

## FPGA Lab 7 – Sine wave generator

**Purpose:** In this lab you will build an 8-bit triangle-wave and sine-wave generator that will produce tones on your speaker. You will learn how to use a ROM (or look-up table) to translate the waveform of a triangle wave to a sine wave.

- 1) **Triangle-wave generator.** In this project you will first build a triangle-wave generator that drives the speaker on the LiveDesign board. An 8-bit triangle wave is generated with an 8-bit Up/Down counter, using a circuit discussed in class. Its output is connected to the codec D/A converter and the speaker. Design the circuit so that the triangle wave oscillates at about 1 kHz.
- 2) Check for proper operation of the generator by measuring with an oscilloscope the output of the D/A converter on the “Line Out” jack. Please ask the TA’s for a phono jack plug.
- 3) **Sine-wave generator:** The triangle wave can be converted to a sine wave using a ROM look-up table. This can be created with the megafunction “LPM\_ALTSYNCRAM”, choosing the ROM option. The data for the ROM is given in the “sinencode.mif” file that is located on the server. Use a 2-input 8-bit multiplexer to choose between the triangle wave and the sine wave, with the select input for the multiplexer set by a dipswitch.
- 4) Check for proper operation of the generator with an oscilloscope.