

Title of the doctoral program

Computer and Control Engineering

Title of the research activity

Exascale High Performance Computing for Safety Critical Applications

Short description of the research activity

The research activity is oriented to the future existence of Exascale High Performance Computing (HPC) elaboration systems. Exascale HPC applications will share many properties with standard programs, including the need for safety and security. HPC applications have to make use of a vast amount of parallel resources, which can only be obtained if the HPC application itself exploits as much concurrency as possible. The effectiveness of exascale HPC will be obtained if elementary elements are integrated versus this scope. Computational cores, memories and interconnections will require to be suitably modified in order to permit the performance gain. The programming paradigm and the computational layers require a substantial modification in order to sustain the exa-scale processing goals. On the other sides, the existence of thousands devices elaborating within a parallel infrastructure will exacerbate the failure rate. Therefore accurate design methodologies oriented to guarantee the testability and reliability of the elementary HPC basic component such as GPGPUs and FPGAs are needed. The research activity includes the study and analysis of the failure rate of modern GPGPU and FPGA devices, the development of design and programming techniques for the performances optimization and power characterization at the component and interconnection layers.

Scientific responsible (name, surname, role, email)Luca Sterpone, Associate Professor, luca.sterpone@polito.it**Number of vacancies for XXXI cycle (3 years program)**

1

Specific requirements (experiences, skills)

Methods: Basic knowledge of the FPGA design flow and GPU programming approaches (OpenCL and CUDA)

Languages: C/C++ and VHDL

Website of the research group (if any)www.cad.polito.it