# Technical aspects for development laboratory base for learning FPGA and microcontroller systems

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*Abstract* - **Principles for design of laboratory base for learning FPGA and microcontroller systems in technical disciplines are described.**

*Keywords* – **FPGA, microcontroller, laboratory base, modern principles of learning, logical synthesis.**

## I. INTRODUCTION

Training of specialists in digital electronics is very actuality in modern stage. Learning FPGA and micro-controller systems must base on a special high-performance laboratory equipment. The modern laboratory base for different technical applications is designed in Kharkiv national university of radioelectronics. Now our laboratory equipment based on 5 different devises.

## II. OUR MODERN LABORATORY BASE

For learning and designing the microcontroller systems we have a special laboratory stand ML-1 (Fig. 1). This stand bases on RISC architecture of AVR microcontroller ATmega-128 from ATMEL and consists of ISP and JTAG-programmer ports, extended RAM and flash-ROM, 4×3 matrix keyboard, functional keys, module of 8-bit light-emitting indication, 240×128 LCD-display, serial interface RS-232C, build-in temperature sensor and digital input/output connectors. This stand allows designing a simple microprocessor control systems.

Fig.1 Microcontroller-based stand.

For learning and designing the systems on FPGA devises we have a special laboratory stand ML-2 (Fig. 2). This stand bases on ALTERA ACEX EP1K100QC208 (50 MHz) with several interfaces for configure by USB, Byte-Blaster, flash-RAM, expanded microcontroller ATMega-128, extended RAM and flash-ROM, 320×240 LCD-display, serial interfaces USB and RS-232C, 10-bit video DAC, 8-bit ADC, functional keys, module of 8-bit light-emitting indication and digital input/output connectors. This stand is designed for implementation of complex digital devises on FPGA and real-time video-processing.

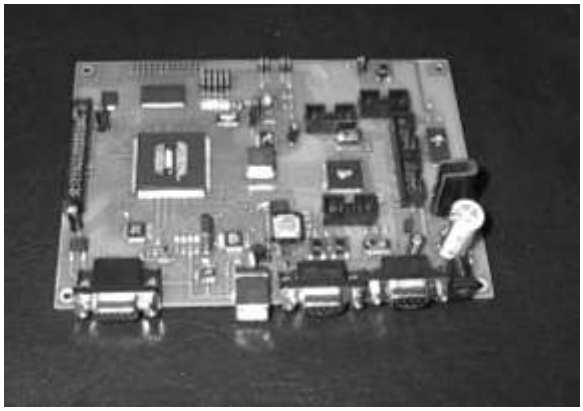

Fig.2 FPGA-based stand.

For learning and designing ADSP-based systems we have microcontroller stand (Fig. 3). This stand bases on ADSP BF532B BlackFinB® processor, extended SDRAM and flash-RAM, AD-1836 96 kHz audio coder, ADV 7183 and ADV7171 video decoder/encoder, serial interfaces USB and RS-232C. functional keys, light-emitting indication module and programmable digital input/output connectors. This stand is designed for implementation in digital signal and image processing systems for real-time audio- and video-processing .

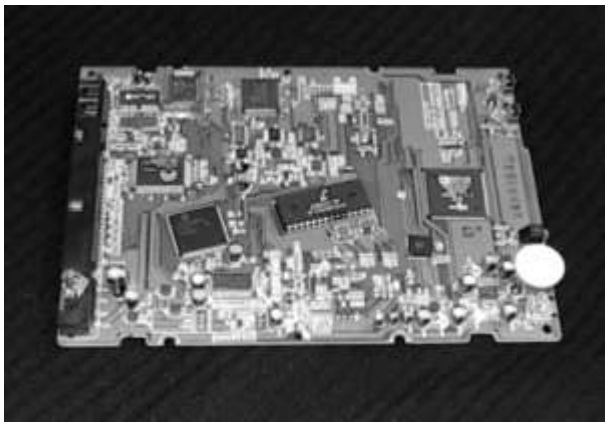

Fig.3 ADSP-based stand.

Also in our laboratory of microcontroller systems designed ARM-based laboratory stand on high-performance 32-bit microcontroller PHILIPS LPC-2106 with the peripheral components set and universal computer measure complex for different signal-measurements (100 MHz, 2 input channels).

## III. CONCLUSION

Capabilities of these laboratory stands will be improved for specifically applications. This laboratory stands embedded in learning process in our university, Kharkiv polytechnical university "KPI", Kiev university of technology and transport, Cherkassky state technical university and Ivano-frankovsky national technical university.

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