

OUTLINE

Goal: Building and programming a monophonic (one-note) synthesizer. The frequency (which should be in the range of human hearing) is controlled by a potentiometer, and the output is to a piezo speaker. The shape of the waveform is controlled by a button.

- Human Hearing: 20 Hz to 20 kHz
- Frequency Controlled By a potentiometer

To create a sawtooth wave

Increment the counter until it overflows

Counter equals y-axis and timer = x-axis

Timer = potentiometer

$\sin(\text{val}) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^9}{7!}$

Db sawtooth 0 1 2 3 4 ...255

$V_{\text{out}} = (V_0)/16 + (V_1)/8 + (V_2)/4 + V_3/2$

Pseudo-Code:

sawtooth:

Input: Frequency from Potentiometer

Use ADC to convert potentiometer value to certain prescaler

Set timer interrupt

Begin linear timer

Loop

Triangular:

Input: Frequency from Potentiometer

Use ADC to convert potentiometer value to certain prescaler

Set timer interrupt

Begin linear timer

Once timer0 interrupt flag is set:

Decrement from 256 back down to 0

loop

Sine:

Input: Frequency from Potentiometer

Use ADC to convert potentiometer value to certain prescaler

Begin sin counter ($\sin(\text{val}) = (x) - \frac{(x^3)}{3!} + \frac{(x^5)}{5!} - \frac{(x^9)}{7!}$)

loop