Implementation of a Spectrum Analyzer on a System on a Programmable Chip

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Abstract—The spectrum analysis of a signal is a common operation performed in a huge number of fields, spreading from the the audio entertainment, to the electronic devices testing, to the biological or mechanical responses study.

This operation often requires to be performed under real-time and low power constraints, but at the same time usually needs a computational power that cannot be handled by most of the microcontrollers currently available on the market.

This project aims at developing a simple audio signals spectrum analyzer by using the DE1-SoC Board provided by Terasic, which embeds a Cyclone II FPGA elaboration unit and some interfaces for signal handling. In particular, this application will make use of the audio A/D converter and the VGA module.

The audio signal is generated by an external source (i.e. a PC). This signal is acquired by the A/D converter and elaborated by an ad-hoc hardware module that will be programmed on the board's FPGA in order to generate the signal's FFT. This data will be prompted to the user through a VGA screen connected to the board.

The user will be also able to choose which operations must be performed on the signal, like detecting the main harmonic's frequency and amplitude, as well as applying some filters and choosing their parameters.

The data flow and the user interaction will be managed by the firmware running on the Altera Nios II soft-core, that will be also programmed on the FPGA.