

March 2022

CURRICULUM VITAE

Shahar Kvatinsky

Personal Details

Work Address: Viterbi Faculty of Electrical and Computer Engineering
Technion – Israel Institute of Technology
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<http://asic2.group>

Academic Degrees

- 2014 *Ph.D. Electrical Engineering, Technion*
Dissertation Title: "Memristor-based Circuits and Architectures".
Direct track degree.
Advisors: Prof. Avinoam Kolodny, Prof. Eby Friedman, and Prof. Uri Weiser.
- 2010 *MBA Business Administration, Hebrew University, Jerusalem*
Graduated Magna Cum Laude, GPA: 94.8/100.
Specialized in business strategy and entrepreneurship, and finance and banking.
- 2009 *B.Sc. Computer Engineering and Applied Physics, Hebrew University, Jerusalem*
Graduated Magna Cum Laude, GPA: 96.6/100.
Specialized in microelectronics and optoelectronics.

Academic Appointments

- 11/2019-now *Associate Professor*
Electrical and Computer Engineering, Technion
- 7-8/2018 *Visiting Assistant Professor Electrical Engineering*
University of Utah
- 10/2015-10/2019 *Assistant Professor*
Electrical Engineering, Technion
Viterbi fellow at the Technion Computer Engineering Center.
- 2014-2015 *Post Doctoral Researcher*
Computer Science, Stanford University

Professional Experience

- 2007-2009 *Circuit designer at Intel, Jerusalem.*

Research Interests

VLSI, computer architecture, digital circuits, analog circuits, memory design, hardware for machine learning, neuromorphic computing, cytomorphic computing, system-on-a-chip, FPGA, hardware-software interface, emerging non-volatile memory technologies, EDA, hardware security, superconductor logic.

Teaching

Technion

2019-now	<i>Digital Systems and Computer Organization</i> (undergraduate level)	Lecturer (in charge)
2018	<i>Advanced Topics in Computer Engineering</i> (graduate level, new, with Mark Silberstein and Yoav Etsion)	Lecturer
2017-now	<i>Seminar in VLSI Systems</i> (graduate level)	Lecturer
2016-now	<i>Circuits and Architectures with Memristor</i> (undergraduate and graduate level, new)	Lecturer
2015-2018	<i>Logic Design and Introduction to Computers</i> (undergraduate level)	Lecturer (in charge)
2015-2016	<i>Advanced Topics in Computer Design</i> (graduate level, new)	Lecturer
2011-2014	<i>Computer Architecture</i> (undergraduate and graduate level)	Teaching assistant (in charge)
2011-2014	<i>Advanced VLSI Architectures</i> (undergraduate and graduate level)	Teaching assistant (in charge)
2009-2013	<i>Linear Electronics Circuits</i> (undergraduate level)	Teaching assistant
2009-2014	<i>SOPC (System on a Programmable Chip) lab</i> (undergraduate level)	Instructor
2010-2014	<i>B.Sc. projects, VLSI laboratory</i> (undergraduate level)	Supervisor

Received commendation as a lecturer (Spring 2018), won six times the Technion excellence award for teaching assistants (Spring 2010, Winter 2011, Spring 2011, Spring 2012, winter 2013, Spring 2014). Supervised the winning projects in the Yehoraz Kasher annual EE project contest in 2011, the Oz Mozes prize in 2012, and the Seiden Prize 2015.

The Hebrew University, Jerusalem.

2009	<i>Physics Lab for Engineers</i> (undergraduate level)	Instructor
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Professional Service Activities

National Activities

2021-now Committee on VLSI engineers in Israel

Technion Activities

2021-now New faculty mentorship program leader (with Prof. Yoav Shechtman and Prof. Galit Yom-Tov)

2020-now Technion undergraduate entrepreneurship and innovation committee member

2019-now Technion Hiroshi Fujiwara cyber security research center scientific committee member

Departmental Activities

2020-now	Entrepreneurship coordinator
2019-now	Master studies acceptance committee
2019-2020	Undergraduate best project committee
2018-now	Graduate studies committee
2016-now	Advanced Circuits Research Center (ACRC) – co-director
2018-now	Undergraduate students' consultant for the VLSI and circuits chain
2015-2019	Undergraduate students' consultant for 1 st year students
2015-2018	Undergraduate students' consultant for the computer engineering track and the computers chain

Associate Editor

2014-now	Microelectronics Journal, Elsevier
2018-now	Array, Elsevier

Guest Editor

Frontiers in Neuroscience – Special issue on "Advances in Highly Efficient Neuromorphic Computing with Emerging Memory Devices" (co-editors Nan Du, TU Chemnitz, Wei Wang, Technion, and Yuriy Pershyn, University of South Carolina).

MDPI Applied Sciences - special issue on "Advances in Brain-Inspired Computing" (co-editors Elishai Ezra Tsur, the Open University of Israel and Ehud Ahissar, Weizmann Institute).

IEEE Nanotechnology Magazine – special issue on "Novel Applications Enabled by Memristors" (co-editor Marco Ottavi, University of Rome Tor Vergata).

IEEE Embedded Systems Letters – special issue on "Embedded Nano-Security" (co-editors Farhad Merchant and Rainer Leupers, RWTH Aachen University).

Program Committee Chair

VLSI-SoC 2020.

Topic Program Committee Chair

DATE 2020, 2021, 2022 (topic D15 – Emerging Design Technologies for Future Memories).

Tutorials and Workshops Chair

HPCA 2018.

Program Committee

ICONS 2022, DAC 2022, ICONS 2021, DAC 2021, VLSID 2021, NVMW 2021, DAC 2020, CIMW 2020, NVMW 2020, VLSID 2020, eMTDT 2019, MEMRISYS 2019, SPACE 2019, VLSI-SoC 2019, DATE 2019, APCCAS 2018, VLSI-SoC 2018, MDAC in HiPEAC 2017, 2018, DATE 2018, MemTCAD in HiPEAC 2015, 2016, ChipEx 2016.

PhD Committee

1. Ilan Oren, Technion, 2022.
2. Or Levit, Technion, 2022.
3. Itamar Melamed, Technion, 2021.
4. Erez Zolkov, Technion, 2021.
5. Oren Kalinsky, Technion, 2020.
6. Itay Hubara, Technion, 2019.

7. Nimrod Ginzberg, Technion, 2019, 2022.
8. Ayal Eshkoli, Technion, 2018.
9. Gil Shomron, Technion, 2018.
10. Binyamin Frankel, Bar Ilan University, 2018.
11. Roman Kaplan, Technion, 2017.
12. Oron Port, Technion, 2017.
13. Robert Gitterman, Bar Ilan University, 2016.
14. Evripides Kyriakides, University of Nicosia, Cyprus, 2016.

MSc Committee

1. Avi Hazan, Open University, 2021.
2. Itamar Melamed, Technion, 2020.
3. Natan Vinshtok-Melnik, Bar Ilan University, 2020.
4. Hanna Abu Hanna, Technion, 2019.
5. Tsahi Noy, Bar Ilan University, 2019.
6. Daniel Vana, Tel Aviv University, 2019.
7. Iliah Konstantinovsky, Technion, 2019.
8. Roy Weiss, Technion, 2018.
9. Yuval Ben-Hur, Technion, 2018.
10. Amit Kazimirsky, Bar Ilan University, 2016.
11. Kfir Mizrahi, Technion, 2017.
12. Oren Nishri, Technion, 2017.

Workshop, Tutorials, and Training School Organizer

- 2019 *Real Processing-in-Memory with Memristive Memory Processing Unit*
Tutorial in SPACE (India)
- 2018 *Analog Mixed-Signal Circuit Design with Memristors*
Tutorial in ISCAS (Italy)
- 2017 *Mixed Signal Circuit Design with Memristors*
Tutorial in IEEE COMCAS (Tel Aviv, Israel)
- 2017 EU COST Action IC-1401
Training school at the Technion (Haifa, Israel)
- 2017 *Stephen and Sharon Seiden Frontiers in Engineering and Science Workshop: Beyond CMOS: From Devices to Systems*
Workshop (Haifa, Israel)
Co-organizers: Eby Friedman (Rochester) and Avinoam Kolodny (Technion)
- 2016 *In-Memory and In-Storage Computing with Emerging Technologies*
Workshop in PACT (Haifa, Israel)
Co-organizer: Leonid Yavits (Technion)

Special Session Organizer

- 2019 *Synthetic Biology – when Biology and Electronics Meet* BioCAS
Co-organizers: Ramez Danial (Technion) and Yosi Shacham-Diamand (Tel Aviv University)
- 2017 *Memristor for Computing: Myth or Reality?* DATE
Co-organizers: Said Hamdioui (TU Delft) and Gert Cauwenberghs (UCSD)
- 2016 *Memristors for Computing* CNNA
Co-organizer: Dietmar Fey (FAU).

Scientific Advisory Board

- Chua Memristor Center (CMC) at TU Dresden, Germany.
- International Advisory Board of the 3rd International Conference "Emerging Materials, Technologies and Applications for Non-volatile Memory Devices"
- DFG-funded Priority Program "Nano Security: From Nano-Electronics to Secure Systems".

Journal/Conference Referee

1. 17th International Conference on Digital Signal Processing (DSP 2011).
2. 39th International Symposium on Computer Architecture (ISCA 2012).
3. Microelectronics Journal.
4. IEEE Transactions on Nanotechnology.
5. 7th International Symposium on Networks-on-Chip (NOCS 2013).
6. Reed-Muller Workshop (RM 2013).
7. IEEE International Symposium on Circuits and Systems (ISCAS) 2013.
8. Radioengineering.
9. PLOS ONE.
10. IEEE International Symposium on Circuits and Systems (ISCAS) 2014.
11. IEEE Transactions on Electron Devices.
12. Journal of Circuits, Systems, and Computers.
13. IEEE Transactions on Circuits and Systems I: Regular Papers.
14. IEEE Transactions on Circuits and Systems II: Express Briefs.
15. IEEE Transactions on Very Large Scale Integration (VLSI).
16. IEEE Transactions on Neural Networks and Learning Systems.
17. IEEE Journal on Emerging and Selected Topics in Circuits and Systems.
18. International Journal of Electronics and Communications.
19. IEEE Electron Device Letters.
20. Frontiers in Neuroscience.
21. The 48th Annual IEEE/ACM International Symposium on Microarchitecture (MICRO 2015).
22. BIOCAS 2015.
23. IEEE International Symposium on Circuits and Systems (ISCAS) 2016.
24. IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems.
25. IEEE Transactions on Emerging Topics in Computing.
26. ACM Journal on Emerging Technologies in Computing Systems.
27. IET Circuits, Devices, & Systems.
28. International Workshop on Cellular Nanoscale Networks and their Applications (CNNA) 2016.
29. Neural Computing and Applications (NCAA).
30. IEEE International Symposium on Circuits and Systems (ISCAS) 2017.
31. Electronics Letters.
32. High Performance Computer Architecture (HPCA) 2018.
33. IEEE International Symposium on Circuits and Systems (ISCAS) 2018.
34. Nature Nanotechnology.
35. Nature Electronics.
36. Nature Communications.
37. High Performance Computer Architecture (HPCA) 2019.
38. IEEE International Symposium on Circuits and Systems (ISCAS) 2019.
39. IEEE Computer Architecture Letters.
40. IEEE International Conference on Electronics Circuits and Systems (ICECS) 2019.
41. Advanced Intelligent Systems.

42. Physica Status Solidi A: Applications and Materials Science
43. IEEE International Symposium on Circuits and Systems (ISCAS) 2021.
44. IEEE Journal of the Electron Devices Society.
45. Advanced Science.

Grants Referee

1. Israel Science Foundation.
2. Deutsche Forschungsgemeinschaft (DFG).

Membership in Professional Societies

IEEE (senior member).
 IEEE Israel Circuits and Systems chair.
 IEEE Cellular Nanoscale Networks and Memristor Array Computing Technical Committee.

Military Service

1999-2004 *Officer in the IDF, rank: Lieutenant Colonel.*
 Participated in several courses and training including sergeant course, officer course, and company commander course and served in several commanding positions including an artillery battery commander and artillery officer course commander.
 Currently in the reserve forces.

Fellowships, Awards and Honors:

2021	Device Research Conference best student poster award
2021	Norman Seiden Prize for Academic Excellence
2021	Elected as a member of the Israel Young Academy
2021	Hershel Rich Technion Innovation Award
2020	Most cited paper in 5 years, <i>IEEE Transactions of Circuits and Systems II: Express Briefs</i>
2020	Paper selected among top 15 papers in the VLSI-SoC conference to appear in the VLSI-SoC book
2020	MDPI Electronics Young Investigator Award
2020	Jacobs Best Paper (Technion award for best paper by a graduate student in engineering)
2020	Selected as "one of the 20 promising Israelis of the next decade" by Yedioth Aharonot
2019	Paper selected among top 18 papers in the VLSI-SoC conference to appear in the VLSI-SoC book
2019	Best poster award in Neuromorphic Computing – A Nature Conference
2019	Alexander Goldberg Research Prize Fund (Technion)
2019	Wolf Foundation Krill Prize for Excellence in Scientific Research
2018	Commendation as a lecturer (top 12% at the Technion)
2018	KLA-Tencor Excellent Conference Paper Award
2017	European Research Council starting grant
2017	Pazy Memorial Research Award for "the most outstanding and original BSF supported project in mathematical and computer sciences"
2017	Hershel Rich Technion Innovation Award

2016	Paper selected among top 10 papers in the VLSI-SoC conference to appear in the VLSI-SoC book
2015	Supervised the Seiden Prize for Multidisciplinary Undergraduate Projects in Nano Electronics
2015-2018	Viterbi Fellowship in the Center for Computer Engineering at the Technion
2015	Best Paper of Computer Architecture Letters Award
2015	Supervised the 3 rd place winning project in the Yehoraz Kasher Annual EE Project Contest
2015	IEEE Guillemin-Cauer Best Paper Award
2015	Viterbi Fellowship for Nurturing Future Faculty Members
2014	Hershel Rich Technion Innovation Award
2014	The Andrew and Erna Finci Viterbi Fellowship
2013, 2014	Vivian Konigsberg Award for Excellence in Teaching (twice)
2013	Sanford Kaplan Prize for Creative Management in High Tech in the 21st Century – 1 st place
2013	Best lecturer award – ChipEx 2013
2012	Supervised the winning project in the Oz Mozes Project Contest
2012	Intel award for excellence in research
2011	Vivian Konigsberg Award for Excellence in Teaching (twice)
2011-2014	Hasso Plattner Institute Fellowship (four years)
2011	Irwin and Joan Jacobs Fellowship
2011	Supervised the winning project in the Yehoraz Kasher Annual EE Project Contest
2010, 2012	Sandor Szego Award for Excellence in Teaching (twice)
2010	Benin prize for graduate students
2010	The Marker MBA Case Study Competition finalist
2009	"Peter Brojde Center for Innovative Engineering and Computer Science" excellence final B.Sc. project prize
2007, 2008	Dean's reward for excellence, Hebrew University (twice)
2006-2009	Dean's honorary list, Hebrew University (all four years)

Students Supervised

Completed PhD theses

2021	Nicolas Wainstein	<i>RF Front-End Circuits Based on Memristive Devices</i> Co-advisor: Eilam Yalon First employment with Intel
2021	Loai Danial	<i>Neuromorphic Data Converters using Memristors</i> First employment with Intel

Completed MSc theses

2021	Mor Dahan	<i>Design of Ferroelectric FET Memories</i> First employment a PhD student at the Technion
2021	Adi Eliahu	<i>Programmable Processing-in-Memory Memristive Architectures</i> First employment with Apple

2018	Nimrod Wald	<i>Use of Memristor Based Logic Circuits for Beyond von Neumann Computer Architectures</i> First employment with Terrain EDA
2018	Ameer Haj Ali	<i>Performing Image Processing in Memristive Memory Arrays</i> First employment a PhD student at UC Berkeley
2018	Nishil Talati	<i>Logic Design for non-von Neumann Architectures using Memristors</i> First employment a PhD student at University of Michigan
2017	Misbah Ramadan	<i>Adaptive Programming for Multi-Level Cell ReRAM</i> Co-advisor: Ran Ginosar First employment with Apple
2015	Yifat Levy	<i>Logic with Memristive Akers Arrays</i> Co-advisors: Avinoam Kolodny and Eby Friedman First employment with Intel

PhD theses in progress

2015-2022	Rotem Ben-Hur	<i>Logic within the Memory</i>
2017-2022	Ben Perach	<i>Architecture for High Performance Computing and Cyber Security of memristive Memory Processing Unit</i>
2016-2022	Tzofnat Greenberg-Toledo	<i>Memristive Artificial Neural Network Accelerator with Online Training</i> Co-advisor: Daniel Soudry
2020-2024	Lior Rodes	<i>Thermoelectric PUFs</i> Co-advisor: Eilam Yalon
2018-2023	Barak Hoffer	<i>Chip Design of Memristive Memory Processing Unit</i>
2021-2024	Orian Leitersdorf	<i>Advancing Computer Science with Memristive Processing-in-Memory</i>

MSc theses in progress

2020-2022	Issa Salameh	<i>Superconductor Logic</i>
2020-2022	Marcel Khalifa	<i>DNA Sequencing with Processing-in-Memory</i>

Post-docs

2021-now	Anindita Chakraborty	
2021-now	Minhui Zou	
2020-2021	Wei Wang	
2019-2020	Kunal Korgaonkar	
2017-2018	John Reuben	First employment Associate Professor in Vellore Institute of Technology, India)

Sponsored Long-Term Visitors

September-December 2021	Devangshu Datta <i>National Institute of Technology, Jamshedpur, India</i>	Visiting scholar
September-December 2021	Sumukh Pinge <i>BITS Pilani, India</i>	Visiting scholar
March-August 2021	Aatman Borda <i>BITS Pilani, India</i>	Visiting scholar
January-June 2020	Ruchi Dhamnani <i>International Institute of Information Technology, Naya Raipur, India</i>	Visiting scholar
January-June 2020	Parul Damahe <i>International Institute of Information Technology, Naya Raipur, India</i>	Visiting scholar
January-June 2020	Purvi Agrawal <i>International Institute of Information Technology, Naya Raipur, India</i>	Visiting scholar
June-August 2019	Rajaie Ismeeh <i>Bir Zeit University, Ramallah, Palestinian Territories</i>	Visiting scholar
May-July 2019	Anmol Jain <i>Indian Institute of Technology, Roorkee, India</i>	Visiting scholar
May-December 2019	Jeffrey Louis <i>BITS Pilani, India</i>	Visiting scholar
May – November 2019	Shivansh Dwivedi <i>Indian Institute of Technology, Indore, India</i>	Visiting scholar
May – November 2019	Kanishka Sharma <i>Indian Institute of Technology, Indore, India</i>	Visiting scholar
October 2018-May 2019	Varun Tandon	Visiting scholar
July-September 2018	Debjyoti Bhattacharjee <i>Nanyang Technological University, Singapore</i>	Visiting scholar
June 2018-May 2019	Kunal Korgaonkar <i>University of California, San Diego</i>	Visiting scholar
May-July 2018	Vasu Gupta <i>BITS Pilani, India</i>	Visiting scholar
May-July 2018	Sidharth Thomas <i>Indian Institute of Technology, Roorkee, India</i>	Visiting scholar
May-July 2018	Keshav Tiwari <i>Indian Institute of Technology, Roorkee, India</i>	Visiting scholar
December 2016-January 2017	Elias Cohen <i>Reed College, Oregon</i>	Visiting scholar
May-July 2016	Nishil Talati <i>BITS Pilani, India</i>	Visiting scholar

B.Sc. Projects

1. Dmitry Belousov and Slavik Liman, "Memristor-based Circuits" (*Winners of the Yehoraz Kasher EE Project Contest*).
2. Zahi Lahti and Elad Osherov, "Memristor Model."
3. Oren Lev and Emanuel Darji, "Analysis of Power Grids."
4. Keren Talisveyberg and Dmitry Fliter, "Memristor Verilog-A and MATLAB Modeling."
5. Ilan Shusterman and Michael Rozenblat, "Memristor-based Memory Analysis."
6. Leon Karbachevsky and Boaz Blankrot, "Memristor-based Analog Circuits."
7. Guy Satat and Nimrod Wald, "Memristor-based Full Adder," "Memristor-based Multithreading Processor" (*Winners of the Oz Mozes Project Contest*).
8. Boris Bashkansky and Lahav Madlinsky, "Memristor-based Memory Array Circuit and Layout Design."
9. Rotem Tabach and Dina Leshinsky, "Neuromorphic Systems."
10. Yiffah Fishler and Shir Lindenbaum, "Memristor Modeling."
11. Firas Shama and Louie Matar, "Memristor-based Multithreading Processor."
12. Keren Tendeter and Shiran Shuster, "Simulator for Memristor-based Memory."
13. Misbah Ramadan and Loai Danial, "Analysis of a Memristor-based Crossbar."
14. Hani Bezalel and Rotem Gabay, "Controller for Memristor-based Logic."
15. Benny Fellman and Gilad Tsoran, "Memristor-based Multithreading Processor."
16. Moab Arar and Muhammad Grefat, "Simulation Tools for Emerging Memory Technologies."
17. Israel Goldstein and Alex Dozortzev, "Memristor-based Crossbar for Neural Networks."
18. Misbah Ramadan, "Memristor Modeling."
19. Yoav Furman and Rula Naffaa, "Complementary MRL."
20. Avishay Drori and Elad Amrani, "Logic Design with Memristive Devices."
21. Eyal Rosenthal and Sergey Greshnikov, "Machine Learning with Memristors."
22. Itay Tsabari, "DNA Sequencing by Logic within Memory."
23. Adi Eliahu, "PulpFiction."
24. Barak Hoffer, "Testing of Memristive Memory Processing Unit."
25. Liora Huf, "Single Flux Logic Survey."

Research Grants (Total Funding 2015-2022: \$5,500,000)

Competitive

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| 2022 | <i>European Research Council Proof of Concept</i>
Real Processing in Phase Change Memory
(Total funding 150K Euro for 1 year). |
| 2022-2024 | <i>Technion Human Health Institute</i>
Harnessing Synthetic Biology and Ultra-Low Power Electronics to Monitor Environmental Signals in the Gastrointestinal Tract
Co-PIs: Naama Geva-Zatorsky, Hossam Haick, Eilam Yalon, and Ramez Daniel
(Total funding \$500K for 2 years, Kvatinsky's part \$100K) |
| 2021-2024 | <i>NSF-BSF</i>
Reliable and Zero-Power Timkeepers for Intermittently Powered Computing Devices via Stochastic Magnetic Tunnel Junctions
Co-PIs: Josiah Hester and Pedram Khalili (Northwestern University)
(Total funding \$800K for 3 years, Technion's part \$240K) |

- 2021-2022 *Peter Munk Research Institute*
Design and Characterization of Sneak Path Coating Based Physical Unclonable Function
Co-PI: Eilam Yalon (Technion)
(Total funding 100K NIS for 1 year)
- 2021-2024 *EU H2020-FETOPEN*
NEU-ChiP
Co-PI (Technion): Ramez Daniel
(Total funding 3.46M Euro for 3 years, Technion's part 400K Euro)
- 2020-2021 *Polak Fund for Applied Research*
Intelligent Analog-to-Digital Converter using Emerging Memory
(\$30K for 1 year)
- 2019-2021 *KAMIN - Israel Innovation Authority* Project no. 66769
Memristor-Based Reconfigurable RF Circuits
(887K NIS for 2 year)
- 2019-2020 *Technion Hiroshi Fujiwara cyber security research center and the Israel cyber bureau*
(140K NIS for 1 year)
- 2018-2021 *MAGNET consortium - GenPro - Israel Innovation Authority*
(835K NIS for 3 years)
- 2018-2020 *Technion Hiroshi Fujiwara cyber security research center and the Israel cyber bureau*
Co-PI: Avi Mendelson (Technion)
(300K NIS for 3 years)
- 2018-2019 *Julia and Joshua Ruch Exchange Program*
Co-PI: Zhiru Zhang (Cornell)
(\$7K for traveling)
- 2018-2022 ***European Research Council Starting Grant*** Grant no. 757259
Memristive In-Memory Processing Systems
(1.5M Euro for 5 years)
- 2017-2021 *Israel Science Foundation (ISF)* Grant no. 1514/17
Design of Computer Memories with Independent Computing Capabilities
(1M NIS for 4 years)
- 2017-2020 *Ministry of Science and Technology*
Integrated Genetics and Memristors breaking through the scaling limits of Moore's law
Co-PI: Ramez Daniel (Technion)
(1.555M NIS for 3 years)
- 2017-2019 *US-Israel Binational Science Foundation (BSF)* Grant no. 2016016
High-Performance Normally-Off Parallel Processing
Co-PI: Pierre-Emmanuel Gaillardon (University of Utah)
(\$150K for 3 years)
- 2017-2019 *NSF-BSF* Grant no. 2015709
Dynamically Configurable Memory Technology Based on Ferroelectric-Gated FET's (FeFET's)
Co-PIs: Moshe Eizenberg (Technion) and Ma Tso-Ping (Yale University)
(\$150K for 3 years)

- 2017-2018 *Russell Berrie Nanotechnology Institute Nevet*
Integrated Genetics and Nanoelectronics Breaking through the Scaling Limits
of Moore's Law
Co-PI: Ramez Daniel (Technion)
(\$40K for 1 year)
- 2017 *Israel Science Foundation equipment grant for new faculty* Grant no. 1515/17
(758,517 NIS)
- 2016-2018 *KAMIN - Israel Innovation Authority* Project no. 57681
Analog to Digital Converters with Memristive Neural Network
(840K NIS for 2 years)
- 2016-2019 *MAGNET consortium - HiPER - Israel Innovation Authority*
(700K NIS for 3 years)
- 2015-2018 ICT COST action
Memristors – Devices, Models, Circuits, Systems and Applications
(MemoCIS)
(travel grants)

Industrial

- 2019-2020 *Western Digital*
RISC-V Infrastructure
(\$48K NIS for 1 year)
- 2018-2019 *Huawei*
(\$200K for 1 years)
- 2017 *Cisco University Research Program Fund*
Vulnerability Analysis of Emerging Nonvolatile Memory Technologies
Co-PI: Avi Mendelson (Technion)
(\$80K for 1 years)
- 2015-2017 *Intel Collaborative Research Institute – Computational Intelligence*
Memory Intensive Architectures
(\$137.5K for 2 years)

PUBLICATIONS (4798 citations, h-index 28, i10-index 51, students are underlined)

Thesis

S. Kvatinsky, "Memristor-Based Circuits and Architectures," PhD dissertation, August 2014.

Books Edited

1. *VLSI-SoC: Design Trends*, IFIP Advances in Information and Communication Technology, A. Calimera, P.-E. Gaillardon, K. Korganokar, **S. Kvatinsky**, R. Reis, (Eds.), Springer, 2021.

Refereed Journal Papers:

1. **S. Kvatinsky**, E. G. Friedman, A. Kolodny, and U. C. Weiser, "TEAM - ThrEshold Adaptive Memristor Model," *IEEE Transactions on Circuits and Systems I: Regular Papers*, Vol. 60, No. 1, pp. 211-221, January 2013. **2015 IEEE Guillemin-Cauer Best Paper Award.**

2. **S. Kvatinsky**, E. G. Friedman, A. Kolodny, and U. C. Weiser, "The Desired Memristor for Circuit Designers," *IEEE Circuits and Systems Magazine*, Vol. 13, No. 2, pp. 17-22, second quarter 2013.
3. **S. Kvatinsky**, Y. H. Nacson, Y. Etsion, E. G. Friedman, A. Kolodny, and U. C. Weiser, "Memristor-Based Multithreading," *IEEE Computer Architecture Letters*, Vol. 13, No. 1, pp. 41-44, January-June 2014.
4. **S. Kvatinsky**, N. Wald, G. Satat, E. G. Friedman, A. Kolodny, and U. C. Weiser, "Memristor-Based Material Implication (IMPLY) Logic: Design Principles and Methodologies," *IEEE Transactions on Very Large Scale Integration (VLSI)*, Vol. 22, No. 10, pp. 2054-2066, October 2014.
5. **S. Kvatinsky**, D. Belousov, S. Liman, G. Satat, N. Wald, E. G. Friedman, A. Kolodny, and U. C. Weiser, "MAGIC – Memristor Aided LoGIC," *IEEE Transactions on Circuits and Systems II: Express Briefs*, Vol. 61, No. 11, pp. 895-899, November 2014.
6. Y. Levy, J. Bruck, Y. Cassuto, E. G. Friedman, A. Kolodny, E. Yaacobi, and **S. Kvatinsky**, "Logic Operation in Memory Using a Memristive Akers Array," *Microelectronics Journal*, Vol. 45, No. 11, pp. 1429-1437, November 2014.
7. **S. Kvatinsky**, M. Ramadan, E. G. Friedman, and A. Kolodny, "VTEAM – A General Model for Voltage Controlled Memristor," *IEEE Transactions on Circuits and Systems II: Express Briefs*, Vol. 62, No. 8, pp. 786-790, August 2015.
8. R. Patel, **S. Kvatinsky**, E. G. Friedman, and A. Kolodny, "Multistate Register Based on Resistive RAM," *IEEE Transactions on Very Large Scale Integration (VLSI)*, Vol. 23, No. 9, pp. 1750-1759, September 2015.
9. D. Soudry, D. Di Castro, A. Gal, A. Kolodny, and **S. Kvatinsky**, "Memristor-based Multilayer Neural Networks with Online Gradient Descent Training," *IEEE Transactions on Neural Networks and Learning Systems*, Vol. 26, No. 10, pp. 2408-2421, October 2015.
10. L. Yavits, **S. Kvatinsky**, A. Morad, and R. Ginosar, "Resistive Associative Processor," *IEEE Computer Architecture Letters*, Vol. 14, No. 2, July-December 2015. **Best of CAL winner 2015.**
11. A. Morad, L. Yavits, **S. Kvatinsky**, and R. Ginosar, "Resistive GP-SIMD Processing In-Memory," *ACM Transactions on Architecture and Code Optimization*, Vol. 12, No. 4, Article 57, January 2016.
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57. I. Salameh, E. G. Friedman, and **S. Kvatinsky**, "Superconducting Logic Using 2Φ Josephson Junctions with Half Flux Quantum Pulses," *Proceedings of the IEEE International Symposium on Circuits and Systems*, May 2022 (in press).

Submitted Refereed Conference Papers:

58. A. Gero, M. A. Hadish, and **S. Kvatinsky**, "Undergraduate Students' Attitudes Toward an Engineering Course that Integrates Several Levels of Abstraction," (in review).

Magazines:

1. R. Daniel and **S. Kvatinsky**, "Combining Biology and Electronics Using Emerging Memristive Technologies," *Tower Jazz Technical Journal*, Vol. 8, pp. 30-38, June 2017.
2. **S. Kvatinsky**, "Computers that Look Like the Brain," *Frontiers for Young Minds*, Vol. 8, December 2020.

Technical Reports:

1. **S. Kvatinsky**, E. G. Friedman, A. Kolodny, and U. C. Weiser, "Memristor-based IMPLY Logic Design Flow," *CCIT Technical Report #795*, August 2011.
2. **S. Kvatinsky**, K. Talisveyberg, D. Fliter, E. G. Friedman, A. Kolodny, and U. C. Weiser, "Verilog-A for Memristor Models," *CCIT Technical Report #801*, December 2011.
3. **S. Kvatinsky**, E. G. Friedman, A. Kolodny, and U. C. Weiser, "TEAM - ThrEshold Adaptive Memristor Model," *CCIT Technical Report #804*, January 2012.
4. D. Soudry, D. Di Castro, A. Gal, A. Kolodny, and **S. Kvatinsky**, "Hebbian Learning Rules with Memristors," *CCIT Technical Report #840*, September 2013.
5. **S. Kvatinsky**, M. Ramadan, E. G. Friedman, and A. Kolodny, "VTEAM - A General Model for Voltage Controlled Memristors," *CCIT Technical Report #856*, April 2014.
6. X. Yang, J. Pu, B. B. Rister, N. Bhagdikar, J. Ragan-Kelley, S. Richardson, **S. Kvatinsky**, A. Pedram, and M. Horowitz, "A Systematic Approach to Blocking Convolutional Neural Networks," *ArXiv:1606.04209*, June 2016.
7. R. Ben Hur, N. Wald, N. Talati, and **S. Kvatinsky**, "Latency Optimized Mapping of Logic Functions for Memristor Aided Logic (MAGIC)," *CCIT Technical Report #908*, December 2016.
8. K. Korgaonkar, R. Ronen, A. Chattopadhyay, and **S. Kvatinsky**, "Bitlet Model: Defining a Litmus Test for the Bitwise Processing-in-Memory Paradigm," *ArXiv:1910.10234*, October 2019.
9. T. Greenberg-Toledo, B. Perach, D. Soudry, and **S. Kvatinsky**, "MTJ-Based Hardware Synapse Design for Ternary Deep Neural Networks," *ArXiv:1912.12636*, December 2019.

Patents Granted:

1. S. Kvatinsky, Y. Levy, and A. Kolodny, "Memristive Akers Logic Array," US patent no. 9548741.
2. A. Kolodny, S. Kvatinsky, R. Patel, and E. G. Friedman, "Multistate Register Having a Flip Flop and Multiple Memristive Devices," US patent no. 9679650.
3. S. Kvatinsky, D. Belousov, S. Liman, N. Wald, and G. Satat, "A Pure Memristive Logic Gate," US patent no. 9685954.
4. D. Soudry, S. Kvatinsky, A. Gal, D. Di Castro, and A. Kolodny, "Implementating multiplication in adaptive circuits using memristive devices," US patent no. 9754203.
5. S. Kvatinsky, D. Belousov, S. Liman, N. Wald, and G. Satat, "Pure Memristive Logic Gate," US patent no. 10284203.
6. M. Ramadan, S. Kvatinsky, and R. Ginosar, "Adaptive Programming for Memories with Multi-Level Cells," US patent no. 103667526.
7. S. Kvatinsky, A. Kolodny, and U. C. Weiser, "Memristor-Based Multithreading," Israel patent no. 225988.

8. S. Kvatinsky, A. Kolodny, and U. C. Weiser, "Memristor-Based Multithreading," US patent application no. 10521237.
9. L. Azriel and S. Kvatinsky, "Memristive Security Hash Function," US patent no. 10708041.
10. A. Drori, E. Amrani, and S. Kvatinsky, "Logic Design with Unipolar Memristors," US patent no. 10516398.
11. A. Drori, E. Amrani, and S. Kvatinsky, "Logic Design with Unipolar Memristors," US patent no. 10855288.
12. A. Morad, L. Yavits, S. Kvatinsky, and R. Ginosar, "Hybrid Processor," US patent no. 10996959.
13. L. Danial and S. Kvatinsky, "Reconfigurable DAC Implemented by Memristor Based Neural Network," US patent no. 2021/0143834 A1.
14. L. Danial and S. Kvatinsky, "Analog-to-Digital Converter Using a Pipelined Memristive Neural Network," US patent no. 2021/0175893 A1.
15. T. Greenberg-Toledo, D. Soudry, and S. Kvatinsky, "MTJ-Based Hardware Synapse Implementation for Ternary and Binary Deep Neural Networks," US patent no. 2021/0174182.

Patents Filed:

16. B. Perach and S. Kvatinsky, "Asynchronous True Random Number Generator using STT-MTJ." US patent application no. 62/774,258.
17. L. Danial and S. Kvatinsky, "Delta-Sigma Modulation Neurons for High Precision Training of Memristive Synapses in Deep Neural Networks," US patent application no. 62/774,933.
18. P.-E. Gaillardon, E. Giacomini, and S. Kvatinsky, "A Robust Digital RRAM-based Convolutional Block for Low-Power Image Processing and Learning Applications," US patent application no. 62/734,023.
19. L. Danial and S. Kvatinsky, "Analog-to-Digital Converter Using a Pieplined Memristive Neural Network," US patent application no. 17/116,144.
20. B. Hoffer and S. Kvatinsky, "Memristor Aided Logic (MAGIC) using Valence Change Memory (VCM)," US patent application no. 63/006,131.
21. S. Kvatinsky, B. Hoffer, E. Yalon, and N. Wainstein, "Logic Gates and Stateful Logic using Phase Change Memory," US patent application no. 63/006,114.

Selected Talks (Plenary, Keynote, and Invited)

On-Device Machine Learning with Memristors in the Neuromorphic Era

- SIRC "Designing Better Hardware with artificial Intelligence," Samsung, Tel Aviv, Israel, December 2021 (keynote).

Making Real Memristive Processing -in-Memory Faster and Reliable

- (E2A), NIT Silchar, India, December 2021 (keynote, virtual talk).
- The 7th Memristor and Memristive Symposium, Catania, Italy, October 2021 (invited talk).

Memristive Processing-in-Memory for Artificial Intelligence

- Faculty Development Program on Neuronal Dynamics and Neuromorphic Computing, Indian Institute of Technology, Patna, India (distinguished speaker, virtual talk), December 2021.
- Faculty Development Program on Neuronal Dynamics and Neuromorphic Computing, Indian Institute of Technology, Patna, India (distinguished speaker, virtual talk), October 2020.

Real Processing-in-Memory using Memristive Memory Processing Unit

- Faculty Development Program on Emerging Topics in Computing: Quantum, Microfluidic and Memristors, JIS University, Kolkata, India, August 2021 (invited talk, online).
- TEQIP-III Online Workshop on VLSI Based System Design, Indian Institute of Information Technology, Guwahati, India, March 2021 (invited, online).
- Huawei Compute and Storage Technology Conference 2020 (virtual), December 2020 (invited).
- Inaugural Chua Memristor Institute Conference (ICMIC), Wuhan, China, November 2019 (invited).
- International Conference on Memristive Materials, Devices and Systems, Dresden, Germany, July 2019 (keynote).
- IEEE International Symposium on Online Testing and Robust System Design, Rhodes, Greece, July 2019 (invited).
- IEEE International Conference on the Science of Electrical Engineering, Eilat, Israel, December 2018 (invited).
- In-Memory Computing: Emerging Devices, Architectures, and Applications, Politecnico di Torino, Italy, September 2018 (invited).
- 18th International Forum on MPSoC for Software Defined Hardware, Snowbird, UT, USA, August 2018 (plenary talk).
- International Conference on Neuromorphic Systems, Knoxville, Tennessee, USA, July 2018 (invited).
- The 8th Workshop on Systems for Multi-core and Heterogeneous Architectures, Porto, Portugal, April 2018 (keynote).
- Emertech 2018, Singapore, April 2018 (invited).

A Taxonomy and Evaluation Framework to Memristive Logic

- MemoCIS workshop, Dresden, Germany, September 2018 (plenary talk).

Logic Synthesis and Automation for Memristive Memory Processing Unit

- EPFL Workshop on Logic Synthesis and Emerging Technologies, Lausanne, Switzerland, September 2017 (invited).

Memristors for Learning

- IEEE International Conference on Science of Electrical Engineering, November 2016 (invited).

Computation with Memristors

- MemoCIS workshop, Palma de Mallorca, Spain, September 2016 (invited).

Introduction to Memristors

- ChipEx 2016, Tel Aviv, May 2016 (invited).

Avoiding the Dark Ages with Memristors

- MemoCIS Workshop: “Memristors: at the Crossroad of Devices and Applications”, Milan, March 2016 (keynote).

Emerging Memory Technologies: Challenges and Opportunities

- DesignEx 2015, Tel Aviv, November 2015 (invited).

Additional Selected Talks

Making Real Memristive Processing -in-Memory Faster and Reliable

- Marvel, Israel, March 2022 (virtual).
- Huawei Compute Technology Workshop, November 2021 (virtual, invited talk).

On-Device Machine Learning with Memristors in the Neuromorphic Era

- Israel Innovation Authority Workshop on Accelerators for AI, April 2021 (virtual, invited talk).
- Apple's Virtual Workshop on On-Device Machine Learning, April 2021 (virtual, invited talk).

Memristors in the Neuromorphic Era

- Weizmann Institute, Rehovot, Israel, February 2021 (virtual, invited seminar).

Real Processing-in-Memory using Memristive Memory Processing Unit

- Pliops, Tel Aviv, Israel, July 2021.
- RWTH Aachen University, Germany, December 2020 (virtual, invited seminar).
- Universita' della Tuscia, Viterbo, Italy, March 2018.
- University of Rome Tor Vergata, Italy, March 2018.

Intelligent Trainable Data Converters

- SRC/SIA/DoE Workshop on New Trajectories for Analog Electronics, IBM Almaden, San Jose, CA, December 2019 (invited talk and panel).

Processing-in-Memory with Memristors

- Indian Institute of Technology, Delhi, India, December 2019 (seminar).

Memristors for Artificial Intelligence

- Bar Ilan University, Ramat Gan, Israel, April 2019 (department colloquium).
- Samsung, Ramat Gan, Israel, April 2019.

Designing Extremely Efficient Computers with Memristors

- Refael, Israel, September 2020.
- University of California, Irvine, CA, August 2018.
- University of Utah, Salt Lake City, Utah, July 2018.

Memristors: The Future of Non-Volatile Memory or Perhaps Even More?

- Nova, Rehovot, Israel, October 2021.
- Ramon Chips, Israel, August 2020 (virtual).
- Motorola Solutions, Airport City, Israel, September 2019.
- Intel, Jerusalem, Israel, January 2019.
- Applied Physics, School of Computer Engineering and Science, Hebrew University, Jerusalem, May 2018 (department colloquium).
- Department of Material Engineering and Science, Technion – Israel Institute of Technology, May 2018 (department colloquium).

Real Processing-in-Memory using Memristive Memory Processing Unit

- Universita' della Tuscia, Viterbo, Italy, March 2018.
- University of Rome Tor Vergata, Italy, March 2018.

Artificial Intelligence: Can a Computer Outsmart Humans?

- Italy-Technion Society event, Rome, Italy, March 2018 (invited).

A Taxonomy and Evaluation Framework to Memristive Logic

- MDAC HiPEAC, Manchester, United Kingdom, January 2018.

Memory Intensive Architectures

- Intel, Hillsborough, OR, USA, June 2017.

mMPU: Memristor Memory Processing Unit

- 2017 Stephen and Sharon Seiden Frontiers in Engineering and Science Workshop: Beyond CMOS: From Devices to Systems, Technion, Haifa, Israel, June 2017.
- Intel Collaborative Research Institute - Computational Intelligence Retreat, Haifa, Israel May 2017.

Computation with Memristors

- Intel, Haifa, Israel, December 2016.

Designing Extremely Energy Efficient Computers with Memristors

- 3rd Green Photonics Symposium, Technion, Haifa, Israel, March 2016.
- UT Dresden, Dresden, Germany, February 2016.
- Qualcomm, Haifa, Israel, January 2016.
- Mellanox, Yokneham, Israel, December 2015.
- Marvell, Petach Tikva, Israel, November 2015.
- Qualcomm, San Diego, July 2015.
- ARM, San Jose, CA, June 2015.
- UCLA, Los Angeles, CA, June 2015.
- UC Santa Barbara, Santa Barbara, CA, June 2015.
- Nvidia Research, Santa Clara, CA, May 2015.
- Intel Labs, Hillsborough, OR, May 2015.

Designing Extremely Energy Efficient Computers

- UT Austin, Austin, TX, March 2015.
- Technion – Israel Institute of Technology, Haifa, Israel, January 2015.
- Hebrew University of Jerusalem, Jerusalem, Israel, January 2015.
- Ben Gurion University of the Negev, Beer Sheva, Israel, January 2015.

Memory Intensive Computing

- Tel Aviv University, Tel Aviv, July 2014.
- *DATE 2014*, Dresden, Germany, March 2014.
- *HiPEAC 2014*, Vienna, Austria, January 2014.

Building the Computers of the Future – a Talk about Resistors, Memories, and More

- *Jacobs Showcase Lecture Series: Much is New Under the Sun*, Technion - Israel Institute of Technology, Haifa, Israel, November 2013.

Memristors – Not Only Memory

- Princeton University, NJ, September 2013.
- Columbia University, NY, September 2013.
- Stanford University, Stanford, CA, September 2013.
- UC Berkeley, Berkeley, CA, September 2013.
- HP Labs, Palo Alto, CA, September 2013.
- UC San Diego, La Jolle, CA, September 2013.
- UC Santa Barbara, Santa Barbara, CA, October 2013.

- *The International Conference of the Israeli Semiconductor Industry (ChipEx 2013)*, Tel Aviv, Israel, May 2013. **Best lecture award.**

The Desired Memristor for Circuit Designers

- *Nature Conference on "Frontiers in Electronic Materials: Correlation Effects and Memristive Phenomena,"* Aachen, Germany, June 2012.

Memristor-based Logic Circuit Design

- *IEEE/ACRC Workshop on Memristors and Resistive Memory Devices and Applications in Computer Architecture and Brain-Inspired Systems,* Technion - Israel Institute of Technology, Haifa, Israel, March 2012.

Memristors and Related Applications

- *The International Conference of the Israeli Semiconductor Industry (ChipEx 2011)*, Tel Aviv, Israel, May 2011.

Posters

1. **S. Kvatinsky**, E. G. Friedman, A. Kolodny and U.C. Weiser, "Memristor-based Applications," *1st Technion Computer Engineering (TCE) Conference*, June 2011.
2. **S. Kvatinsky**, E. G. Friedman, A. Kolodny and U.C. Weiser, "Memristor-based Circuits and Architectures," *2nd Technion Computer Engineering (TCE) Conference*, June 2012.
3. **S. Kvatinsky**, E. G. Friedman, A. Kolodny and U.C. Weiser, "Memristor-based Logic," *MemCo Workshop - Memristors for Computing*, November 2012.
4. D. Soudry, D. Di Castro, A. Gal, A. Kolodny, and **S. Kvatinsky**, "Implementing Hebbian Learning Rules with Memristors," *Workshop on "Memristor-based Systems for Neuromorphic Applications,"* September 2013.
5. **R. Ben-Hur** and **S. Kvatinsky**, "Processing within a Memristive Memory," *Proceedings of the International Workshop on Emerging Memory Solutions, DATE Conference*, March 2016.
6. **N. Wainstein** and **S. Kvatinsky**, "RF Memristor Modeling," *International Conference on Memristive Materials, Devices & Systems*, April 2017.
7. E. Giacomini, **T. Greenberg-Toledo**, **S. Kvatinsky**, and P.-E. Gaillardon, "A Robust Digital RRAM-based Convolutional Block without Process Variation Dependencies," *Design Automation Conference*, June 2018.
8. **L. Danial**, Y. Roizin, and **S. Kvatinsky**, "Neuromorphic Data Converters Using Floating-Gate Memristive Devices," *Neuromorphic Computing – a Nature Conference*, October 2019. **Best poster award**
9. D. Bhattacharjee, A. Chattopadhyay, S. Dutta, R. Ronen, and **S. Kvatinsky**, "SCAR: A Scalable ARea-Constrained Technology Mapping Flow for MAGIC," *Design Automation Conference*, July 2020.
10. **N. Wainstein**, G. Akonina, **S. Kvatinsky**, and E. Yalon, "Electrothermal Compact Modeling of Indirectly Heated Phase Change RF Switches," *Device Research Conference*, June 2020.
11. K. Stern, **N. Wainstein**, Y. Keller, C. M. Neumann, E. Pop, **S. Kvatinsky**, and E. Yalon, "Sub-Nanosecond Partial Reset for Analog Phase Change Neuromorphic Devices," *Device Research Conference*, June 2021. **Best student poster award**