Ph.D. in Information Technology
Thesis Defenses

May 12th, 2022
at 10:00
Beta Room

Nicola CORNA – XXXIV Cycle

Cutting edge solutions for high-performance processing of events in the time domain

Supervisor: Prof. **Angelo Geraci**

Abstract:

Nowadays, the demand for very accurate and precise waveforms with picosecond resolution and wide Full-Scale Range is becoming broader and broader in an ever-growing range of applications and fields. Several solutions have been proposed through the years to meet the needs. Still, nonetheless, the most significant limitation and most concerning downside shared between them is represented by the large amount of hardware needed for their realization, which is then reflected on the Bill-Of-Materials and on the complexity of the device itself.
To efficiently design such platforms of generation and, in general, processing of time-domain events, another standard building block is missing, which is an efficient, flexible, complete and easy-to-use communication system.
Therefore, the thesis will address the design and implementation of the whole developed system, based on Field Programmable Gate Arrays, giving first an introduction to the state-of-the-art about time-domain signals and communication protocols, and later deeply describing the structure of the platform. It will then move to its features and simulation results, the encountered issues, mainly related to the system's very high resolution, and finally, the results obtained in experimental testing.

Fabio GARZETTI – XXXIV Cycle

Ultra-high performance digital electronic architectures for events management in real time environments

Supervisor: Prof. **Angelo Geraci**

Abstract:

The project research area is across several field of application from medicine to biotechnology, from environmental monitoring to imaging. In fact, the measurements of signal parameters such as time of occurrence with very high-efficiency, for instance in term of resolution and count rate, need oriented and customized processing procedures. For this reason digital solutions have been focused, because they are the most efficient for realizing configurable elaboration architectures that can be application-oriented. The efficiency is dependent on the application, e.g. the efficiency could be the resolution in case of measurement of energy spectra or bit-rate and bit-error-rate in communication systems. In order to settle actual design principles and rules that are at the state-of-art in one of the

most dynamic branches of very high-efficiency measurement, the research activity is finalized to develop high resolution time measurement systems in Field Programmable Gate Array (FPGA) devices with the target of optimizing resolution, linearity and speed of processing. In particular, the research will be focused in using innovative communication and data transfer solution aimed to maximize the number of events processed in real-time, for instance using more devices in parallel.

PhD Committee
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