

Dina El-Damak | Curriculum Vitae

Assistant Professor, University of Southern California (USC)

3737 Watt Way, PHE 620, Los Angeles, CA 90089-0271

Email: eldamak@usc.edu, URL: <http://www.deldamak.com>

Research Interests

Energy harvesting, power management circuits, ultra-low power data converters, ultra-low power biomedical devices and circuit design with emerging technologies.

Appointments

- **08/2016 – Present**
Assistant Professor, Department of Electrical and Computer Engineering
University of Southern California, Los Angeles, CA, USA
- **07/2015 – 07/2016**
Postdoctoral Associate, Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology, Cambridge, MA, USA
- **09/2010 – 06/2015**
Graduate Student, Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology, Cambridge, MA, USA
- **09/2007 – 08/2010**
Teaching Assistant, Department of Electrical Engineering
Ain Shams University, Cairo, Egypt

Education

- **Ph.D. - Massachusetts Institute of Technology, Cambridge, MA**
Electrical Engineering and Computer Science, June 2015
Minor in Finance at MIT Sloan School of Management
Thesis title: “Power Management Circuits for Ultra-Low Power Systems”
Advisor: Prof. Anantha P. Chandrakasan
- **S.M. - Massachusetts Institute of Technology, Cambridge, MA**
Electrical Engineering and Computer Science, February 2012
Thesis title: “Design of Ultra Low Power ADC for Ambulatory EEG Recording”, GPA: 5.0/5.0
Advisor: Prof. Anantha P. Chandrakasan
- **M.Sc. - Ain Shams University, Cairo, Egypt**
Electrical Engineering, June 2010
Thesis title: “CMOS Transimpedance Amplifiers for Biomedical Applications”
- **B.Sc. - Ain Shams University, Cairo, Egypt**
Electrical Engineering, June 2007
Cumulative Grade: Distinction with honor (95.81%), Order of merit: 2nd out of 187 successful candidates.

Journal and Conference Papers

- [1] P. Garcha, **D. El-Damak**, N. Desai, J. Troncoso, E. Mazotti, J. Mullenix, S. Tang, D. Trombley, D. Buss, J. Lang, A. P. Chandrakasan, “**A 25 mV-Startup Cold Start System with On-Chip Magnetics for Thermal Energy Harvesting**,” *IEEE European Solid-State Circuits Conference (ESSCIRC)*, Leuven, Belgium, Sep. 2017.
- [2] P. Nadaeau, **D. El-Damak**, D. Glettig, Y. Kong, S. Mo, C. Cleveland, L. Booth, N. Roxhed, R. Langer, A. Chandrakasan, G. Traverso, “**Prolonged Energy Harvesting for Ingestible Devices**,” *Nature Biomedical Engineering*, 1, 0022 (2017).
- [3] L. Yu*, **D. El-Damak***, U. Radhakrishna, A. Zubair, D. Piedra, X. Ling, Y. Lin, Y. Zhang, Y.-H. Lee, D. Antoniadis, J. Kong, A. Chandrakasan, T. Palacios, “**High-Yield Large Area MoS₂ Technology: Material, Device and Circuits Co-optimization**,” *IEEE International Electron Devices Meeting (IEDM)*, San Francisco, December 2016. (*PaperPresenter*)

- [4] L. Yu*, **D. El-Damak***, U. Radhakrishna, X. Ling, A. Zubair, Y. Lin, Y. Zhang, M. Chuang, Y. Lee, D. Antoniadis, J. Kong, A. Chandrakasan, T. Palacios, “**Design, Modeling and Fabrication of CVD Grown MoS₂ Circuits with E-Mode FETs for Large-Area Electronics,**” *ACS NanoLetters*, 2016.
- [5] **D. El-Damak** and A. P. Chandrakasan, “**A 10nW-1μW Power Management IC with Integrated Battery Management and Self-startup for Energy Harvesting Applications,**” *IEEE Journal of Solid-State Circuits (JSSC)*, vol. 51, no. 4, pp. 943-954, April 2016.
- [6] L. Yu*, **D. El-Damak***, S. Ha, X. Ling, Y. Lin, A. Zubair, Y.-H. Lee, J. Kong, A. Chandrakasan, T. Palacios, “**Enhancement-Mode Single-layer CVD MoS₂ FET Technology for Digital Electronics,**” *IEEE International Electron Devices Meeting (IEDM)*, Washington, DC, December 2015. (*L. Yu and D. El-Damak contributed equally to this work.)
- [7] **D. El-Damak** and A. P. Chandrakasan, “**Solar Energy Harvesting System with Integrated Battery Management and Startup Using Single Inductor and 3.2nW Quiescent Power,**” *IEEE Symposium on VLSI Circuits (VLSI)*, Kyoto, Japan, pp. C280-C281, June 2015.
- [8] L. Yu, **D. El-Damak**, S. Ha, S. Rakheja, X. Ling, D. Antoniadis, J. Kong, A. Chandrakasan, and T. Palacios, “**MoS₂ FET Fabrication and Modeling for Large-Scale Flexible Electronics,**” *IEEE Symposium on VLSI Technology (VLSI)*, Kyoto, Japan, pp. T144-T145, June 2015.
- [9] **D. El-Damak**, S. Bandyopadhyay, A. P. Chandrakasan, “**A 93% Efficiency Reconfigurable Switched-Capacitor DC-DC Converter Using On-Chip Ferroelectric Capacitors,**” *IEEE International Solid-State Circuits Conf. (ISSCC)*, San Francisco, CA, pp. 374-375, Feb. 2013.
- [10] J. Yoo, L. Yan, **D. El-Damak**, M. Bin Altaf, A. Shoeb, and A. P. Chandrakasan, “**An 8-channel Scalable EEG Acquisition SoC with Patient-Specific Seizure Classification and Recording Processor,**” *IEEE Journal of Solid-State Circuits (JSSC)*, vol.48, no.1, pp. 214 - 228, Jan. 2013.
- [11] J. Yoo, L. Yan, **D. El-Damak**, M. Bin Altaf, A. Shoeb, H-J. Yoo , A. Chandrakasan “**An 8-Channel Scalable EEG Acquisition SoC with Fully Integrated Patient-Specific Seizure Classification and Recording Processor,**” *IEEE International Solid-State Circuits Conf. (ISSCC)*, San Francisco, CA, pp. 292-294, Feb. 2012.
- [12] **D. El-Damak**, E. Hegazi, H. Ragai, “**Analytical Design of Circular CMUT Cells in Immersion,**” *IEEE Ultrasonics Symposium (IUS)*, San Diego, CA, pp. 1865 – 1868, Oct. 2010.
- [13] **D. El-Damak**, E. Hegazi, K. N. Salama, H. Ragai, “**Design of Low Noise Transimpedance Amplifier for Intravascular Ultrasound,**” *IEEE Biomedical Circuits and Systems Conference (BIOCAS)*, Beijing, China, pp. 57 – 60, Nov. 2009.
- [14] A. Adel, A. Arafa, **D. El-Damak**, F. Atef, M. Mostafa, M. Omar “**Equalizer Implementation for 10 Gbps Serial Data Link in 90 nm CMOS Technology,**” *International Conference for Microelectronics (ICM)*, Cairo, Egypt, pp. 453 - 456, Dec. 2007.

Patents

- [1] J. Yoo, A. P. Chandrakasan , L. Yan, **D. El-Damak**, A. Shoeb, and M. Bin Altaf, “**Multi-channel Scalable EEG Acquisition System on a Chip with Integrated Patient Specific Seizure Classification and Recording Processor,**” US Patent App. 15/955,010, 2018.
- [2] P Nadeau, **D. El-Damak**, D. Glettig, YL Kong, N Roxhed, R Langer, AP Chandrakasn, G Traverso “**Ingestible Power Harvesting Device and Related Applications,**” US Patent App. 15/498268, 2017.
- [3] **D. El-Damak**, J Morroni, S. Mercer, “**Coupled Inductor Current Sensing Apparatus and Systems,**” US Patent 9,726,697.
- [4] **D. El-Damak**, R Mukhopadhyay, J. Morroni, “**Reconfigurable Amplifier,**” US Patent 9,473,092.

Service and Leadership

IEEE Solid-State Circuits Society (SSCS)

- Technical Program Committee Member of the IEEE Custom Integrated Circuits Conference (CICC).
- Chair of Power Management Educational Session at CICC 2019.
- Member of the IEEE Solid-State Circuits Women in Circuits Committee (February 2018 -Present).
- Co-Organizer of the Women in Circuits Workshop at the IEEE International Solid-State Circuits Conference (ISSCC) 2019.
- Reviewer: IEEE Journal of Solid State Circuits, IEEE Journal on Emerging and Selected Topics in Circuits and Systems, IEEE Pervasive Computing, IEEE Transactions on Circuits and Systems, IEEE Transactions on Very Large Scale Integration Systems, IEEE Custom Integrated Circuits Conference.

University of Southern California, Los Angeles, CA

- Elected Member of the Viterbi School of Engineering Faculty Council (Fall 2018 – Present)
- Member of the USC Engineering Faculty Council Research Infrastructure committee.
- Member of the USC Munushian Seminars Committee (May 2018 – Present).
- Participant in the SHINE (Summer High School Intensive in Next-Generation Engineering) program by mentoring a high school student during the summer (2018 - Present).
- Co-host, USC Integrated Systems Seminar Series (Spring 2017- present).
- Judge, MHI Research Festival Poster Session (Fall 2016, Fall 2017, Fall 2018).

Massachusetts Institute of Technology, Cambridge, MA

- MIT EECS Postdoctoral Group: Steering Committee Member (2016).
- MIT EECS Visiting Committee: provided student perspective on department and student life to the Visiting Committee (2015).
- Microsystems Technology Laboratories (MTL) Annual Research Conference: Technical Program Committee Member (2014), Seminar Chair (2016).
- MIT Egyptian Student Association: Alumni Chair and Executive Board Member (2013-2015).
 - Initiated and managed a monthly alumni spotlight on the association social media outlets (2013-2014).
 - Initiated the distinguished alumni lecture series to feature highly accomplished Egyptian Alumni at MIT.
 - Co-recipient among the association executive board members of: MIT Golden Beaver Award (2015), MIT Bridge Builder Award (2014), MIT William Stewart, Jr award (2014).

Teaching Experience

• Electrical Engineering Department, USC

EE 479 – Analog Integrated Circuits Design, Graduate (Fall 2018) - Instructor

MOSFET and BJT operation and models; elementary amplifier configurations; biasing and references; frequency response; feedback; operational amplifiers

EE 348L – Electronic Circuits, Undergraduate (Spring 2018, Spring 2019) - Instructor

Basic analog circuit design using diodes, Bipolar Junction Transistors, and Field Effect Transistors.

EE599 – Energy Harvesting Circuits and Systems, Graduate (Fall 2016, Fall 2017)

Instructor and Course Creator

The course provides the students with the solid foundation to design energy harvesting circuits for autonomous systems including power converters design, control circuits, and fundamentals of energy transducers.

• Electrical Engineering and Computer Science Department, MIT

Teaching Assistant – Fall 2014 6.UAR: Preparation for Undergrad Research

• Electrical Engineering Department, Ain Shams University, Cairo, Egypt

Teaching Assistant – September 2007 till June 2010

Responsible for weekly recitations, designing and grading problem sets for several classes and Labs

Analog Circuit Design, Electronic Devices, Application Specific Integrated Circuits, Communication Systems

Honors and Awards

- University of Southern California Women in Science and Engineering (WiSE) Gabilan Assistant Professorship, 2016 - Present.
- Golden Beaver Group Award - MIT Student Leader Awards, Co-recipient among the MIT Egyptian Student Association Executive Board Members, 2015.
- Featured Talk Award, MTL Annual Research Conference (MARC), 2015.
- Poster Presentation Award – Circuits and Systems, MTL Annual Research Conference (MARC), 2015.
- Rising Stars in EECS – Invited Participant at UC Berkeley, 2014.
- Texas Instruments Graduate Woman’s Fellowship for Leadership in Microelectronics (2012-2013, 2013-2014).
- William L. Stewart, Jr. Group Award – MIT Awards Convocation, Co-recipient among the MIT Egyptian Student Association Executive Board Members, 2014.
- Bridge Builder Group Award - MIT Student Leader Awards, Co-recipient among the MIT Egyptian Student Association Executive Board Members, 2014
- Graduate Studies Scholarship by Faculty of Engineering, Ain Shams University (2007-2010)
- Best Technical Paper Award, Mentor Graphics Higher Education Program Workshop, Egypt, 2007 (Co-author).
- Third Place at the International Electronics Design Contest for Students (IEDCS), Egypt, 2007 (Co-author).
- Annual Academic Distinction Award by Faculty of Engineering, Ain Shams University, Egypt, (2003 to 2007).
- One of the top 30 students in the National Secondary School exam (out of more than 200,000 students across Egypt).

Invited Talks/Posters

- **“Empowering the Internet of Things”**, Invited Talk, USC WiSE Research Horizons Symposium: A Showcase of Cutting Edge Research in Health, Nano Science, and Sustainability, March 2018.
- **“Autonomous Ultra-Low Power Systems for the Internet of Things”**, Invited Talk, Bridge@USC, January 2017.
- **“Empowering the IoT: Energy Scavenging and Ultra-low Power Processing”**, Invited Talks
 - KAUST-NSF Research Conference on Electronic Materials, Devices and Systems for a Sustainable Future, March 2016.
 - Harvard University, Cambridge, MA, February 2016.
 - California Institute of Technology (Caltech), Pasadena, CA, December 2015.
 - Responsive Environments Group, MIT Media Lab, Cambridge, MA, May 2015.
- **“Energy-Efficient Power Processing Circuits for Autonomous Sensors and Wearable Devices”**, Invited Talk, Qualcomm, San Diego, CA, January 2015.
- **“Energy-Efficient Power Processing Circuits for Autonomous Sensors and Wearable Devices”**, Invited Poster, Rising Stars in EECS Workshop, UC Berkeley, CA, November 2014.
- **“A 93% Efficiency Reconfigurable Switched-Capacitor DC-DC Converter Using On-Chip Ferroelectric Capacitor”**, Invited Talk, Maxim Integrated, San Jose, CA, February 2013.

Research Experience

- **Postdoctoral Associate - Energy-Efficient Circuits and Systems Group, MIT [July 2015 – July 2016]**
Research in the field of energy harvesting, power management for ultra-low power systems, circuit design using 2D materials and biomedical devices.
- **Graduate Research Assistant- Energy Efficient Circuits and Systems Group, MIT**
 - **Flexible Electronics using 2D Materials [July 2014 – June 2015]:**
Co-developed a computer-aided design (CAD) flow for molybdenum disulfide (MoS₂) based circuits. The work encompassed device modeling in Verilog-A, building custom technology library for the layout of MoS₂ devices, along with circuit design and testing. Part of this work was published at the 2015 Symposia on VLSI Technology and Circuits and the 2015 IEEE International Electron Devices Meeting.
 - **10nW-1μW Power Management IC for Ultra-low Power IoT Devices [Jan. 2013 – Jan. 2015]:**
Designed and tested a power management IC chip with 3.2nW quiescent power for energy harvesting applications. The chip integrates self-startup, battery management, supplies 1V regulated rail with single inductor and supports power range of 10nW to 1μW with a peak efficiency above 80%. The chip was fabricated in 180nm CMOS process. This work was presented at the 2015 Symposia on VLSI Technology and Circuits and invited for extended submission to the IEEE Journal of Solid-State Circuits (April 2016 issue).

- **Switched Capacitor DC-DC Converters using Ferroelectric Capacitors [Sept. 2011- Dec. 2012]:**
Designed and tested a reconfigurable switched capacitor DC-DC converter using high density ferroelectric capacitors. Implemented dynamic gain selection and pulse frequency modulation (PFM) circuits for efficient output voltage regulation. The converter was fabricated in 130 nm CMOS process and achieved a peak efficiency of 93% including the control circuit overhead. This work was presented at the International Solid-State Circuits Conference (ISSCC) 2013.
- **Ultra-low Power ADC for Ambulatory EEG Recording SoC [Sept. 2010- Feb. 2012]:**
Designed and tested an ultra-low power 10 bit SAR ADC with self-resetting logic for a scalable EEG SoC. Utilized a differential capacitive DAC to enhance the ADC CMRR as well as both concepts of split-capacitor array and sub-DAC to reduce the DAC area and power consumption. The full SoC was published at the IEEE International Solid State Circuits Conference (ISSCC) 2012 and the Journal of Solid-Sate Circuits (JSSC) 2013.

Industrial Experience

- **Texas Instruments, Kilby Labs, Dallas, TX**
Design Engineer Intern- June to August 2013
Supervisor: Jeffery Morroni, Manager – Kilby Dallas Power at Texas Instruments
Topic: Current sensing circuits for high switching speed DC-DC converters
- **Texas Instruments, Kilby Labs, Dallas, TX**
Design Engineer Intern- June to August 2012
Supervisor: Dave Freeman, Former CTO for Power Business at Texas Instruments
Topic: High performance integrated isolated DC-DC converters
- **Mentor Graphics, Behavioral Modeling Team, Cairo, Egypt**
AMS Behavioral Modeling Engineer – March to June 2008
Developed VHDL-AMS based library for SerDes Feed-Forward and Decision-Feedback Equalizers

References

Prof. Anantha P. Chandrakasan
Massachusetts Institute of Technology
e-mail: anantha@mit.edu

Prof. Tomás Palacios
Massachusetts Institute of Technology
e-mail: tpalacios@mit.edu

Prof. Giovanni Traverso
Brigham and Women's Hospital (BWH), Harvard Medical School
e-mail: cgt20@mit.edu