Title: Accelerating radio-astronomy algorithms

Abstract:
The Square Kilometre Array (SKA) will be the biggest radio telescope ever built, with unprecedented sensitivity, angular resolution, and survey speed. Collectively, the SKA's antennas are expected to gather exabytes of data per second and store one petabyte of data every day, requiring exa operations per second for the processing. Its construction will face many challenges in all the aspects of the instrument, namely, data transportation, algorithms development, data storage, system design, required computing power. Moreover, a key challenge is to satisfy the strict power budget requirements.

The recent use of accelerators (e.g., GPUs, Many-core CPUs, FPGAs) in high-performance computing has resulted in a significant performance boost for some scientific applications, allowing to increase the amount of operations per second while at the same reducing the overall power consumption.

This talk focuses on the analysis and comparison of different acceleration strategies, while taking as use case part of the SKA processing pipeline.

Several scientific kernels are implemented and studied on CPU, GPUs, FPGAs, and on a custom accelerator.

This talk will show that trading off flexibility and programmability of general purpose CPUs for the energy efficiency accelerator technologies allows to achieve orders of magnitude of power reduction, contributing to the possibility of realizing the final SKA instrument.

Bio:
Leandro Fiorin is a research scientist at IBM Research, at the ASTRON & IBM Center for Exascale Technology, the Netherlands. Previously, he was a research associate at the Advanced Learning and Research Institute (ALaRI) on Embedded System Design, USI. He received the MS degree in electronic engineering from the University of Cagliari, Italy, the master's of engineering degree in embedded system design from the University of Lugano (USI), Switzerland, and the Ph.D. degree from the Faculty of Informatics USI, in 2001, 2004, and 2012, respectively. His research interests focus on energy efficient computing architectures, fault-tolerant and secure networks-on-chip and embedded systems, onchip multiprocessors, reconfigurable systems.