Project I

Design of a Programmable Waveform Synthesizer

System Configuration

PC   FPGA   DAC   Scope
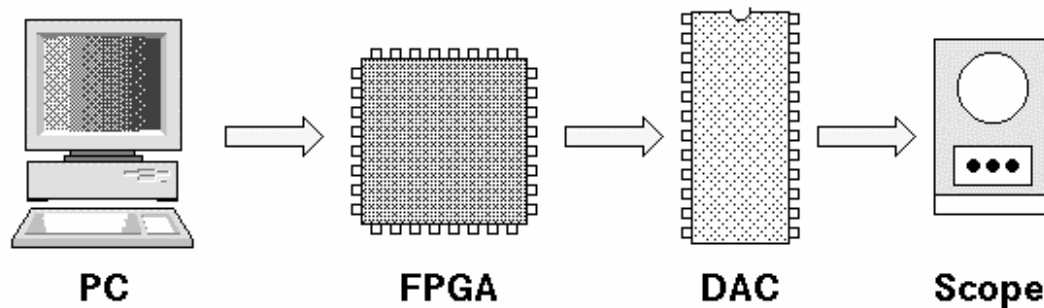
System Specifications:

- ❑ Wave Shapes: Rectangular, Triangular, Sawtooth, Sine, . . .
- ❑ Minimum of 16 samples per Period
- ❑ Frequency Resolution: 16-Bit, linear
- ❑ Output Frequency Range: 0 – 50 kHz
- ❑ Amplitude Resolution: 10-Bit
- ❑ Shape and Frequency PC programmable

Project Description:

The goal of this project is the realization of a programmable waveform synthesizer, where both the wave shape and the frequency can be selected from a host PC.

A possible solution is to generate equal-distant dense time-samples of the desired periodic function via the host PC and then download the binary values onto a fast external memory. The frequency can be changed during memory read-out by varying the "distance" between two subsequent samples (ref: faculty/fischer/public/ddfs_paper.pdf).

Consequently, such a system possesses two modes of operation: a "load" mode where the samples are generated and loaded onto the memory and a "run" mode where the functional values are read out at high speed.

Tasks to be performed:

1. Subdivide the complete system into the various functional blocks and investigate (analyze) different solutions for their implementation.

2. Verify (and optimize) your "best" solution.

3. Build the corresponding hardware, write the necessary software and thoroughly test the entire system.

4. Document all your work in a final report.

About the Report:

A) *Structure:*
Divide your report into the following sections:

1. Introduction (identify primary Author)
State problem in wider context.

2. Circuit Description (identify primary Author)
Explain your approach and briefly discuss advantages and disadvantages.

3. Circuit Analysis/Verification (identify primary Author)
Paper analysis, computer simulations, etc. (in summarized form).

4. Measurements/Performance Evaluation (identify primary Author)
Complete record of measurements performed, including detailed diagrams of the measurement set-up.

5. Conclusions
Analyze and explain particularly interesting problems you encountered and/or suggest possible methods to improve the system in terms of performance, flexibility, cost, etc.

B) *Grading:*
Your project will be graded according to the following criteria:
❑ Completeness of system analysis
❑ Completeness of system description
❑ Structure and clarity of report
❑ Teamwork and individual contribution
❑ System performance

C) *Due Date:*
Friday, October 19, 2007 (report must be in K214 by 5 p.m.)

Note:
Besides the co-authored final project report, each Student is required to hand in a personal progress report due at the end (i.e. Friday 5p.m.) of each of the 2 intermediate weeks! (First due date: Friday, October 5, 2006)