Training Opportunity for Portuguese Trainees

Reference	Title	Duty Station
PT-2015-TEC-SWS(1)	**Multicore / Processor emulation for future Flight SW verification needs**	ESTEC

Overview of the Unit missions:

The Software Systems division has the responsibility in domain of software engineering http://www.esa.int/Our_Activities/Space_Engineering/Software_Systems. In particular the division covers verification and validation techniques for checking mission-critical software, software technology for flight as well as ground systems, real-time software embedded in spacecraft systems and payloads; ground facilities software, including electrical ground support equipment, testbenches, databases and simulation and modelling tools;
The division is supporting all ESA satellite projects in the above domains.

Overview of the field of activity proposed:

Within the domain of Spacecraft Flight Software, Software Validation Facilities the Flight Software Systems Section offer a training opportunity within;

Next Generation MicroProcessor (NGMP) emulation technology survey and prototyping

The future generation of processors prepared for flying on upcoming On-Board Computer ESA's missions, the SPARC LEON4-NGMP, is a challenging step forward in the use of multicore architecture in Space environment. Developed under ESA contract, the project passed recently to maturity with the achievement of the new Functional Prototype (http://microelectronics.esa.int/ngmp/).
A fundamental tool, when comes the moment of validation the flight SW, is the Software Validation Facility (SVF). It supports the validation of all the typical on-board software elements, providing the correct simulating environment. Between all the components, the SVF is equipped with a detailed emulator of the On-Board Computer, which is typically the core element.
Closely related with the state of the art in Space Systems, the SVF evolution needs to be a continuous process. This implies the inclusion of support for new microprocessors and enhancement or addition of support tools.
Therefore, the foreseen arrive of the NGMP requires to survey and assess the background technology needed to develop one new emulator.
Different solutions can be chosen taking into account a trade-off between accuracy, performances and costs. One *Hardware acceleration technology*, where the emulator is based on the VHDL of the real HW that could either be synthesized or simulated, will maintain full accuracy regarding functionalities and timing, but will limit performances to the available technology. On the other hand *Dynamic Translation*, in which the target process instructions are compiled dynamically, allows a fast pure SW emulation with the expense of lesser accuracy.
The candidate shall perform this study using his/her abilities to choose the most promising technology:

Trade-off 1: to select hardware acceleration technology for a HW/SW emulator with high accuracy and performance.
Preliminary options are:

1. HW emulation based on FPGA System on Chip, where the emulated processor and additional control logic are deployed on a single high performance FPGA.
2. HW emulation based on FPGA + NGMP ASIC, where the additional control logic is deployed on a FPGA and interfaces with the real NGMP chip.

3. HW emulation based on NGMP ASIC DSU3, where the additional control logic is represented by the LEON4 embedded Debug Support Unit of the real NGMP chip.
4. HW emulation based on OpenSPARC multicore host, where a high performance SPARC workstation is used to emulate the NGMP chip.

Trade-off 2: dynamic translation (or similar) technology for a SW emulator faster-than-real-time.
Possible starting products are:

a) SIMICS.
b) PQEMU.
c) QERx.
d) Spacebel emulator.

For all options, performances, accuracy, HW design choices, SW support and recurrent costs shall be taken into account in the trade-off.
Depending on the duration of the contract and the technical background, the candidate shall perform one or both trade-offs.
Once the trade-off phase is complete, the candidate shall focus on the prototyping on the selected options.

Required Education:

Applicants should have just completed, or be in their final year of a University course at Masters Level (or equivalent) in a technical or scientific discipline.

Applicants should have good interpersonal and communication skills and should be able to work in a multi-cultural environment, both independently and as part of a team.

Applicants must be fluent in English and/or French, the working languages of the Agency.