Shahin Roozkhosh

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Research Interests

- ◇ Cyber-Physical Systems(CPS)
- ◇ Partially Re-configurable Platforms
- ◇ OS-level Multi-core Resource Management
- ◇ Multi-core and Many-core Architectures
- ◇ Real-time and Embedded Systems
- ◇ Parallel and Distributed Systems

Education

Ph.D. Candidate in Computer Science, Sept. 2018 - Now
Boston University, Boston, MA, USA
- ○ Thesis: "*Software Defined Platforms on Reconfigurable Cyber-Physical Systems*"
- ○ Advisor: Prof. Renato Mancuso

Master of Science in Computer Science, Sept. 2018 - Dec. 2022
Boston University, Boston, MA, USA
- ○ Thesis: "*Clarifying the Sources of Unpredictability in Multi-core Systems* "
- ○ Advisor: Prof. Renato Mancuso
- ○ Obtained while pursuing a Ph.D. degree as a post-bachelor

B.Sc. in Computer Hardware Engineering, Sept. 2012 - Jan. 2018
Sharif University of Technology, Tehran, Iran
- ○ Thesis: "*Effective Cache Bank Placement for GPUs*"
- ○ Advisor: Prof. Hamid Sarbazi-Azad

Diploma in Mathematics and Physics Discipline, Sept. 2008 - Jun. 2012
Shahid Dastgheib High School, Shiraz, Iran
- ○ Affiliated with the National Organization for Development of Exceptional Talents (NODET).

Publications

- ◇ Renato Mancuso, **Shahin Roozkhosh**, Denis Hoornaert, Ju Hyoung Mun, Tarikul Islam Papon and Manos Athanassoulis. "*Software-Shaped Platforms.*" Real-time And intelliGent Edge computing workshop (RAGE), 2023. RAGE, 2023.
- ◇ Tarikul Islam Papon, Ju Hyoung Mun, **Shahin Roozkhosh**, Denis Hoornaert, Ahmed Sanaullah, Ulrich Drepper, Renato Mancuso, Manos Athanassoulis. "*Relational Fabric: Transparent Data Transformation.*" 39th IEEE International Conference on Data Engineering (ICDE), 2023. ICDE, 2023.
- ◇ **Shahin Roozkhosh**, Denis Hoornaert, Ju Hyoung Mun, Tarikul Islam Papon, Ahmed Sanaullah, Ulrich Drepper, Renato Mancuso, Manos Athanassoulis. "*Relational Memory: Native In-Memory Accesses on Rows and Columns.*" 26th International Conference on Extending Database Technology (EDBT), 2023. EDBT/ICDT, 2023.
- ◇ **Shahin Roozkhosh**, Denis Hoornaert, Renato Mancuso. "*CAESAR: Coherence-Aided Elective and Seamless Alternative Routing via on-chip FPGA.*" 43rd IEEE Real-Time Systems Symposium (RTSS), 2022. IEEE, 2022.
- ◇ Mattia Nicolella, Denis Hoornaert, **Shahin Roozkhosh**, Andrea Bastoni, Renato Mancuso. "*Know your Enemy: Benchmarking and Experimenting with Insight as a Goal.*" 43rd IEEE Real-Time Systems Symposium (RTSS@work), 2022. IEEE, 2022.
- ◇ **Shahin Roozkhosh**, Denis Hoornaert, and Renato Mancuso. "*Hardware Data Re-organization Engine for Real-Time Systems.*" 43rd IEEE Real-Time Systems Symposium (RTSS@work), 2022. IEEE, 2022.
- ◇ Mattia Nicolella, **Shahin Roozkhosh**, Denis Hoornaert, Andrea Bastoni, Renato Mancuso. "*RT-Bench: an Extensible Benchmark Framework for the Analysis and Management of Real-Time Appli-*

cations." The 30th International Conference on Real-Time Networks and Systems (RTNS), 2022.

- ◇ **{Shahin Roozkhosh**, Denis Hoornaert**}**, Renato Mancuso. "*A Memory Scheduling Infrastructure for Multi-core Systems with Re-programmable Logic.*" 33rd Euromicro Conference on Real-Time Systems (ECRTS), 2021. IEEE, 2021.
- ◇ Denis Hoornaert,**Shahin Roozkhosh**, Renato Mancuso and Marco Caccamo "*Identifying Unexpected Inter-coreInterference Induced by Shared Cache.*" 27th IEEE Real-Time and Embedded Technology and Applications Symposium (WiP session) (RTAS), 2021 IEEE, 2021.
- ◇ Dharmesh Tarapore, **Shahin Roozkhosh**, Steven Brzozowski, Renato Mancuso. "*Observing the Invisible: Live Cache Inspection for High-Performance Embedded Systems.*" IEEE Transactions on Computers (IEEE TC), 2021. IEEE, 2021.
- ◇ **(Best Paper Award) Shahin Roozkhosh**, Renato Mancuso."*The potential of programmable logic in the middle: cache bleaching.*" 26th Real-Time and Embedded Technology and Applications Symposium (RTAS), 2020, pp. 296-309. IEEE, 2020.
- ◇ Sadrosadati, Mohammad, Ramin Bashizade, **Shahin Roozkhosh**, Ali Shafiee, and Hamid Sarbazi-Azad. "*A Method to Improve Adaptivity of Odd-Even Routing Algorithm in Mesh NoCs.*" In Parallel, Distributed, and Network-Based Processing (PDP), 2016 24th Euromicro International Conference on, pp. 755-758. IEEE, 2016.
- ◇ Sadrosadati, Mohammad, Amirhossein Mirhosseini, **Shahin Roozkhosh**, Hazhir Bakhishi, and Hamid Sarbazi-Azad. "*Effective Cache Bank Placement for GPUs*" In 2017 Design, Automation & Test in Europe Conference & Exhibition (DATE), pp. 31-36. IEEE, 2017.

Publications (Pre-print)

- ◇ **{Shahin Roozkhosh**, Bassel El Mabsout**}**, Siddharth Mysore, Kate Saenko, Renato Mancuso. "*SwaNNFlight and Anchored Learning for On-the-Fly Sim-to-Real Adaptation.*"
- ◇ Weifan Chen, Ivan Izhbirdeev, Denis Hoornaert†, **Shahin Roozkhosh**, Sanskriti Sharma, Patrick Carpanedo and Renato Mancuso. "*Timely Progress Integrity: Low-overhead Online Assessment of Timely Progress as a Commodity.*"

Research Collaborations

- ◇ Peer Reviewer Experience
  - At *Design, Automation and Test in Europe Conference 2022*(DATE'22).
  - At *33rd Euromicro Conference on Real-Time Systems* (ECRTS'21).
  - At *International Conference on Embedded Software* (EMSOFT'20).
  - At *57th Design Automation Conference* (DAC'20).
  - At *26th IEEE Real-time and Embedded Technology and Applications Symposium* (RTAS'20).
  - At *41st IEEE Real-time Systems Symposium* (RTSS'20).
  - At *25th IEEE Real-time and Embedded Technology and Applications Symposium* (RTAS'19).
- ◇ **Red Hat Research. (RedHat)** **Sep. 2019 - Now**
  Affiliated Researcher, Supervisor: Ulrich Drepper, Red Hat Research

  · *Research focused on Design and Development of an **AI Accelerator***
  Funed by Red Hat Research Incubation Award, I designed and implemented a **Re-configurable** Hardware Accelerator. A novel memory abstraction that enables the definition of workload-specific memory access paradigms. *Published open-source*

  · *Design and Development of an **Relational Memory Controller***
  Funed by Red Hat Research Incubation Award, we are presently developing **Relational** Memory Controller. A novel a memory controller that can transform data on the fly, thus pushing through the memory hierarchy towards the CPU only the relevant data tightly packed, increasing locality and efficiency.

  · *Affiliated with Massive Data, Algorithms, and Systems Group (MiDAS) at Boston University*
  Advisor: Prof. Manos Athanassoulis

◇ **The Institute for Research in Fundamental Sciences (IPM)** Jun. 2013 - Jan. 2018
Research Assistant, Supervisor: Prof. Hamid Sarbazi-Azad, School of Computer Science
Advisor: Dr. Arash Tavakkol and Mohammad Sadrosadati

· *Studies and research focused on* ***SSDs***
We proposed a **Performance Evaluation of Dynamic Page Allocation Strategies in SSDs**.
Corresponding Paper Published in ACM Transactions on Modeling and Performance Evaluation of Computing Systems (TOMPECS)

· *Technical assistant in implementation of* ***XMulator***
Xmulator is an object-oriented event-based simulator software for interconnection networks and wireless networks. I contributed to the packages required for Network-on-Chip (NoCS) simulation. Xmulator uses Orion power library for power and energy estimation.

· *Extension and improvement in* ***DiskSim***.
DiskSim is an efficient, accurate, highly-configurable disk system simulator which includes modules for most secondary storage components of interest, including device drivers, buses, controllers, adapters, and disk drives.

◇ **High-Performance Computing Architectures and Networks**, Jun. 2013 - Jan. 2018
HPCAN Laboratory
Research Assistant, Supervisor: Prof. Hamid Sarbazi-Azad, Department of Computer Engineering, Sharif University of Technology.

· *Studies and research focused on* ***GPUs***
The placement of the Last Level Cache (LLC) banks in the GPU on-chip network can significantly affect the performance of memory-intensive workloads. We attempt to offer a placement methodology for the LLC banks to maximize the performance of the on-chip network connecting the LLC banks to the streaming multiprocessors in GPUs.

· *Extension and improvement in* ***GPGPU-Sim***.
GPGPU-Sim provides a detailed simulation model of a contemporary GPU (such as NVIDIA's Fermi and GT200 architectures) running CUDA and/or OpenCL workloads and now includes an integrated (and validated) energy model, GPUWattch.

· *Implementation of a* ***Genetic algorithm based, intermediate Software***
The software was linked to GPGPU-Sim to process all data collected from previous simulations automatically and lead us to find a new throughput aware metric in The placement of the Last Level Cache (LLC) banks in the GPU on-chip network.
Genetic Algorithm (GA) is a metaheuristic inspired by the process of natural selection that belongs to the larger class of evolutionary algorithms (EA).

· *Studies and research on* ***NoCs*** *focused on* ***Routing Algorithms***
We figured a novel approach, called Preemptive Waiting, which applied to Odd-Even routing algorithm (PWOE). PWOE postpones the saturation traffic rate of NoC compared to OE, under synthetic traffic loads.
BookSim which is a cycle-accurate simulator developed in C++ was as our Simulation Environment.

Talks and Conferences

◇ **Presented** 43rd IEEE Real-Time Systems Symposium (RTSS), **slides** Dec. 2022
◇ **Presented** 43rd IEEE Real-Time Systems Symposium (RTSS@work), **slides**, **poster** Dec. 2022
◇ **Presented** at Boston University - Depth **slides** Nov. 2022
◇ **Presented** at a virtual workshop for BOSCH research engineers. Aug. 2020
Title: A Deep Dive Into Hypervisor on the Xilinx's Zynq UltraScale+ MPSo
◇ **Presented** at open source community conference DevConf.US 2022
◇ **Presented** at Greater New England Research Interest Group Meeting (Red Hat RIG) June. 2021
Title: Near-Memory Data Reorganization Engine for Data Table Access.
◇ Attended 40th IEEE Real-Time Systems Symposium(RTSS), Virtual Dec. 2020

- ◇ **Presented** at a virtual workshop for BOSCH research engineers. Aug. 2020
  Title: A Deep Dive Into Hypervisor on the Xilinx's Zynq UltraScale+ MPSoC
- ◇ **Presented** at 27th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS) April. 2020
  Title: The Potential of Programmable Logic in the Middle: Cache Bleaching
- ◇ **Presented** at BU Cloud Workshop with IBM Research and Red Hat. Feb. 2020
  Title: Shared Resource Management with Programmable Logic-in-the-Middle
- ◇ Attended 39th IEEE Real-Time Systems Symposium(RTSS), Nashville, TN, USA Nov. 2018
- ◇ Attended 1st International Conference on Topics In Theoretical Computer Science (TTCS), Tehran, Iran Sep. 2017

Teaching Experience

Invited Lecturer-Boston University
- ○ **Embedded Systems Development** Spring 2019

Teaching Fellow-Boston University
- ○ **Systems Architecture in Management and Applications** Spring 2023
- ○ **Embedded Systems Development** Spring 2022
- ○ **Embedded Systems Development** Spring 2019

Teaching Assistant-Sharif University of Technology
- ○ **Digital System Design** Fall 2015
- ○ **Automata and Compiler** Spring 2015
- ○ **Computer Structure and Language** Fall 2015
- ○ **Discrete Structures** Fall 2015
- ○ **Logic Design** Fall 2014
- ○ **Computer Architecture** Fall 2014
- ○ **Advanced Programming** Fall 2013
- ○ **Fundamentals of Programming** Fall 2013, Spring 2013

Tutor-Tehran, Iran
- ○ **Private C and C++ Programming Tutor** 2013 - Jan. 2018
- ○ **Private English Tutor** 2016 - Jan. 2018

Honors and Awards

- ◇ Obtained student travel grant (RTSS), Houston, Tx, USA Dec. 2022
- ◇ **Best Paper Award** (RTAS), Sydney, Australia April. 2020
- ◇ Obtained student travel grant (RTSS), Nashville, TN, USA Nov. 2018
- ◇ **Ranked** 285^{th} (**top 0.1%**) in the **National University Entrance Examination**, 2012
  Among more than 380,000 participants, Iran
- ◇ Member of National Organization for Development of Exceptional Talents (NODET) 2005 - 2012
- ◇ **Selected** to study in **Shahid Dastgheib High school**, Sept. 2008
  Through an exam with less than 1% acceptance rate.
- ◇ Semifinalist in 27^{th}, 28^{th}, 29^{th} Iranian National Olympiad in Mathematics 2009, 2010, 2011
- ◇ Semifinalist in 19^{th} and 20^{th} Iranian National Olympiad in Informatics (INOI) 2009, 2010

Notable Projects

- ◇ **Built a Quad-copter Drone with an stand-alone Flight Controller**
  Established a bi-directional connection to the ground for low-level **attitude flight Control** using **Neural Network** This is a continuation of NeuroFlight
  Currently, under development. Boston University
- ◇ **Digaai: A Neural-Network-based Name-Ethnicity Classification Platform**
  This project assists in locating and classifying locations in the US made of the Brazilian immigrant population. Digaai, documents the Brazilian diaspora and through media. Boston University
- ◇ **Simulation and FPGA Implementation of a Simple Computer using VHDL and Xilinx ISE**

Course Project for Computer Architecture lab, Sharif University of Technology

- ◇ **Design and Implementation of a 16-bit ALU using Proteus**
  Course Project for Computer Architecture, Sharif University of Technology
- ◇ **Design and Implementation of MIPS Processor on FPGA**
  Course Project for Computer Digital System Design, Sharif University of Technology
- ◇ **Implementation of an HTTP Proxy Server using Java**
  Course Project for Computer Networks, Sharif University of Technology
- ◇ **Implementation of Basic USB Flash using AVR Assembly and Proteus**
  Top mark project in the course of Micro Controllers, Sharif University of Technology
- ◇ **Implementation of a Noise Reduction Filters using Nvidia CUDA**
  Course Project for Multicore Computing, Sharif University of Technology
- ◇ **Implementation of Multiple Face Detection in Real-Time**
  Top mark project in the course of Fundamentals of Programming, Sharif University of Technology
- ◇ **Implementation of a Graphical Strategic Game using QT Framework**
  Top mark project in the course of Advanced Programming, Sharif University of Technology
- ◇ **Implementation of Minesweeper Game using QT Framework**
  Course Project for Advanced Programming, Sharif University of Technology
- ◇ **Design and Implementation of a Compiler using LEX and YACC Tools**
  Course Project for Principles of Compiler Design, Sharif University of Technology

Work Experience

Embedded Engineering Co-op at Shell TechWorks Jan. 2023 - Present
Boston, USA
Assigned as a full-time engineer to **Shell International** Exploration and Production Company (SIEP), of which Shell *TechWorks* is a part. My responsibilities include but are not limited to developing or directing embedded systems for heavy vehicle fueling; testing or validation procedures and embedded programming.
Supervisor: Leland Smith

(Start-Up) Developer at Appetizer Mobile App. Jun. 2017 - Jan. 2017
Tehran, Iran
Appetizer is an Integrated Management System for Food Services and Clients which inform them about features like Checkin, Reserve, Takeaway and more Services

(Start-Up) Developer at Peeyade Mobile App. Jun. 2016 - May 2016
Tehran, Iran
Peeyade is a media application that gives users location-based information about Tehran

(Start-Up) Full-Stack Developer at Green Bird Studio Jun. 2013 - Oct. 2013
Tehran, Iran
Job Description: Developing Android mobile applications and Implementing back-end services using PHP.

Skills

- ◇ **Programming Languages:** C, C++, C#, Java, OpenMP, Nvidia CUDA, Pthread, VHDL, Verilog HDL, PLC, Matlab, Python, PHP, HTML, CSS, Javascript, Assembly
- ◇ **Applications and Scientific Tools:** Eclipse, Shell Scripting, SimpleScalar, GPGPU-Sim, Disksim, BookSim, CACTI, MS Office, Quartus, ModelSim, Xilinx SDK, CodeVision, Microsoft Visual Studio, Qt Framework, ISE, Eclipse, OpenCV
- ◇ **Operating Systems:** GNU Linux(Ubuntu), Microsoft Windows
- ◇ **Typesetting:** TEX, LATEX, VIM , Microsoft Word, Gnuplot

Hobbies

- ◇ **Adventure:** Hiking, Hitchhiking, Camping
- ◇ **Art:** Professional Photography
  With a concentration in Portrait and Documentary Photography.
  Photography is also my avocation.

- **Other Hobbies:** Freelance Blog Writer, Reading
  I love the feeling of sharing my experiences with others through my blog.