACTIVITIES AND INTERESTS

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- Member of IEEE, and University of Toronto operation research group 2010-11
- Executive board of University of Toronto engineering toastmaster club 2008-09
- Member of engineering without borders (EWB) and UToronto Robotic team 2007-09
- **Hobbies:** following current world issues, outdoor activities & sports and socializing

## GRADUAGE COURSES

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Broadband Digital Communication, Convex Optimization, Quality of Service, DSP, Intelligent image processing and Wearable computing, Data and Computer Networks, Information Theory, System Modeling and Analysis, Internet Programming, Stochastic Process, Integrated Circuit for Digital Communication

## PUBLICATIONS (JOURNAL, REFEREED)

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- **M. Hajiaghayi**, M. Dong, B. Liang "Jointly Optimal Channel and Power Assignment for Dual-Hop Multi-channel Multi- user Relaying" accepted to appear in IEEE Journal on Selected Areas in Communications (JSAC), 2011.
- **M. Hajiaghayi**, M. Dong, B. Liang "Jointly Optimal Channel Pairing and Power Allocation for Multi-channel Multi-hop Relaying" IEEE Transaction on Signal Processing, vol. 59, pages: 4998 - 5012 Oct. 2011.
- **M. Hajiaghayi**, M. Dong, B. Liang "Maximizing Lifetime in Relay Cooperation through Energy-Aware Optimal Power Allocation" IEEE Transaction on Signal Processing, vol.58, no.8, pages: 4354-4366, Aug. 2010
- M. Ramezani, **M. Hajiaghayi**, M. Ardakani C. Tellambura " Receive Antenna Selection for Unitary Space-Time Modulation over Semi-Correlated Ricean Channels" IEEE Transactions on Communication, vol.58, no.2, pages: 521-530, Feb. 2010
- **M. Hajiaghayi** and C. Tellambura "Unitary Signal Constellation for Differential Space-Time Modulation" IEEE Communication Letters, vol. 11, issue 1, pages: 25 - 27, Jan. 2007
- M.T. Hajiaghayi and **M. Hajiaghayi** " On the Bounded Fragmentation Property and its Applications" European Journal of Combinatorics, vol. 24, no. 7, pages: 891-896, 2003

## **PUBLICATIONS (CONFERENCE, REFEREED)**

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- **M. Hajiaghayi**, M. Dong and B. Liang ”*Jointly Optimal Bit Loading, Channel Pairing and Power Allocation for Multi-channel Relaying*” accepted to appear in Proc. IEEE International Conference on Computer Communications (INFOCOM), Florida, USA, Mar. 2012
- **M. Hajiaghayi**, M. Dong and B. Liang ”*Optimal Channel Assignment and Power Allocation for Dual-Hop Multi-channel Multi-user Relaying*” Proc. IEEE International Conference on Computer Communications (INFOCOM), Shanghai, China, Apr. 2011
- M. Dong, **M. Hajiaghayi**, B. Liang ”*On Linear Processing for Dual-hop Multi-channel Relaying*” Proc. Of Annual Conference on Information Sciences and Systems (CISS), Baltimore, USA, Mar. 2011
- **M. Hajiaghayi**, M. Dong and B. Liang ”*Optimal Channel Pairing and Power Allocation for Multi-channel Multi-hop Relay Networks*” International Conference on Heterogeneous Networking for Quality, Reliability, Security and Robustness (QShine), Houston, USA Nov. 2010 (Invited Paper)
- **M. Hajiaghayi**, M. Dong and B. Liang ”Energy-aware power allocation for lifetime maximization in single-source relay cooperation” Proc. 25th Biennial Symposium of Communication, Kingston, Canada, May 2010 (presented).
- **M. Hajiaghayi**, M. Dong and B. Liang ”*Using Limited Feedback in Power Allocation design for a Two-hop Relay OFDM System*” Proc. IEEE International Conference on Communications (ICC), Dresden, Germany, June 2009 (presented)
- J.P Thibault, **M. Hajiaghayi** ”*On Minimizing network coding nodes for Multicast*” Proc. IEEE Canadian Workshop of Information Theory (CWIT), Ottawa, Canada, May 2009
- **M. Hajiaghayi**, C. Tellambura ”Antenna Selection for Unitary Space-Time Modulation over Correlated Rayleigh Channels” Proc. IEEE International Conference on Communications (ICC), Beijing, China, May 2008
- A. Ghaderipour, **M. Hajiaghayi** and C. Tellambura ”*A Novel Structure for 2×2 Full-Rate Full-Diversity Space-Time Block Codes*” Proc. Global Telecommunications Conference (GLOBECOM), Washington, USA, Nov. 2007
- M. Hajiaghayi and C.Tellambura ”*Optimum Design of Differential Unitary Space-Time Modulation*” Vehicular Technology Conference (VTC Fall), Montreal, Canada, Sept. 2007 (presented)
- A. Ghaderipour, **M. Hajiaghayi** and Chintha Tellambura ” *Unitary Matrix Design via Genetic Search for Differential Space-Time Modulation and Limited Feedback Precoding*” Proc. Indoor and Mobile Radio Communications Symposium (PIMRC), Helsinki, Finland, Sept. 2006 (Presented)
- **M. Hajiaghayi** and M.T. Hajiaghayi ”*On the Bounded Fragmentation Property and its Applications*” Proc. Euro Conference on Combinatorics, Graph Theory and Applications, EuroCOMB’03, Prague, Czech republic, Sept. 2003 (a preliminary version of the journal paper)

## **SURVEY PAPERS (NON-REFEREED)**

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- **M. Hajiaghayi** ” *Game Theory and its Application in Wireless Network Design*” available online at <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.124.1820>, Feb. 2008
- **M. Hajiaghayi** ” *A survey on security and pollution control in Peer-to-Peer Networks*” available online at <http://www.comm.utoronto.ca/mahdih/P2Pnetwork.pdf>, Apr. 2008