Laboratory 2: Introduction to FPGAs

In this week's lab, we look at how relatively large and complex circuits can be easily implemented in an FPGA.

1. 1-bit Adder

Construct a circuit which adds to two 1-bit numbers with the standard logic gates available in the lab (NAND, NOR, AND, OR, XOR, XNOR, NOT) and verify that it works. Your circuit should have two input lines and two output lines.

2. 2-bit Adder

Construct a circuit which adds two 2-bit numbers using the schematic design feature of Quartus II. Simulate the circuit to make sure that it works, and load it into the DE2 FPGA board.Use the expansion header input/output pins on the DE2 in combination with the slide switches to control the inputs to the adder. You can use the LEDs on the DE2 as the output indicators for your adder. Verify that your circuit works.

3. 8-bit Adder

Construct an FPGA circuit which adds two 8-bit numbers using a Verilog program in Quartus II. Simulate the circuit to make sure that it works, and load it into the DE2 FPGA board. Use the expansion header input/output pins on the DE2 in combination with the slide switches and DIP switches to control the inputs to the adder. You can use the LEDs on the DE2 as the output indicators for your adder. Verify that your circuit works.
Note: The DIP switches are a block of 8 independent on-off switches.

4. 8-bit multiplier

Construct an FPGA circuit which multiplies two 8-bit numbers using a Verilog program in Quartus II. Simulate the circuit to make sure that it works, and load it into the DE2 FPGA board. Use the expansion header input/output pins on the DE2 in combination with the slide switches and DIP switches to control the inputs to the multiplier. You can use the LEDs on the DE2 as the output indicators for your multiplier. Verify that your circuit works.
How many output bits do you need?