MUSTAFA ALTAY KARAMUFTUOGLU

CONTACT INFORMATION

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OBJECTIVE & SUMMARY

A talented, and self-motivated electrical engineer pursuing a Ph.D. with a strong background in VLSI design, and methodologies to develop efficient and cost-effective solutions. My M.Sc. research is about designing a spiking artificial neuron with a high order of firing frequency and its quantized spiking neural network implementations. Currently, studying and conducting research activities related to circuit design and computationally efficient model implementations on hardware and software mainly in the field of VLSI circuits and systems at USC.

EDUCATION

University of Southern California (USC), USA   13 Jan 2020–Present
Electrical Engineering (Ph.D. Degree)   Cumulative GPA: 3.84/4.00

TOBB Economics & Technology University, Turkey   24 Aug 2016–10 Dec 2018
Electrical & Electronics Engineering (M.Sc. Degree)   Cumulative GPA: 3.93/4.00
Thesis: Design and implementation of an ultrahigh speed and low energy artificial neuron

TOBB Economics & Technology University, Turkey   01 Sep 2010–28 Dec 2015
Electrical & Electronics Engineering (B.Sc. Degree)   Cumulative GPA: 3.72/4.00
Final Project: Design of a 3-axis gimbal   Ranking 3rd out of 62

Biltepe, Turkey   2006–18 June 2010
High School   94.86/100

RESEARCH AND WORKING EXPERIENCE

University of Southern California (USC)   13 Jan 2020–Present
Research Assistant, Full-time
- Translating text description of architecture to a hardware description language
- Automated GDSII to LEF file conversion using Python
- Programming superconductor circuit (RSFQ and AQFP) analysis tool for margin calculation, yield analysis, and analog optimization on MATLAB (qCS, https://github.com/Karamuft/qCS)
- Development of a hybrid optimization method (Automatic Niching Particle Swarm Optimization and Fireworks algorithms with Roulette Wheel Selection)
- Design and implementation of superconductor circuits such as scalable up-down counter, scalable RAM circuit, alpha cell with standard SFQ logic library cells, high-fan-in superconductor neuron, and advanced Josephson junction soma cell (α-Soma), and scalable & trainable synapse circuit on Cadence Virtuoso
- Programming SFQ-based neural network simulator and analysis of spiking neural network inference for datasets using Python
- Conducting research on half-flux quantum circuits with possible implementations
- Experience with Intel LAVA and BindsNET frameworks for spiking neural network applications using Python
- Working experience on government-funded projects:
  - SuperTools Program (ColdFlux Project by IARPA, USA) and Discover Expedition (by NSF, USA)
- Mentoring M.Sc. degree students for the preparation of XNOR SFQ neural network (Spring 2020)
- TA for Computer-Aided Design (CAD) of Digital Systems I (EE 680) (Fall 2023-2024)
- Reviewer, IEEE Transactions on Applied Superconductivity (IEEE TAS)

TOBB Economics & Technology University (TOBB ETU)   28 Aug 2019–05 Dec 2019
Research Assistant, Part-time
- RSFQ circuit design and hardware implementation (neuromorphic computing) with Cadence Virtuoso
- Mentoring M.Sc. degree students on superconductor circuit design, chip designs, and experiments

TOBB Economics & Technology University (TOBB ETU)   24 Aug 2016–10 Dec 2018
Research Assistant and Teaching Assistant, Full-time
- Design of a digital character recognition circuit with artificial superconductor neuron circuits using Cadence Virtuoso
- Design and implementation of superconductor spiking neurons and artificial neuro-inspired arithmetic & logic circuits (funded by TUBITAK - Scientific and Technological Research Council of Turkey)
- TA for electronic circuits and laboratory (ELE224 & ELE224L) (Fall 2016-2017, Fall 2017-2018, Fall 2018-2019)
- TA for analog circuits (ELE311) (Spring 2016-2017, Spring 2017-2018)

- TA for C programming language (BIL141) (Summer 2016-2017, Fall 2018-2019)
- TA for Logic Circuit Design Laboratory (BIL264L) (Summer 2017-2018)
- Working experience on a government-funded project: Hybrid Neuromorphic Processor (by TUBITAK, Turkey)

University of Zaragoza (ICMA)   14 Sep 2015–10 Dec 2015
Researcher, Full-time
- Modelling X-ray sensor (Transitional Edge Sensor, TES) using MATLAB
- Programming measurement system log visualizer for chip experiment system on MATLAB GUI
- Image-based resistance calculator for superconducting materials on MATLAB GUI

ROKETSAN Inc.   06 May 2015–13 Aug 2015
Researcher and Developer, Full-time
- Design of DC motor driver circuit on Altium Designer
- Various interactive signal processing and control software on MATLAB and Simulink

TOBB ETU Superconductor Electronics Lab. (SEL)   24 June 2014–01 Dec 2014
Researcher, Part-time
- Analog optimization of superconducting NDRO Vortex Transitional Memory (VTM) cell using PSO algorithm on MATLAB
- Design and PCB fabrication of FM radio circuit on Eagle PCB design software
- 8-bit CMOS Fast Fourier Transform design and simulation on Cadence Virtuoso

ARTLab   16 Jan 2014–24 Apr 2014
Researcher, Full-time
- Implementation of 8-bit 3D Fast Fourier Transform circuit for protein folding on Xilinx ISE
- Superconductor (RSFQ) digital circuit design such as counters, adders, and shift registers using Cadence Virtuoso

TOBB ETU Superconductor Electronics Lab. (SEL)   17 June 2011–02 Nov 2012
Research Assistant, Part-time
- Porting a MATLAB simulator for timing calculations of Superconductor RSFQ circuits into C++
- CMOS digital circuit design such as counters, adders, and shift registers using Xilinx ISE

SKILLS
• Python, Verilog & VHDL, C/C++, Java, Assembly programming, SQL
• MATLAB & Simulink, Cadence Virtuoso, Xilinx ISE & Vivado, PSPICE, QuestaSim, LabVIEW, AutoCAD, SolidWorks
• Adobe Illustrator & Photoshop & InDesign, Inkscape, Unity, MS Office (Word, Excel, PowerPoint)
• Windows & UNIX OS

PUBLICATIONS & CONFERENCES	
• B. Z. Ucpinar, **M. A. Karamuftuoglu**, S. Razmkhah, M. Pedram, "*On-Chip Trainable Neuron Circuit for SFQ-Based Spiking Neural Networks*", Article is under preparation.	N/A
• Y. Kopur, B. Z. Ucpinar, **M. A. Karamuftuoglu**, S. Razmkhah, M. Pedram, "New SFQ Logic Library with *α-cell interconnect based asynchronous resets*", Article is under preparation.	N/A
• B. Z. Ucpinar, Y. Kopur, **M. A. Karamuftuoglu**, H. Cong, S. Razmkhah, M. Pedram, "Superconducting Multiflux Destructive and Non-Destructive Memory Unit Design", Article is under preparation.	N/A
• **M. A. Karamuftuoglu**, B. Z. Ucpinar, S. Razmkhah, M. Pedram, "*Development of SFQ-based scalable up-down counter*", Article is under preparation.	N/A
• S. Razmkhah, **Mustafa Altay Karamuftuoglu**, A. Bozbey "JJ-Synapse: Towards a Spiking Neuromorphic Processor Architecture", Article is ready to submit.	N/A
• **M. A. Karamuftuoglu**, Haolin Cong, M. Pedram, "*qCS: Analog and Digital Optimization Tool for Superconductor Cells*", Article is under preparation.	N/A
• **M. A. Karamuftuoglu** et al, "Superconducting Spiking Neuron Design with Application to Spiking Neuron Network Inference", Article is ready to submit.	Expected Early-2024
• **M. A. Karamuftuoglu**, B. Z. Ucpinar, S. Razmkhah, M. Kamal, M. Pedram, "SFQ-Based SNN Accelerator with High Accuracy and Ultra-high Throughput", Invited Poster, EUCAS 2023.	Sep 2023
• C. J. Fourie et al, "Results from the ColdFlux Superconductor Integrated Circuit Design Tool Project", in IEEE TAS, doi: 10.1109/TASC.2023.3306381	Aug 2023
• **M. A. Karamuftuoglu**, A. Bozbey, A. Murat Ozbayoglu, "*Implementation of Neuro-inspired Arithmetic and Logic Circuits*", in IEEE TAS, doi: 10.1109/TASC.2023.3295835.	July 2023
• **M. A. Karamuftuoglu**, A. Bozbey, S. Razmkhah, "*JJ-Soma: Towards a Spiking Neuromorphic Processor Architecture*", in IEEE TAS, doi: 10.1109/TASC.2023.3270766	Apr 2023

• **M. A. Karamuftuoglu**, "*SFQ-Based SNN Accelerator*", Oral Presentation, DISCoVER Expedition, Los Angeles, CA, USA	Apr 2023
• **M. A. Karamuftuoglu**, M. Pedram, "*α-Soma: Single Flux Quantum Threshold Cell for Spiking Neural Network Implementations*", in IEEE TAS, vol. 33, no. 5, pp. 1-5, Aug. 2023, Art no. 1801005	Apr 2023
• **M. A. Karamuftuoglu,** S. N. Shahsavani and M. Pedram, "*Margin and Yield Optimization of Single Flux Quantum Logic Cells Using Swarm Optimization Techniques,*" in IEEE TAS, vol. 33, no. 1, pp. 1-10	Jan 2023
• H. Cong, M. Li, **M. A. Karamuftuoglu**, M. Pedram, "*qSportLib: An optimized and Validated Rapid Single Flux Quantum Standard Cell Library*", Poster Presentation, The Applied Superconductivity Conference, ASC2022, Honolulu, Hawaii, USA	Oct 2022
• **M. A. Karamuftuoglu**, H. Cong, M. Pedram, "*qCS: A Mixed-Signal Design Optimization Tool Targeting SFQ Logic Cells* ", Poster Presentation, The Applied Superconductivity Conference, ASC2022, Honolulu, Hawaii, USA	Oct 2022
• **M. A. Karamuftuoglu**, M. Pedram, "*α-Soma: Single Flux Quantum Threshold Cell with Excitatory and Inhibitory Inputs*", Poster Presentation, The Applied Superconductivity Conference, ASC2022, Honolulu, Hawaii, USA	Oct 2022
• **M. A. Karamuftuoglu**, S. N. Shahsavani, M. Pedram, "*Margin Optimization of Single Flux Quantum Logic Cells*", In: Topaloglu, R.O. (eds) Design Automation of Quantum Computers. Springer, pp 105–133.	Aug 2022
• A. Bozbey, **M. A. Karamuftuoglu**, "*Logic Gate with Neuron Circuit*", TR patent application no: 2019/10971 and PCT patent application no: PCT/TR2020/050601	July 2019
• **M. A. Karamuftuoglu**, A. Bozbey, A. Murat Ozbayoglu, "*Implementation of Neuro-inspired Arithmetic and Logic Circuits by Using Josephson Junction Based Artificial Neurons*", Poster Presentation, 17th International Superconductive Electronics Conference, ISEC2019, Riverside, CA, USA	July 2019
• A. Bozbey, **M. A. Karamuftuoglu**, S. Razmkhah, M. Ozbayoglu, "Single Flux Quantum Based Ultrahigh Speed Spiking Neuromorphic Processor Architecture", Article is on Arxiv (1812.10354). Updated: July 2020.	Dec 2018
• A. Bozbey, **M. A. Karamuftuoglu**, "*Neuron Circuit*", TR patent application no: 2018/09195 and PCT patent application no: PCT/TR2019/050510	June 2018
• **M. A. Karamuftuoglu**, "*Development of Josephson Junction based Artificial Neuron Circuit*", Poster Presentation, International Conference on Superconductivity and Magnetism, 6th ICSM, Antalya, Turkey	May 2018
• **M. A. Karamuftuoglu**, "*Development of Superconductor Integrated Logic Circuit Design with Artificial Neural Network Structure*", Oral Presentation, International Conference on Condensed Matter and Materials Science, ICCMMS2017, Adana, Turkey	Oct 2017
• **M. A. Karamuftuoglu**, S. Demirhan, Y. Komura, M. E. Çelik, M. Tanaka, A. Bozbey, and A. Fujimaki, "*Development of an Optimizer for Vortex Transitional Memory Using Particle Swarm Optimization*", IEEE Transactions on Applied Superconductivity, vol. 26, no. 8, pp. 1-6	Aug 2016
• 8th Superconducting SFQ VLSI Workshop, SSV 2015, Japan	July 2015
• **M. A. Karamuftuoglu**, "*Development of an Optimizer for Vortex Transitional Memory using Particle Swarm Optimization*", Poster Presentation, 15th International Superconductive Electronics Conference, Nagoya, Japan	July 2015

CERTIFICATES	
• International Conference on Superconductivity and Magnetism, Certificate of Attendance, 6th ICSM, Turkey	May 2018
• International Conference on Condensed Matter and Materials Science, Certificate of Oral Presentation, ICCMMS2017, Adana, Turkey	Oct 2017
• Summer School on Superconducting Electronics, Certificate of Attendance, FLUXONICS, Sardinia, Italy	Sep 2016
• Spring School and Educational Courses on Superconductivity, Cryogenics, and Magnetism, Certificate of Attendance, 5th ICSM & SSEC2016, Antalya, Turkey	Apr 2016
• Spanish courses as a foreign language, Certificate of Attendance, A1 Level, University of Zaragoza, Spain	Sep–Oct 2015

SELECTED COURSES
Ph.D. Degree: Computer-Aided Design of Digital Systems II (EE 681), MOS VLSI Circuit Design (EE 477), VLSI System Design (EE 577A), VLSI System Design (EE 577B), Computer Systems Organization (EE 457), Diagnosis and Design of Reliable Digital Systems (EE 658), Probability for Electrical and Computer Engineers (EE 503), Analysis of Algorithms (CSCI 570), Database Systems (CSCI-585)
M.Sc. Degree: Artificial Neural Networks (BIL 542), Pattern Recognition (BIL 564), Embedded Systems (ELE 519), Computerized Control with MATLAB (ELE 515), Instrumentation and Experimental Techniques (LabVIEW) (ELE 527), Solar Energy Systems (ELE 557), Superconductivity Electronics II (ELE 529), Smart Systems (Audit) (ELE 516), Artificial Intelligence (Audit) (BIL 541), Linear Systems (Audit) (ELE 501), Approximation Algorithms (Audit) (BIL 536)
B.Sc. Degree: CMOS VLSI Circuit Design (ELE 422), VOIP & IPTV (BIL 550), Power System Analysis (ELE 481), Computer Aided Technical Drawing I (AutoCAD) (MAK 101), Industrial Electronics (ELE 423), Materials Science & Fabrication (MAK 209)

ACADEMIC EXPERIENCE FROM COURSES	
EE 681: Computer-Aided Design of Digital Systems II	Coding various partitioning, placement & route algorithms in Python
EE 658: Diagnosis and Design of Reliable Digital Systems	Programming Automatic Test Pattern Generation (ATPG) in C

EE 577B: VLSI System Design	Tiled multi-core processor using NoC routers (w/ Syn, P&R) (Verilog)
EE 577A: VLSI System Design	10T-SRAM design & simulation for in-memory computing (Virtuoso)
EE 477: MOS VLSI Circuit Design	10-bit multiply-accumulator with design and simulation (Virtuoso)
EE 457: Computer Systems Organization	Out of order Execution divider, RISC-V processor with Verilog
CSCI 585: Database Systems	Performing queries on STEM tutoring business with SQL via Docker
BIL 564: Pattern Recognition	Improved a toolbox (nntool) for neural networks on MATLAB
ELE 557: Solar Energy Systems	Conducting research on graphene solar panels
BIL 542: Artificial Neural Network	Poker hand classification with UCI data on MATLAB
ELE 529: Superconductor Electronics II	Neural network research on superconductor circuits (RSFQ)
ELE 527: Instrumentation and Experimental Methods	Temperature stabilization for a metal plate with LabVIEW
ELE 519: Embedded Systems	AES256 encryption with VHDL on Xilinx
ELE 515: Computer-Aided Control Design	Rotary inverted pendulum modeling and analysis with MATLAB
ELE 423: Industrial Electronics	Design and PCB fabrication of FM radio circuit on Eagle
ELE 422: CMOS VLSI Design	Radix-2 butterfly circuit gate level design on Xilinx
BIL 362: Microprocessors	Bubble shooter game with assembly language for 8086 microprocessor
UGI 315: Entrepreneurship and Leadership	Distance education platform documentation for KOSGEB
ELE 311: Analog Electronic Circuits	5 Layer amplifier circuit design on PSPICE & PCB implementation

EDUCATIONAL HONORS

25% Research Assistantship & 25% Teaching Assistantship Award ECE PhD degree program at USC	2023-2024
50% Research Assistantship Award ECE PhD degree program at USC	2020-2023
Extra Success-scholarship EEE MSc degree program at TOBB ETU	2017-2018
Success-scholarship EEE MSc degree program at TOBB ETU	2016-2017
Ranked 3rd of EEE department TOBB ETU based on Cumulative GPA	2015
Success-scholarship EEE undergraduate program at TOBB ETU	2013-2015
Half-scholarship EEE undergraduate program at TOBB ETU	2010-2013
High Honor Trimesters (B.Sc.): 2011-2012 (Spring, Summer), 2012-2013 (Spring, Summer), 2013-2014 (Summer), 2014-2015 (Fall, Spring)	
Honor Trimesters (B.Sc.): 2012-2013 (Fall), 2013-2014 (Fall)	

FOREIGN LANGUAGES

Turkish:	Native proficiency
English:	Professional working proficiency, 4-Trimester English Lectures at TOBB ETU
	TOEFL IBT: 98 (Jul 2019) (*MyBest™ score*: 102), GRE: 310 (Math: 167, Writing: 3.5) (Aug 2019)
	Academic and Professional Writing III (ALI-245) Lectures at USC
Spanish:	Limited working proficiency, 4-Trimester Spanish Lectures at TOBB ETU and A1 level Spanish courses in Spain

REFERENCES

Dr. Massoud PEDRAM, Prof	**Dr. Douglas Scott HOLMES**	**Dr. Ali BOZBEY, Prof**
pedram@usc.edu	d.scott.holmes@ieee.org	bozbey@etu.edu.tr
University of Southern California, USA	IARPA, USA	TOBB University, TURKEY
Dr. Akira FUJIMAKI, Prof	**Dr. Pascal FEBVRE, Prof**	**Dr. Agustín CAMÓN**
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Nagoya University, JAPAN	Savoie University, FRANCE	Zaragoza University, SPAIN