



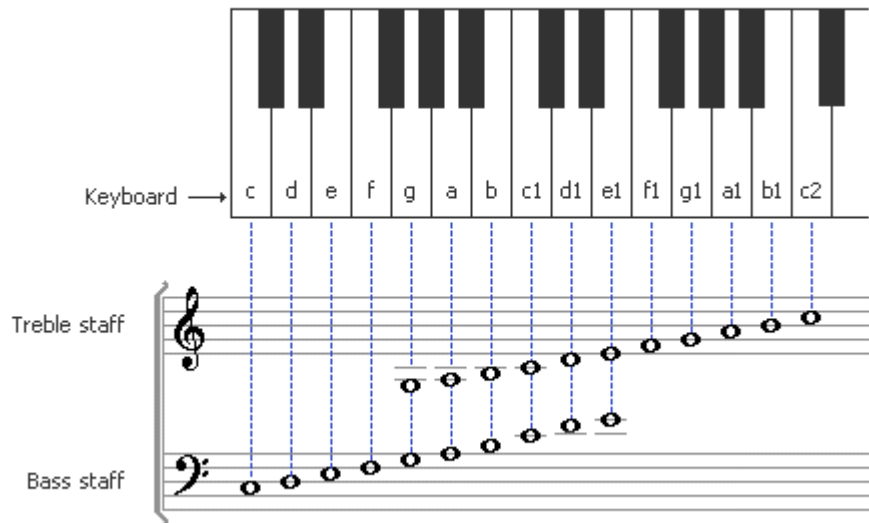
EE3623 Embedded System Design Laboratory

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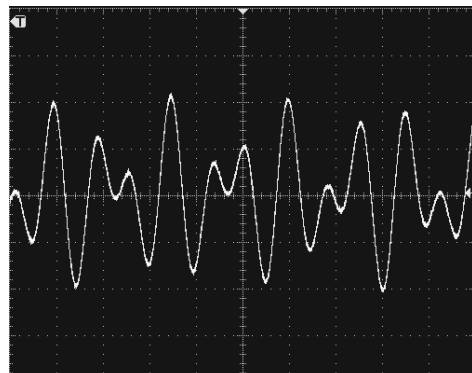
DAC Music

In this Laboratory you will be introduced to the application of the external SPI bus 12-bit digital-to-analog converter (DAC) peripheral in Verilog. The audible result will be an *attempt* at music. External peripherals augment the FPGA with embedded system design capabilities not available *on-chip*.



The project is to research the frequencies required for a *four note pure musical scale* of your choosing and to produce them using the four pushbuttons as input and outputted using a single channel of the DAC. An inventive project would be to play a single or multiple tone short tune.

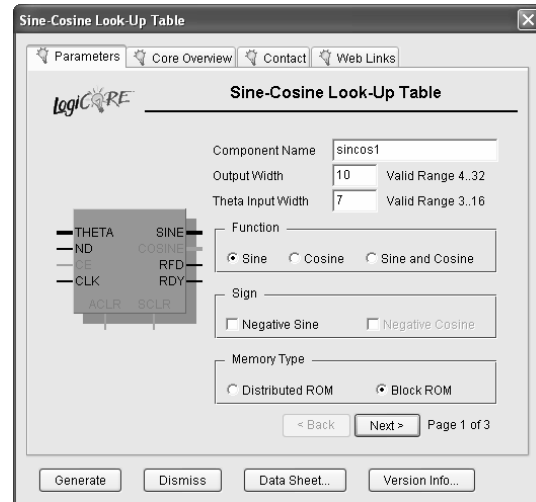
An oscilloscope can display the sinusoidal tone from the DAC and a frequency counter can verify the performance. A small amplifier and speaker will be available in the Laboratory for playback. Alternatively, the PC sound card input and an application program would also accomplish the same playback.



The project should utilize the Sine-Cosine Lookup table LogiCORE blocks as described in the dual-tone multiple-frequency (DTMF or TouchTone) generator project. One Sine-Cosine Lookup table LogiCORE block would be used for each active tone in your design (the DTMF generator uses two). The Xilinx ISE projects for the DAC are listed on pages 159-165 and that for the DTMF generator on pages 234-240 of the *Embedded System Design using Programmable Gate Array* text.

The complete project is to be implemented as a top module with nested modules including the design reuse modules indicated. Although a rather large single module can be configured for this task, the project may not be synthesizable.

Because of the extra time afforded by the Spring Break of March 12th, this is a *one week* Laboratory for March 19th and the project report due date is March 26th.



You must demonstrate your project to the Teaching Assistant or to the Instructor and submit this Laboratory initialed with your completed Laboratory report.



Project Completion _____ (TA or I)

Date _____

Spring 2009

