Faculty of Computer Science

The Institute of Computer Engineering, Chair of Processor Design offers of 1st February 2020 a position as

Research Associate

(subject to personal qualification employees are remunerated according to salary group E 13 TV-L)

Research area: Embedded System Design with FPGA

Terms: The position is limited to 31.12.2020 (with the option to be extended). The period of employment is governed by the Fixed Term Research Contracts Act (Wissenschaftszeitvertragsgesetz – WissZeitVG).

Position and Requirements

At the Chair of Processor Design we have the long-term vision of shaping the way future electronic systems are to be designed.

This project involves accelerating the applications, either image processing or machine learning, by using the FPGA hardware accelerators. In these classes of applications, there are different processing pipelines in order to obtain the final results. For instance, in the inference phase of machine learning, the input will be sent through multiple layers, i.e., fully-connected, convolution, max-pooling, etc. On the other hand, in the image-processing-based people counting applications, the input video is resized, converted into gray-scale, applied Gaussian blur, thresholding, etc. Not all of these steps can be accelerated efficiently by hardware especially when the access pattern is irregular. Additionally, the data communication between hardware and software could be a bottle-neck. It restricts the hardware accelerators to perform at their full potential. Therefore, the hardware-software co-design techniques should be performed to determine the best possible combination of software/hardware functions for the applications. The hardware-software communication paths should be reduced as much as possible to avoid the inevitable bottle-necks. It means that the communication should happen mostly within the hardware between the accelerators.

In order to realize such techniques and systems, different combinations of hardware accelerators and their connections must be generated. Nevertheless, the number of these combinations could grow exponentially with the number of accelerators to become intractable. Thus, there is a need for a flexible framework in which the accelerators will be implemented individually at design-time, then dynamically loaded into the system at run-time as needed. The communication between these accelerators can also be dynamically established at run-time. This kind of framework does not only enable rapid prototyping of the hardware-software co-design techniques, but also be a production-ready system. The reconfigurable system such as FPGA fits well into this context, particularly with the Partial Reconfiguration techniques.

The person is expected to take role in:

- developing the FPGA-based hardware accelerators using either HDL (Verilog, VHDL) or HLS, or another other language (OpenCL, Chisel, etc.);
studying the state-of-the-art multi-processor system-on-chip platforms that support partial reconfiguration to derive the suitable platform for the class of application of interest (either machine learning or image processing, or both). It involves initial application profiling to understand the data access patterns, the communication between functions, etc.;

designing the design automation tool to generate the accelerators as well as the system automatically for design space exploration with hardware-software co-design.

The successful candidate must have:

- a university degree in computer science or electrical engineering, and if applicable a PhD;
- strong FPGA design/architecture background with either Xilinx (preferred) or Intel FPGA;
- strong background in HDL either Verilog or VHDL;
- proficiency in C/C++;
- good knowledge of Computer Architecture and algorithm design;
- good publication record (for Postdoc position) and good communication skills.

The following skills will provide an added advantage:

- good knowledge of System-on-Chip architecture and design with related concepts such as multi-core, multi-processor, network-on-chip, communication interfaces (AXI, AXI-Stream, etc), DMAs, etc.;
- familiarity with TCL script.

What we offer
You will join a team of enthusiastic researchers who pursue creatively their individual research agenda. Other ongoing projects at the Chair of Processor Design can be found at https://www.cfaed.tu-dresden.de/pd-about. The chair is a part of the Center for Advancing Electronics Dresden, which offers plenty of resources and structures for career development.

Informal enquiries can be submitted to Prof. Dr. Akash Kumar, Tel +49 (351) 463 39274; Email: akash.kumar@tu-dresden.de

Applications from women are particularly welcome. The same applies to people with disabilities.

Application Procedure
Your application (in English only) should include: motivation letter, CV, copy of degree certificate, transcript of grades (i.e. the official list of coursework including your grades) and proof of English language skills. Complete applications should be submitted preferably via the TU Dresden Secure-Mail Portal https://securemail.tu-dresden.de by sending it as a single pdf document quoting the reference number PhD19013-PD in the subject header to akash.kumar@tu-dresden.de or by mail to: TU Dresden, Fakultät Informatik, Institut für Technische Informatik, Professur für Prozessorentwurf (Processor Design), Herrn Prof. Akash Kumar, Helmholtzstr.10, 01069 Dresden, Germany. The closing date for applications is 10.01.2020 (stamped arrival date of the university central mail service applies). Please submit copies only, as your application will not be returned to you. Expenses incurred in attending interviews cannot be reimbursed.

Reference to data protection: Your data protection rights, the purpose for which your data will be processed, as well as further information about data protection is available to you on the website: https://tu-dresden.de/karriere/datenschutzhinweis
About cfaed

cfaed is a central academic unit. It brings together 200 researchers from TU Dresden and ten other research institutions in the areas of Electrical and Computer Engineering, Computer Science, Materials Science, Physics, Chemistry, Biology, and Mathematics. cfaed addresses the advancement of electronic information processing systems through exploring new technologies which overcome the limits of today's predominant CMOS technology. [www.tu-dresden.de/cfaed](http://www.tu-dresden.de/cfaed)

About TU Dresden

The TU Dresden is among the top universities in Germany and Europe and one of the eleven German universities that were identified as an ‘elite university’ in June 2012. As a modern full-status university with 18 departments it offers a wide academic range making it one of a very few in Germany.