Mohammad Memarian

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Research Interests

- Electromagnetics, Microwaves, Antennas, Metamaterials, Metasurfaces, Plasmonics, Optics

Journal Publications

- X. Li, **M. Memarian**, and T. Itoh, "A New Cavity Resonance Assisted by Anisotropic Metasurfaces", *IEEE Transactions on Microwave Theory and Techniques*, pp. 1-10, Apr. 2018.
- Y. Morimoto, **M. Memarian**, X. Li and T. Itoh, "Open-End Microstrip Line Terminations Using Lossy Gray-Scale Inkjet Printing," *IEEE Transactions on Microwave Theory and Techniques*, vol. 65, pp. 4861-4870, Dec. 2017.
- L. Xu, D. Chen, C. A. Curwen, **M. Memarian**, J. L. Reno, T. Itoh, B. S. Williams, "Metasurface quantum-cascade laser with electronically-switchable polarization," *Optica*, vol. 4, pp. 468-475, Apr. 2017.
- **M. Memarian**, X. Li, T. Itoh, "Wide-band/angle Blazed Surfaces using Multiple Coupled Blazing Resonances," *Scientific Reports – Nature Publishing Group*, vol. 7, Feb. 2017.
- Y. Morimoto, T. Yuasa, T. Owada, Y. Tahara, H. Miyashita, M. Miyazaki, **M. Memarian**, T. Itoh, "A Multi-Harmonic Absorption Filter Using Quasi-Multilayered Striplines for RF Power Amplifiers," *IEEE Trans. Microw. Theo. Tech.*, Oct. 2016.
- **M. Memarian** and G. V. Eleftheriades, "Analysis of Anisotropic Epsilon-Near-Zero Hetero-junction Lens for Concentration and Beam Splitting," *Optics Letters*, vol. 40, Mar. 2015.
- **M. Memarian** and G. V. Eleftheriades, "Dirac Leaky-Wave Antennas For Continuous Beam Scanning From Photonic Crystals," *Nature Communications*, vol. 6, Jan. 2015.
- **M. Memarian** and G. V. Eleftheriades, "Light Concentration Using Hetero-junctions of Anisotropic Low Permittivity Metamaterials," *Light: Science and Applications – Nature Publishing Group*, vol. 2 e114, Nov. 2013.
- **M. Memarian** and G. V. Eleftheriades, "Enhanced Radiation of an Invisible Array of Sources through a Sub-wavelength Metal-Strip Grating and Applications," *Journal of Applied Physics*, vol. 114, 134902, Oct. 2013.
- **M. Memarian** and G. V. Eleftheriades, "Dipole Radiation Near Anisotropic Low-permittivity Media," *Progress In Electromagnetics Research*, vol. 142, 437-462, 2013.
- **M. Memarian** and G. V. Eleftheriades, "Evanescent-to-Propagating Wave Conversion in Metal Strip Gratings," *IEEE Trans. Microw. Theory and Tech.*, 60, 3893-3907, Dec. 2012.
- **M. Memarian** and R. R. Mansour, "Quad-mode and Dual-mode Dielectric Resonator Filters", *IEEE Trans. Microwave Theory and Techniques*, 57, 3418-3426, Dec. 2009.

Conferences

- S. Rezaee, **M. Memarian**, G. V. Eleftheriades, “SIW based Dirac Leaky-Wave Antenna,” accepted in IEEE AP/URSI 2018.
- M. Rezaei, **M. Memarian**, M. Fakharzadeh, “A 28GHz Dual-Polarized Planar Antenna Array,” accepted in IEEE AP/URSI 2018.
- D. Chen, L. Xu, C. Curwen, **M. Memarian**, J. Reno, T. Itoh, and B. Williams, "Metasurface Terahertz Laser With Electronically-Controlled Polarization," In *CLEO: QELS_Fundamental Science*, pp. FTu4G-5, 2017.
- C. Molero, R. Rodr´ıguez-Berral, F. Medina, F. Mesa, **M. Memarian**, T. Itoh, “Accurate Circuit Model for a Planar Resonant Blazed Grating,” *European Microwave Conference* 2017.
- C.Tao, **M. Memarian**, T. Itoh, “Metasurface assisted PMC-PEC waveguide with leaky wave applications,” *European Microwave Conference*, 2017.
- X. Li, **M. Memarian**, T. Itoh, “A new resonance in a circular waveguide cavity assisted by anisotropic metasurfaces,” accepted in *IEEE International Microwave Symp.*, 2017.
- C. Tao, **M. Memarian**, Y. Morimoto, T. Itoh, “Non-periodic Metasurfaces for Blazing and Beam Splitting,” *IEEE Asia/Pacific Microwave Conference (APMC)*, 2016.
- **M. Memarian**, X. Li, T. Itoh, “Resonant Blazed Metasurface Gratings,” *IEEE European Microwave Conference (EUMC)*, 2016.
- X. Li, **M. Memarian** and T. Itoh, “Blazed Metasurface Grating: The Planar Equivalent of a Sawtooth Grating,” *IEEE MTT-S International Microwave Symposium (IMS*), *May 2016.*
- A. Dorrah, **M. Memarian**, G. V. Eleftheriades, “Modal Analysis and Closure of the Bandgap in 2D Transmission-Line Grids,” *IEEE MTT-S International Microwave Symposium (IMS*), May 2016.
- **M. Memarian** and G. V. Eleftheriades, “Dirac Leaky Wave Antennas,” *Photonics North*, June 2015.
- **M. Memarian** and G. V. Eleftheriades, “All-dielectric Steerable Leaky-Wave THz Antenna,” *IEEE Antennas and Propag. & URSI Symp.*, July 2014.
- **M. Memarian** and G. V. Eleftheriades, “Radiation of Dipoles at the Interface of Anisotropic Low Permittivity Media,” *IEEE Antennas and Propag. & URSI Symp.*, July 2013.
- **M. Memarian** and G. V. Eleftheriades, “Spectral-Impulse-Response Approach for Analyzing the Aperiodic Excitation of a Periodic Diffraction Grating,” *IEEE Int. Microw. Symp. Dig.*, June 2012.
- **M. Memarian** and G. V. Eleftheriades, “Analysis of Near-field Scattering in MIMO Antennas,” *IEEE Antennas and Propag. & URSI Symp.*, July 2011.
- **M. Memarian** and R. R. Mansour, “Dual-band Half-cut Dielectric Resonator Filters”, *Proc. European Microw. Conf.*, Oct. 2009, 555-558.
- **M. Memarian** and R. R. Mansour, “Dual-mode Half-cut Dielectric Resonator Filters,” in *IEEE Int. Microwave Symp. Dig.*, Jun 2009, 1465-1468.

Patents

- **M. Memarian** and R. R. Mansour, "Method of operation and construction of dual-mode filters, quad-mode filters, dual-band filters, and diplexer/multiplexer devices using full or half-cut dielectric resonators," awarded US Patent Application 12/479,263, Feb. 2012, and EU patent, 2011.

- 1 more Submitted patent under review

Education

- Postdoctoral Fellow (NSERC Fellow), Dept. Electrical Engineering, University of California Los Angeles (UCLA), supervisor: Prof. T. Itoh, Nov. 2015 – Feb. 2017.
- Doctor of Philosophy, Electrical & Computer Engineering, University of Toronto, Sept. 2010 - May 2015. A+ in all 5 PhD degree courses, External Examiner: Prof. N. Engheta
  Thesis: **M. Memarian**, "Controlling Electromagnetic Fields Using Periodic Structures: Gratings, Metamaterials, and Photonic Crystals", PhD thesis, University of Toronto, 2015.
- Master of Applied Science, Electrical and Computer Engineering, University of Waterloo, Waterloo, ON, Sept. 2007- Aug. 2009. GPA 93.8% in 5 graduate level courses
  Thesis: **M. Memarian**, "Novel quadruple-mode, dual-mode and dual-band dielectric resonator filters and multiplexers", MASc thesis, University of Waterloo, 2009.
- Bachelor of Applied Science, Electrical Engineering, Honors, Co-op, University of Waterloo, Waterloo, ON, Sept. 2002- Apr. 2007, Dean's Honor List and Distinction

Awards and Achievements

- Co-authored a paper "SIW based Dirac Leaky-Wave Antenna" that received honorable mention award in the IEEE AP/URSI 2018 Student Paper Competition.
- Co-authored a paper "A new resonance in a circular waveguide cavity assisted by anisotropic metasurfaces" reached the IEEE IMS 2017 Student Paper Competition finalists.
- Co-authored a paper "Modal Analysis and Closure of the Bandgap in 2D Transmission-Line Grids" that received 3rd place in the IEEE IMS 2016 Student Paper Competition
- Recipient of the prestigious and very competitive Natural Sciences and Engineering Research Council Postdoctoral Fellowship (NSERC-PDF) award
- Ranked 1st among all electrical engineering PhD graduates in Canada for NSERC-PDF
- Ontario Graduate Scholarship - OGS, 2014
- IEEE Antennas and Propagation Society Doctoral Research Award 2013
- University of Toronto SGS Conference grant for presenting at IEEE APS/URSI 2013
- Patent award at Comdev Ltd., October 2012
- NSERC-PGS (Post Graduate Scholarship) award in PhD studies, University of Toronto, Sept. 2010 - Sept.2013
- Best Paper Competition, recipient of Honorable Mention Award for the paper "Dual-mode half-cut dielectric resonator filters," in the IEEE MTT-S Intern. Microw. Symp. (IMS 2009)
- Best Presentation Award of paper "Dual-mode half-cut dielectric resonator filters", in the IEEE MTT-S International Microwave Symposium (IMS 2009)
- NSERC-CGS M (Canada Graduate Scholarship) for Masters studies

- Entered the Dean's Honor list for three academic terms (2005, 2006, 2007)
- Ontario Graduate Scholarship (OGS) (3 times recipient)
- University of Waterloo President's Scholarship (3 times recipient)
- Graduated from BASc on the Dean's Honor List with last term GPA of 93.5%.
- High ranking student in class during all undergraduate academic terms, including rank 3rd, attained excellent academic standing in all academic terms
- Prestigious Nortel Networks Undergraduate Scholarship for academic achievement
- Various 3M Canada Inc. and multiple University of Waterloo Bursaries
- Distinction Award from the Descartes Mathematic Contest, University of Waterloo
- Very high scorer on the CBT TOEFL test (280/300)
- Ranked first among all students of Tehran's northern district high schools

Research Contributions and Experience

NSERC Postdoctoral Fellow, Univ. California Los Angeles (UCLA) 11/2015-12/2016

- Supervisor: Professor T. Itoh
- Design of novel metasurfaces (MS) and metamaterials at microwaves, mm-wave and THz
- Devising novel concepts: phase-modulated MS, resonant blazed MS, coupled resonant blazed MS, non-periodic MS, THz active MS, tunable THz sources, sub-THz on-chip antennas
- Defining and leading several novel research projects and topics and preparing proposals
- Directly supervised and graduated one MSc student
- Directly supervised and defined thesis topics for one PhD and two other MSc students

Research Assistant, PhD degree, University of Toronto 09/2010-05/2015

- Supervisor: Professor G. V. Eleftheriades
- Introduced the Dirac Leaky Wave Antenna: Leaky wave radiation from photonic crystals with Dirac type dispersion for achieving reliable continuous scanning of directive beams through broadside, applicable at microwaves, terahertz, and optics.
- Introduced a novel lens for collecting, refracting, and concentrating light/electromagnetic waves using anisotropic low permittivity and low index metamaterials. www.ece.utoronto.ca/news/new-metamaterial-lens/ news.engineering.utoronto.ca/new-metamaterial-lens-allows-lighter-thinner-solar-panels/
- Analysis of radiation of sources near anisotropic low-permittivity media for novel ways of beam shaping of light and microwaves.
- Theoretical and experimental discovery of a novel 'radiation enhancement' of invisible sources using sub-wavelength gratings, with applications in detection/sensing/measurement.
- Introduced a semi-analytical method for solving the aperiodic excitation of periodic structures using a `spectral impulse response' method, including near-field scattering.
- Published in high impact journals, including Nature Publishing Group, IEEE, AIP, PIER.

Research Assistant, post MASc degree, Univ. Waterloo 09/2009-09/2010

- Novel mixed time and frequency design techniques for microwave filters.
- Research on microwave and RF applications in nano-electronics.

- Research and design of novel microwave filters and devices.

Research Assistant, MASc degree, Univ. Waterloo 09/2007-08/2009

- Supervisor: Professor R. R. Mansour
- Research, design and development of novel microwave dielectric resonator (DR) filters, multiplexers and system components
- The first ever quadruple-mode DR filter using a simple cylinder structure was demonstrated, allowing considerable shrinkage for microwave DR filters (up to ¼ of single-mode filters).
- This research attracted the industrial audience, most notably COM DEV Ltd. (a major satellite company), which supported the research and patenting of ideas in this work.
- One paper resulting from this work was a finalist at the IEEE IMS 2009 Best Paper Competition and received the Honorable Mention Award & the Best presentation award.

Teaching Experience

- Lecturer at Sharif University of Technology: Electromagnetics (3 terms), Fields and Waves (1 term), Microwave Filters (1 term), Project 1 (1 term), Project 2 (1 term)
- Lecture at University of California Los Angeles, EE266 Computational Methods for Electromagnetics
- Teaching assistant at University of Toronto, Electricity & Magnetism, Electromagnetics, Microwave Circuits, Radio & Microwaves Wireless Systems
- Teaching assistant at University of Waterloo: Electromagnetic waves, Analog control

Work Experience

3G Wireless Developer, Research In Motion 09/2005-12/2005

- Embedded development on Blackfin ADSP535 and Intel XScale processors for Blackberry
- Porting Layer 1 DSP and RTOS code and drivers to RIM hardware platform
- Performance analysis and profiling of Layer 1 DSP and Real Time OS code
- Code maintenance and debugging of layer one code

Undergraduate Research Assistant, Dept. ECE, Univ. Waterloo 05/2005-08/2005

- Research, analysis and design of a smart system to detect and synchronize to arbitrary digital satellite channels, under supervision of Professor S. Safavi-Naeini

Wireless Protocol Specialist, R&D, Research In Motion 01/2005-04/2005

- System level design of features such as ALS (Alternate Line Service) for the Blackberry.
- GSM, GPRS, and EDGE protocol stack testing, debugging and analysis
- Development of test codes on 6103 Air Interface Monitor/Emulator (AIME) test equipment
- Received outstanding evaluation and was recognized for significance of contributions

Wireless Protocol Specialist, R&D, Research In Motion 05/2004-08/2004

- Designed and developed RIM's complete Adaptive Multi Rate (AMR) test suite on 6103 AIME using VB, C/C++, DLL and RTDLL

- GSM, GPRS protocol stack testing, debugging and analysis (Layers 1-3 in C code)

Protocol Tester, R&D, Research In Motion 09/2003-12/2003
- IOT and regression testing of GSM and GPRS protocol stack in Blackberry devices
- Gained hands on experience of Racal Instruments, Agilent 8960, CMU, and Rhode and Schwarz test equipment for protocol testing of mobile devices

Engineering lab student, Easy Heat Ltd. 01/2003-04/2003
- Carried out CSA/UL certification tests on heating cables and heating accessories
- Developed a Windows software package (in the .NET Framework), for optimization of cost and efficiency of various heating cables
- Lab instruments such as insulation tester, dielectric strength tester, tensile tester

Software Developer, University of Waterloo 02/2002-06/2002
- Developed SOMA, a research and teaching software package, using VB/VBA

Other Presentations and Technical Reports

- **M. Memarian**, and G. V. Eleftheriades “Low-Index Light Concentrators for Infra-Red Focal Plane Arrays,” University of Toronto, Aug. 2014.
- **M. Memarian**, “Light Concentration Using Low-Index Metamaterials,” Electromagnetics and Photonic Seminar (EMPS), Dec 2013.
- **M. Memarian**, “Metamaterial for solar cell and Photo-Voltaics applications,” University of Toronto, Oct. 2012.
- **M. Memarian**, “Aperiodic Excitation of a Periodic Diffraction Grating,” Electromagnetics and Photonic Seminar (EMPS), Dec. 2011.
- **M. Memarian**, "Step by step time and frequency domain design and optimization of microwave bandpass filters", research report, University of Waterloo, Dec. 2009.
- **M. Memarian**, “Compact Dielectric Resonator Filters,” IEEE Int. Microw. Symp, June 2009.
- **M. Memarian**, “Novel Dielectric Resonator Filters and Multiplexers,” presentation for COM DEV Ltd., June 2008 and Jan. 2009.
- **M. Memarian et. al.**, “Electronically Variable AC Load” Bachelors thesis, seminar, and poster presentation, Fourth Year Design Project Symposium (FYDP), Dept. ECE, University of Waterloo, 2007.
- **M. Memarian**, 4 co-op work reports, Dept. ECE, Univ.Waterloo, 2002, 2003, 2004, 2005.

Computer and Language Skills

- Microwave & EM: Ansoft HFSS, Comsol, CST Microwave Studio, HP-ADS, Sonnet
- Electrical/Engineering: Matlab, Pspice, Cadence, PSIM, Maple, Solidworks, Autocad
- Programming: C/C++, C#, Assembly, Java, VB .NET & 6.0