PART-TIME RESEARCH AND TEACHING ASSISTANT POSITION

IN EMBEDDED ELECTRONICS

ECOLE POLYTECHNIQUE DE BRUXELLES

Reference : 2024/S253
Application deadline: 28/06/2024
Start date: 01/10/2024

Job Description

Department

The Embedded Systems Design & Security research unit of the BEAMS (Bio, Electro and Mechanical Systems) department specializes in microprocessor system architectures, FPGA and ASIC digital system integration technologies (including sub-CMOS technology 1nm and 3D) and the security of computer systems.

Further information on current research topics is available on the group's website:

Courses provided by the service are mainly in the fields of digital electronics, microcontroller systems and/or FPGA systems, computer security. Bachelor courses are given in French and Master courses in English.

Research and teaching activities

The candidate will be required to carry out high-quality research, leading to a doctorate, in the field of microprocessor architectures for 3D logic-on-logic integration. Existing 3D technologies such as Through-Silicon Vias, Front-side and Back-side bumps allow the integration of several integrated circuits in the same package with a very large number of interconnections between them, which allows the partitioning of systems with a grain very fine. Such technologies are already used in some commercial products but mainly focus on the implementation of memory-on-logic (MoL). As a concrete example of such implementations, we can cite the integration of V-Cache in AMD processors or even Intel's Foveros technology. The next step will undoubtedly aim to extend the stacking principle with Logic-on-Logic (LoL) and fine-grain partitioning. In this case entire subsystems including logic and memory could be partitioned to create true 3D microprocessors. As LoL partitioning of processors is explored to a certain extent (e.g. OpenSPARCT T2 core, S.K. Lim et al.), there is not yet research work dealing with the modification of the architecture of micro-processors for an implementation in 3D (System-Technology-Co-optimization – STCO).

In this thesis the candidate will begin by identifying the main bottlenecks of 2D microprocessors using Berkley-Out-Of-Order Machine (BOOM), an environment for configuring and generating microprocessors, and then propose modifications original architectural designs inspired by 3D LoL.
technology. At the same time the candidate will work on the integration of 3D structures (mainly front-side bumps) in an open-source placement & routing environment: OpenRoad led by the team of Prof. A. Khang of UCSD. This tool will then be used to extract performance parameters, dissipated power and the silicon surface used from 3D systems and compare them with those in 2D.

The candidate will also participate in various educational activities (supervision of end-of-study dissertations, projects, laboratories and exercises) at the Bachelor and Master level of the École Polytechnique. The list of lessons is given below.

Teaching and research tasks will be distributed evenly and re-evaluated periodically.

An initial assistant mandate is granted for a period of two years, renewable on the advice of the competent authorities for a maximum of 2 additional periods of 2 years (full-time).

Title required

Holder of a Master's degree 120 credits in Civil Engineering (Electrician, Electromechanics, IT or biomedical) or in IT, and meet the conditions for access to the doctorate

Skills required

- Microprocessors architecture and programming in C/C++
- Design of digital systems (VHDL and/or Verilog)
- Design flow of integrated circuits (FPGAs and/or ASICs)
- IT security
- Linux OS, scripting languages is a plus
- Writing scientific documents
- Autonomy, reliability and motivation
- Ability to work in a multidisciplinary team
- A B2 level in French and English is required
- A spirit of innovation and creativity is essential

Courses covered

- ELEC-H-305 : Circuits logiques et numériques
- ELEC-H-310 : Digital Electronics
- ELEC-H-409 : Digital architectures and design
- ELEC-H-410 : Real-time computer systems
- ELEC-H-473 : Microprocessor architectures
- ELEC-H-505 : Advanced digital architectures
- ELEC-H-516 : Programmable Logic Controllers
- ELEC-H-423 : Mobile and wireless networks
- ELEC-H-504 : Network security

Interested?

For more information, please contact Prof. Dragomir MILOJEVIC dragomir.milojevic@ulb.be.

Applications must be sent by e-mail to the rectorate of the Université Libre de Bruxelles (rectrice@ulb.be) and to the faculty deanship (le-doyen-polytech@ulb.be).

They must include the following:
an application letter

a Curriculum vitae including a list of publications:


a note on the applicant’s PhD research project (4 pages)

two letters of reference

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