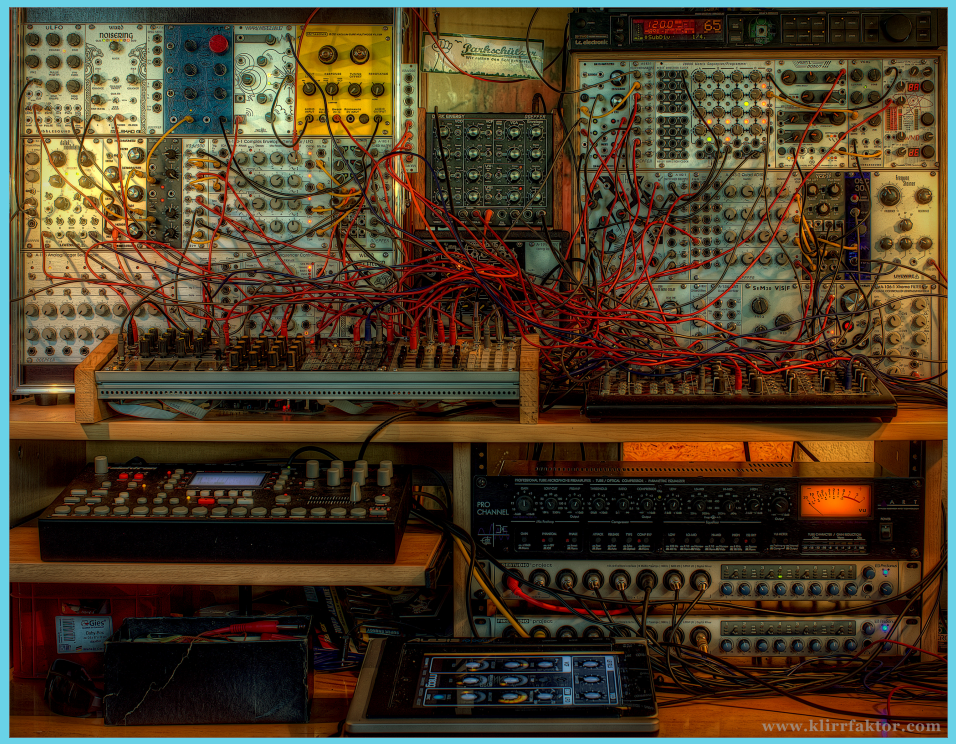
Developing a Digital Synthesizer in C++

What is a Synthesizer?



Source: http://devsound.se/2013/sjs-one-modular-expander

Analog → Digital

Recipe for a Digital Synthesizer:

I. The Generation of Sound

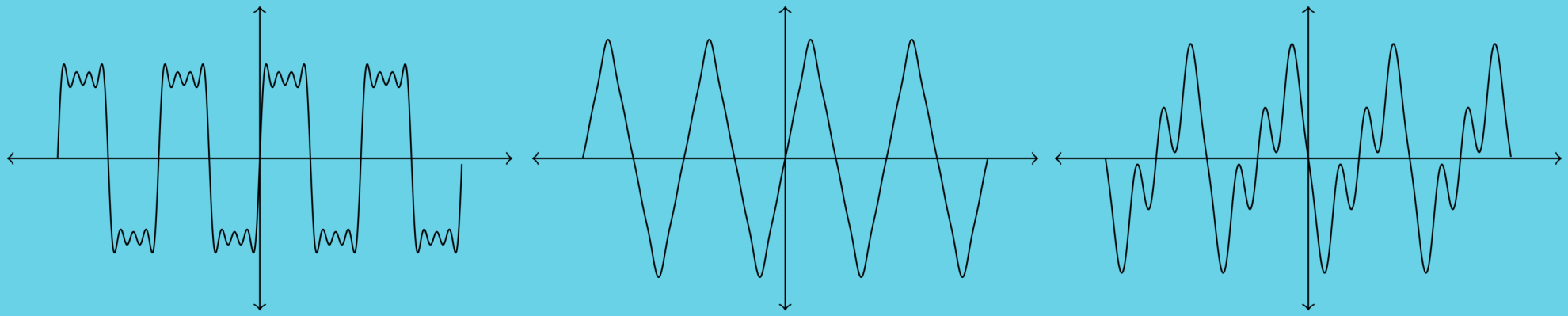
II. The Synthesis of Sound

III. The Modulation of Sound

I. The Generation of Sound

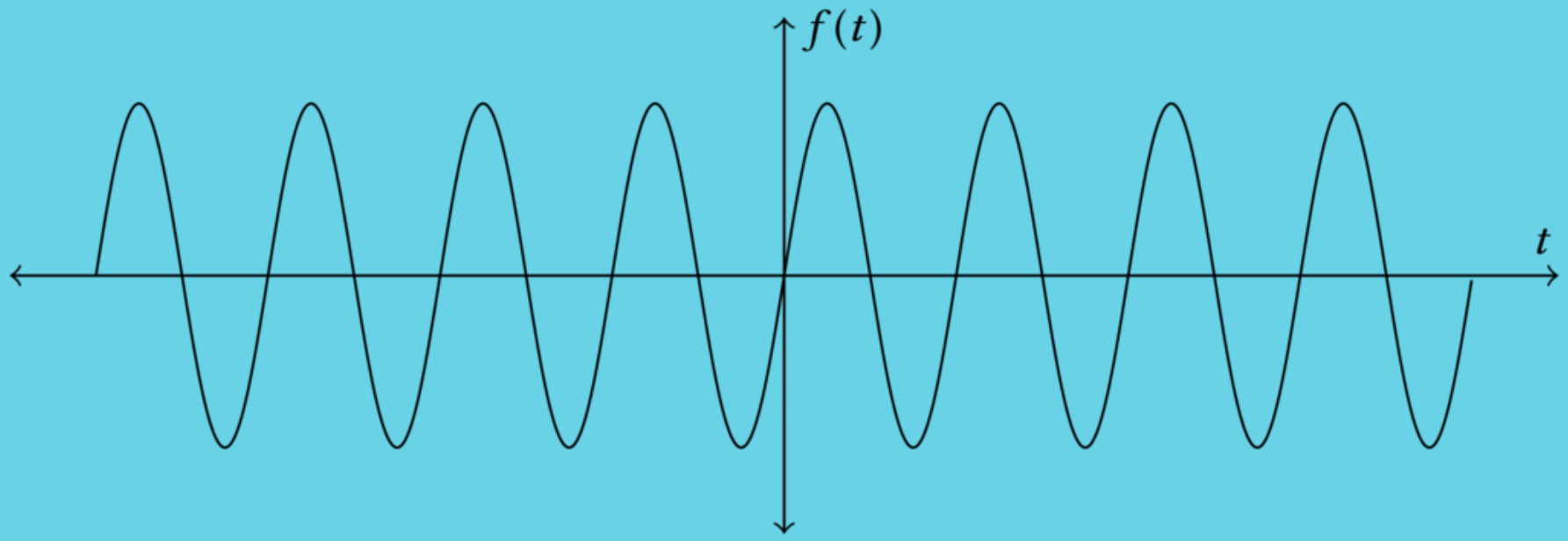
Waveforms:

The basic building blocks of sound



I. The Generation of Sound

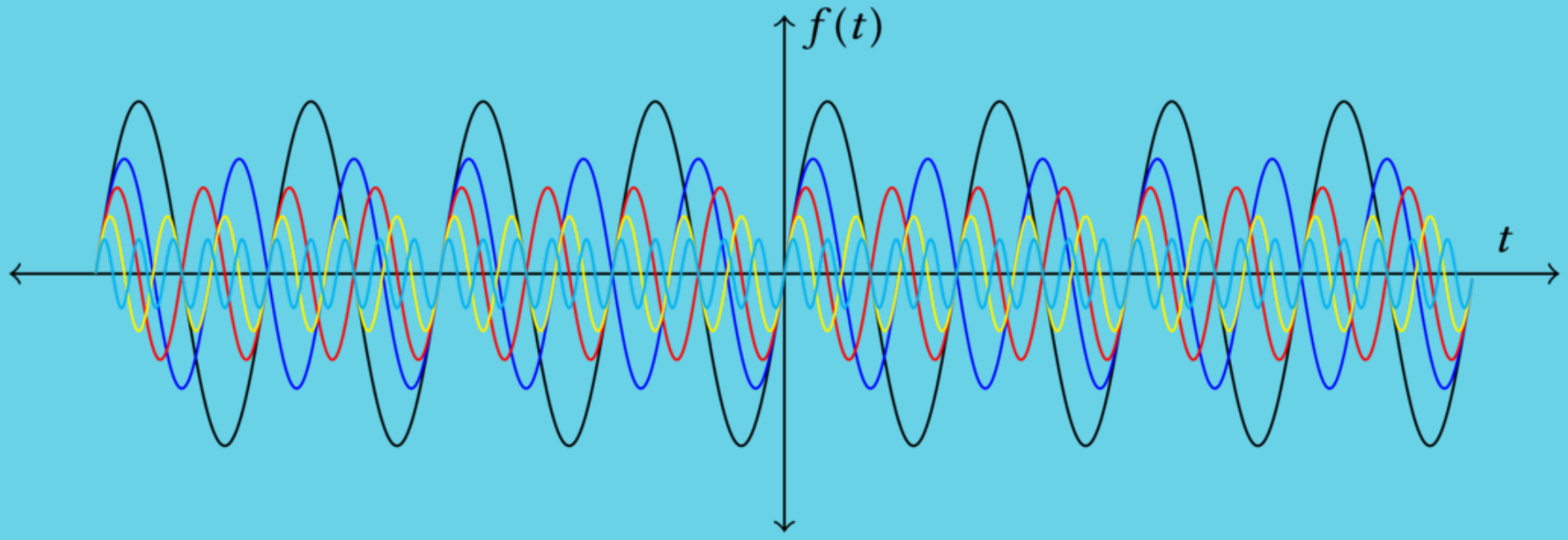
Sine wave



$$f(t) = A \cdot \sin(\omega t)$$

I. The Generation of Sound

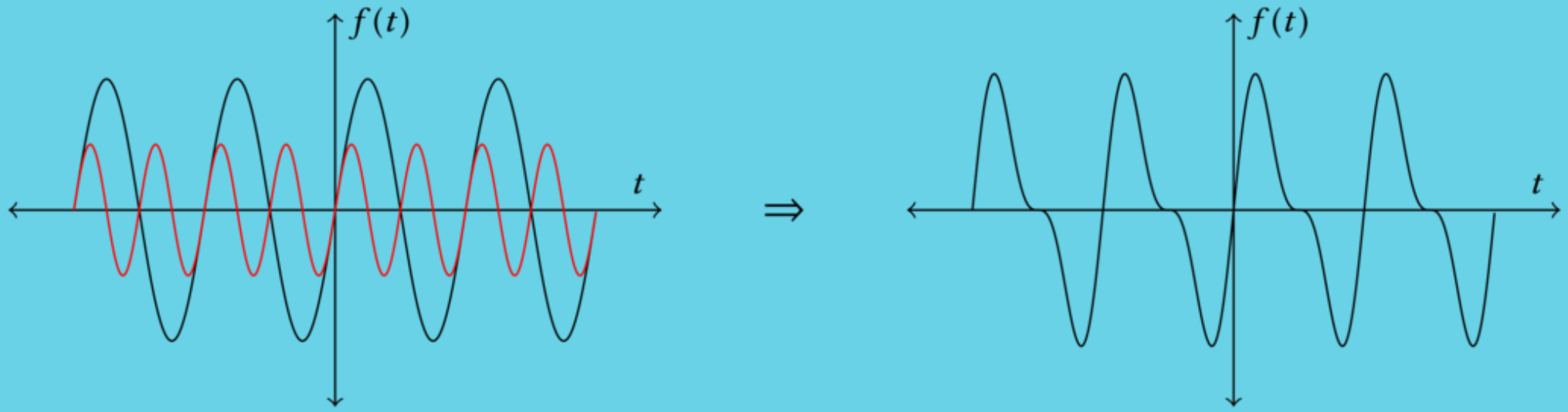
Complex Waveforms: Additive Synthesis



$$f(t) = \sum_{n=1}^{N} A_n \cdot \sin(n \cdot \omega t + \varphi_n)$$

I. The Generation of Sound

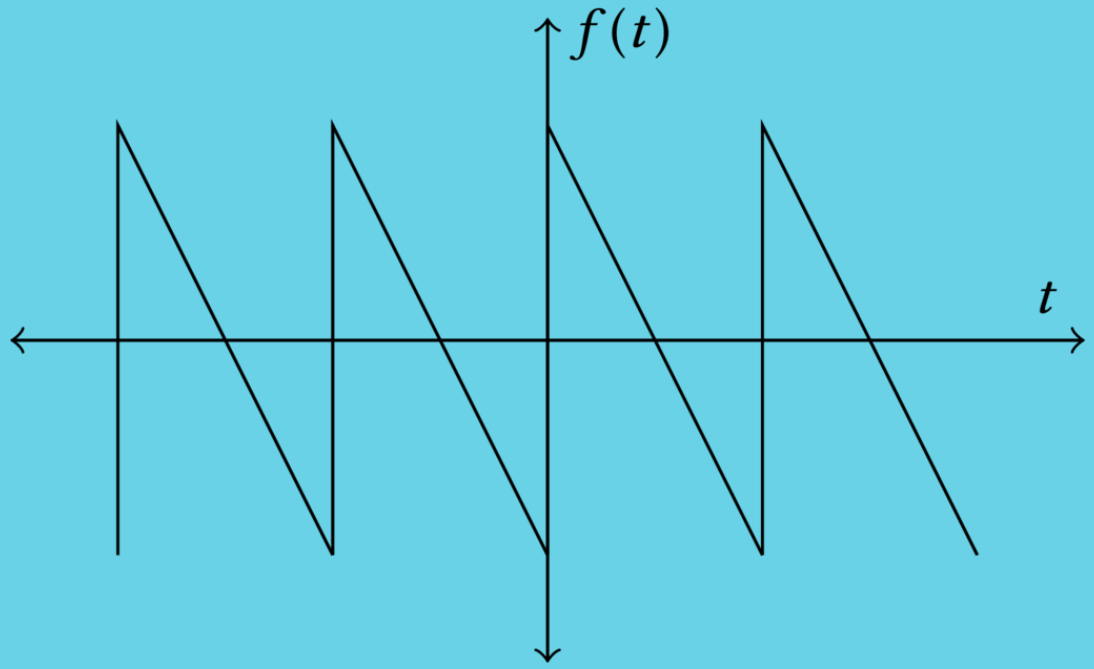
Sawtooth Wave: 2 Partials



$$f(t) = A \cdot \sin(\omega t) + \frac{A}{2} \cdot \sin(2 \cdot \omega t)$$

I. The Generation of Sound

Sawtooth Wave: ∞ Partials



$$f(t) = \sum_{n=1}^{N} \frac{A}{n} \sin(n \cdot \omega t)$$

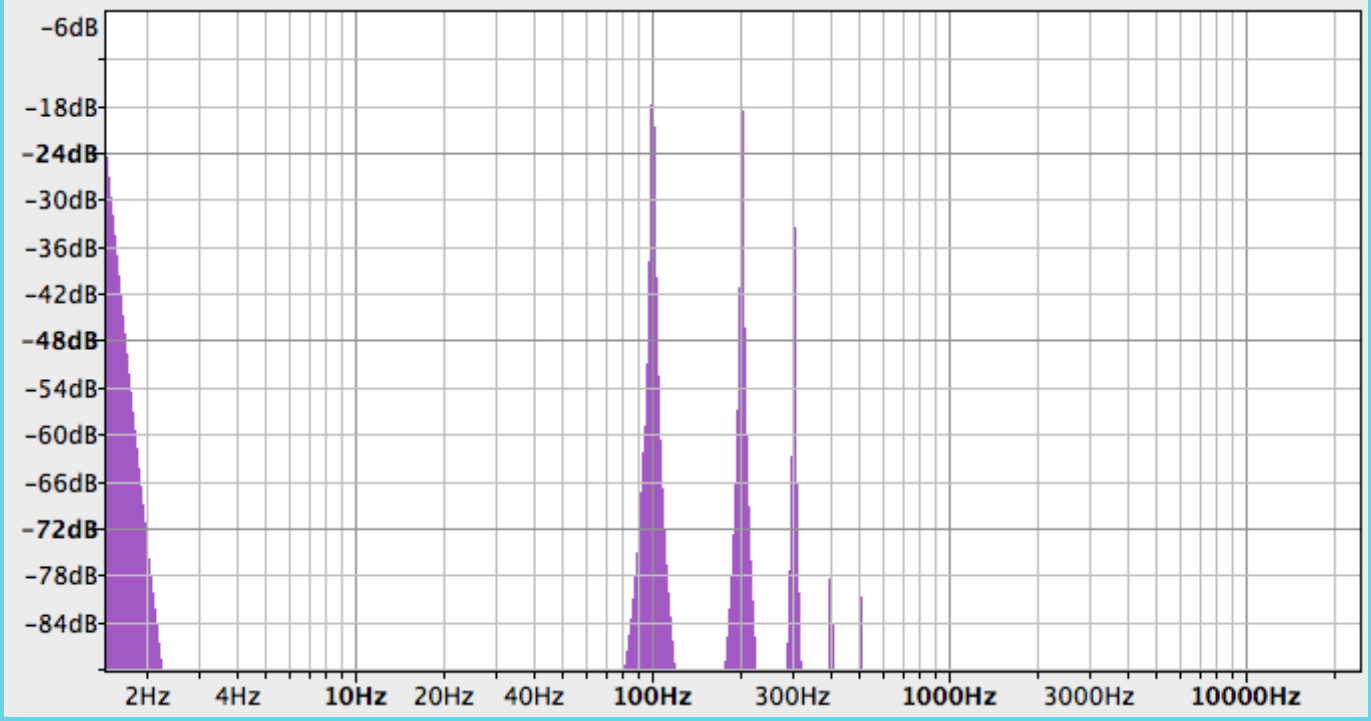
II. The Synthesis of Sound

Frequency Modulation Synthesis

$$f(t) = A_c \cdot \sin((\omega_c + A_m \cdot \sin(\omega_m t))t)$$

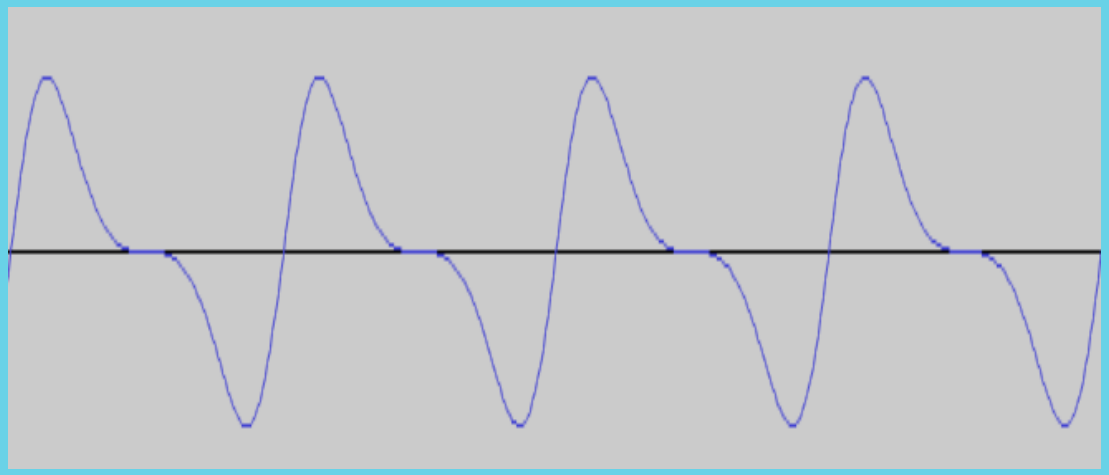
II. The Synthesis of Sound

C : M Ratio



II. The Synthesis of Sound

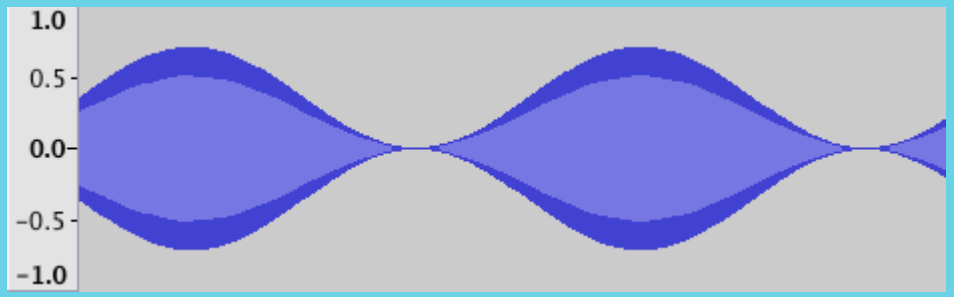
C:M Ratio of 1:1 $\longrightarrow$ Sawtooth wave

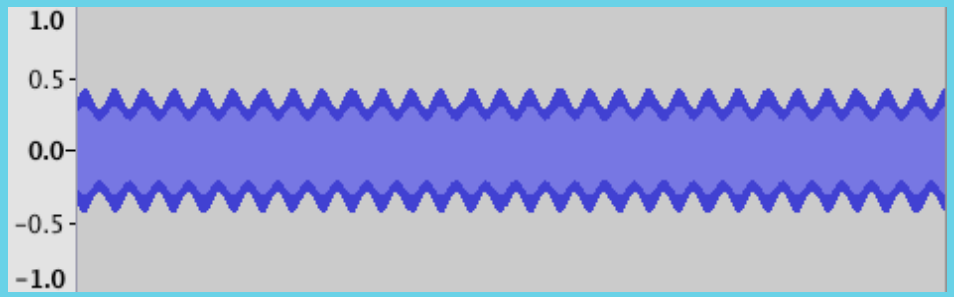


III. The Modulation of Sound

Low Frequency Oscillators

$$f(t) = (A + A_{lfo} \cdot \sin(\omega_{lfo} t)) \cdot \sin(\omega t)$$





I. The Generation of Sound

II. The Synthesis of Sound

III. The Modulation of Sound

Thank you