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Project design tutorial (III)

Typical sensor analogue subsystem

Sensor

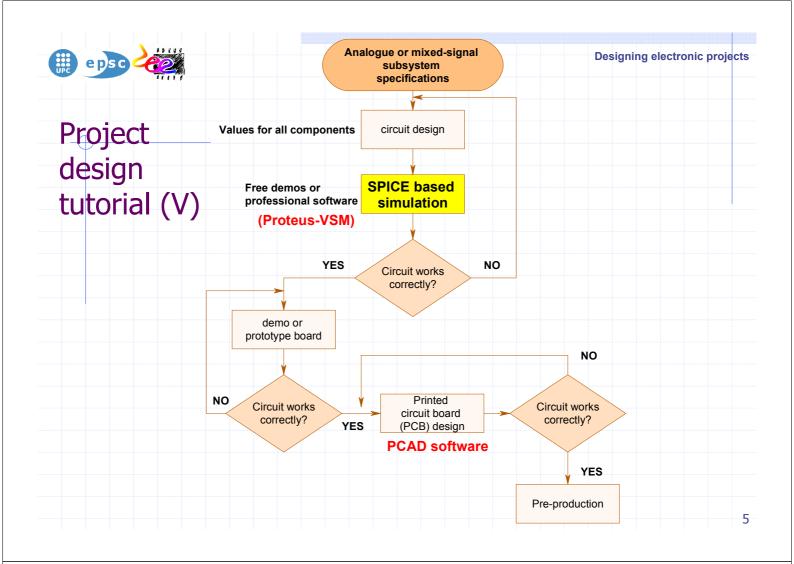
Signal conditioner

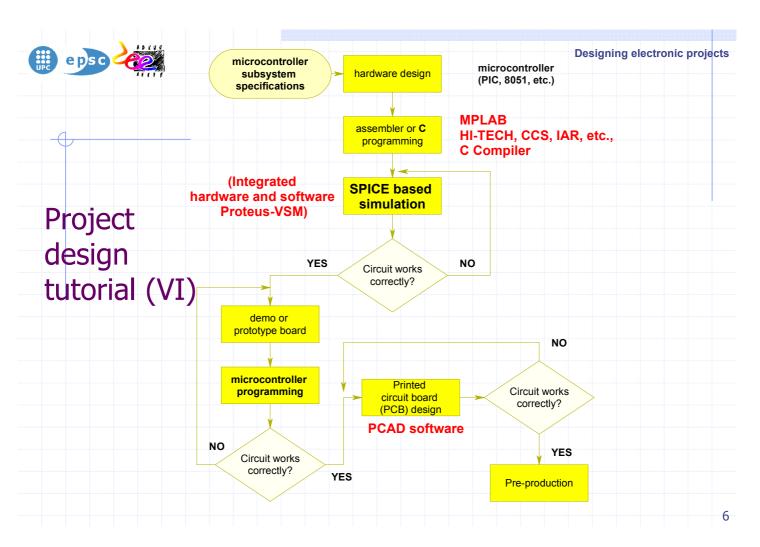
High level, noise-less signal (output voltage) which is a function of the sensed magnitude

Pressure, temperature, speed, acceleration, etc.

Voltage references, operational amplifiers, transistors, etc.

Designing electronic projects Project design tutorial (IV) interfacing analogue signals Signal V1(t) Signal V2(t) Sample Analogue A/D multiplexer converter Hold n-bit digital vector Signal V8(t) A single chip or a microcontroller peripheral From sensor subsystems





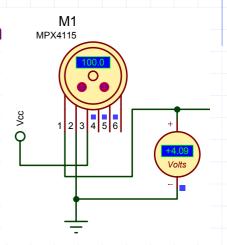
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An example:

Initial design of an absolute pressure meter

- Specifications:
 - Pressure range from 900 hPa 1100 hPa
 - 5 V power supply
- Data from the sensor datasheet
- Initial design of the sensor conditioner
- SPICE-based electrical simulation
- Microcontroller circuit and software design
- Prototyping



See the web page for details:

http://epsc.upc.edu/projectes/sed/unitats/unitat_1_1/Unitat_1_1.htm

Some concepts involved: physical quantities, sensors, instrumentation, electronic circuits, simulation, analogue-to-digital interfaces, PIC microcontrollers, C code compiler

Designing electronic projects epsc Large volume of **Systems on Chip** Digital technology roadmap production (SoC) & ASICS (GA) FPGA Altera NIOS VHDL & C system (>200k logic gates) Systems on **Programmable** Chip (SoPC) Professional Altera CPLD MAX7128 & applications in FLEX10k Telecommunications Microprocessors (µP) (2,5k - 70k logic gates)Systems and **Schematics Telematics** Microcontrollers (µC) The versatile GAL22V10 **VHDL Programmable** PIC family (~500 logic gates) **Logic Devices Assembler** (SPLD & CPLD) The theory basics microcomputers and the classic 74 series (SSI & MSI) Peripherals and C language **Sequential** circuits of medium **Systems** complexity Simple circuits & FSM **Advanced** optional Combinational **Digital Digital** subjects or **Electronic Systems Electronics** research **Systems** 8



CAD tools for digital electronic design systems

Chapter 1: PLD's



The versatile GAL22V10 (~500 logic gates)

Altera CPLD MAX7128 & FLEX10k (2,5k – 70k logic gates)

Combinational **Systems**

Sequential Systems

Programmable Logic Devices (SPLD)

Programmable Logic Devices (CPLD)

Peripherals and circuits of medium

complexity

Simple circuits & FSM



Lattice ispLEVER

Lattice ispVM System



Circuit design,

simulation and device programming



using Schematics



VHDL

UP1 Board

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SPICE based simulation



Altium PCAD PCB

Printed Circuit Board design and prototyping

PROTOGAL Board

9V Power Supply



Chapter 1: PLD's

LAB training for CPLD & **FPGA systems**

Foto from the internet, source:

Altera's MAX+plus II and the **UP 1 Educational Board**

A User's Guide

Advanced Logic Design, CPE/EE 422/502 B. Earl Wells, Sin Ming Loo

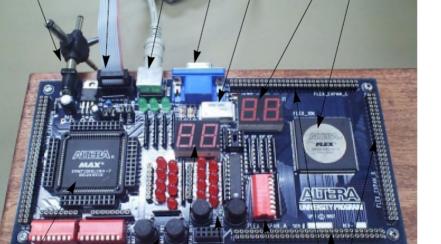
Department of Electrical and **Computer Engineering** The University of Alabama in Huntsville

Huntsville, AL 35899 Version 1, September 14 2000

Designing electronic projects 25.175MHz Oscillator

PS/2 Port JTAG Port VGA Port 10K20's 7Segment LEDs

Altera's 10K20 FPGA



AX7128 CPLD CPLD Push buttons

CPLD dip switches

CPLD's 7Segment LEDs

Flex 10K20's External I/Os

FPGA dip switches FPGA Push buttons



CAD tools for digital electronic design systems



Microchip PIC family of microcontrollers



PROTEUS VSM

Printed Circuit Board design and prototyping

Circuit design, simulation and device programming using

SPICE based interactive simulation of microcontroller circuits

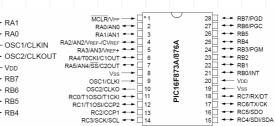


Assembler & C

CA_

HI-TECH Lite C Compiler





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epsc eg

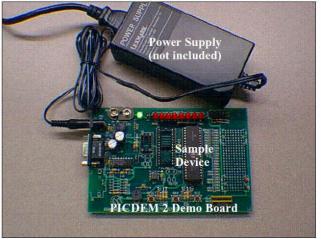
Designing electronic projects

PIC boards

LAB training for microcontroller systems

Chapter 2: μP & μC





PICDEM2 board

PIC Millennium Board

(http://www.elgarelectronics.co.uk/el_prod.html)



CAD tools for digital electronic design systems

Chapter 3: Systems on Programmable Chip

Professional applications in Telecommunications Systems and Telematics

PLD Altera NIOS system (>200k logic gates)



Altera Quartus II

SoPC Builder and device programming

using **Schematics**

VHDL



Altera Nios SDK Shell

C compiler and **Shell for NIOS** processor (serial port interfaced)



Printed Circuit Board design and prototyping

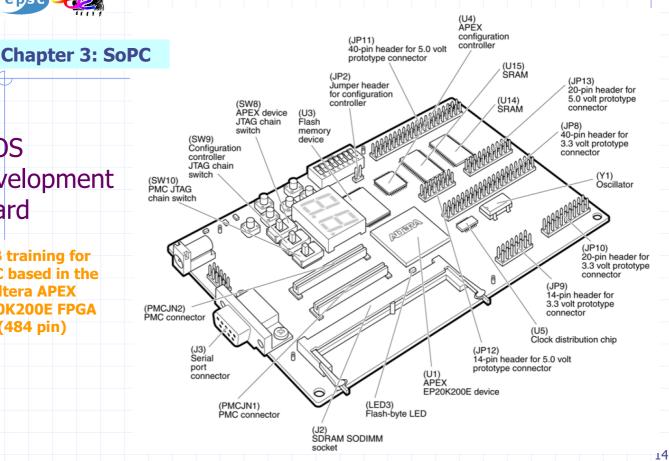
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Designing electronic projects

NIOS Development **Board**

LAB training for SoPC based in the **Altera APEX EP20K200E FPGA** (484 pin)





- You must simulate and use as many as possible CAD-EDA tools before lab prototyping
- EPSC has many software licenses for you to use

Computer Aided Design (CAD) Electronic Design Automation (EDA)

Find some examples in http://epsc.upc.edu/projectes/sed