Queens College Digital Design Laboratory

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Topics

♦ What’s Happening in Digital Design
  ♦ and why it matters to CS majors
♦ What’s Happening at Queens College
♦ Celoxica RC200E Design Kits
♦ Laboratory Assignments
♦ Demonstrations
What’s Happening in Digital Design

- **Application Specific Integrated Circuits (ASICs)**
  - Custom logic designed by engineers
  - High performance, high development cost, long turnaround cycles
  - Use Hardware Description Languages (HDLs)
    - Verilog, VHDL

- **Field Programmable Gate Arrays (FPGAs)**
  - Lower cost, but performance approaching ASICs – Now!

- Need for new development tools: *Hardware Implementation Languages (HILs)*
  - SystemC, System Verilog, Handel-C
... and Why It Matters to CS Majors

♦ More of the development cycle depends on software skills

♦ Old (current) way
  ♦ Partition hardware and software (two design teams)
  ♦ Codesign – parallel development of hw/sw
  ♦ Integrate, test, ship

♦ New way
  ♦ Design and develop in software (one design team)
  ♦ Partition into hardware and software
  ♦ Test, ship

♦ Either the engineers become programmers …
  ♦ … or the programmers learn the new languages
What's Happening at QC

♦ NSF Grant to S. Goodman and C. Vickery
  ♦ Originally planned to introduce HDLs in Computer Organization course

♦ Spring/Summer 2003
  ♦ Purchased IBM PCs (3.06 GHz, 1.25 GB)
  ♦ Purchased Celoxica Hardware/Software
    ♦ RC200E Design Kits
    ♦ DK IDE for FPGA Development

♦ Logic Design Laboratory Course
  ♦ This is the second semester
  ♦ Initially challenging, ultimately rewarding
Celoxica RC200E Design Kits

- Xilinx Virtex II FPGA, RAM
- I/O Interfaces: Touchscreen, Audio, Video, Keyboard, Mouse, Serial, Parallel, Expansion, Ethernet, Bluetooth, SmartMedia

Design Flow
- Compile and Link Handel-C Code
- Simulate (different levels)
- Configure FPGA
Laboratory Assignments

- Familiarize with Language and IDE
- Use PAL with Switches, LEDs, Seven Segment Displays
  - Pipelined Accumulator
- Servomotor Controller
  - Simulate with Waveform Analyzer
  - View Waveform on Oscilloscope
  - Control Modified Servomotor
- Universal Asynchronous Receiver Transmitter
- Touchscreen/Memory Project
Demonstrations

- Celoxica’s RC200E Demos
- Handel-C and the DK IDE
  - Simulation
  - FPGA Configuration