Two Research Assistant Positions –
Reconfigurable Computing Laboratory
University of Arizona

Project1: Domain-Focused Advanced Software-Reconfigurable Heterogeneous System on Chip (DASH-SoC)

Overview: The overall goal of this four year project is to develop a heterogeneous SoC comprised of many cores that mix general-purpose processors, special-purpose processors, hardware accelerators, memory, and input/output (I/O). Much of the work that goes into managing heterogeneous processor resources in current systems and SoCs is done through manual optimization. We seek to improve on this development style by embedding novel resource management solutions into both hardware and software. As the key enabling technology is the intelligent resource manager that orchestrates the distribution of compute and data onto the various processor elements, the resource manager will need to understand the outputs of the compiler beyond just interpreting the binary through vertical integration at three levels. The first level is design-time resource management for deciding the type, number, and distribution of PEs. The second level is compiler-time resource management to statically compile optimizations into each program. The third level is run-time optimization where the scheduler dynamically makes online updates to the use of the PEs to support multiple, simultaneous applications.

Current State and Next Steps: During the first year of the DASH-SoC we focused on emulating the initial design on the Zynq UltraScale MPSoC through software cores and programmable logic representing the accelerators by simultaneously running four applications in Radar and WiFi domains. We are now ready to utilize this emulation environment for:

- Dynamically scheduling task-graphs for multiple applications,
- Evaluating applications task-graphs on different hardware configurations, where each configuration is formed using CPU cores and hardware accelerators,
- Evaluating the performance for different scheduling algorithms at run-time.

This hardware-based emulation environment is intended for accelerating the steps involved in hardware and software co-design for heterogeneous system-on-chip (SoC) architectures. This framework will allow application developers to design, validate, and tune their applications on various heterogeneous SoC configurations before the real platform is made available. Similarly, the proposed framework will allow hardware developers to investigate and evaluate different SoC configurations and scheduling algorithms for the given applications or application domain.

Application process:
If you are interested in taking a role in this multi-year project, contact Dr. Akoglu (akoglu-at-ece.arizona.edu) with the subject line "DASH-Soc" and include your resume that highlights your relevant experience (class, project, programming). You may refer to RCL page for further information about current research projects (https://uweb.engr.arizona.edu/~rcl/).

Project2: Heterogeneous Computing
Overview: We are in the process of building a library of parallelized functions used in optical character recognition, pattern matching, and video content analysis applications targeted for a system that couples a multi-core CPU with Tesla V100 GPU and Xilinx Alveo Data Center Accelerator Card (FPGA). Our aim is to reduce the time scale of the key kernels in the targeted applications through GPU-only, FPGA-only and hybrid implementations. We are looking for a graduate student to take the lead on the GPU-based implementation efforts and collaborate with the team members on designing and developing the hybrid implementations for exploiting the performance benefits of the GPU and FPGA platforms in a complementary manner. For this project, in addition C/C++, CUDA and Python programming, intimate experience with machine learning and data manipulation libraries for GPUs is desired.

Application process:
If you are interested in taking a role in this multi-year project, contact Dr. Akoglu (akoglu-at-ece.arizona.edu) with the subject line "Heterogeneous computing" and include your resume that highlights your relevant experience (class, project, programming). You may refer to RCL page for further information about current research projects (https://uweb.engr.arizona.edu/~rcl/).