VIB WIDTH
VIB RATE
AMP

FIGURE 4.19 Simulation of a simple, periodic vibrato.

4.9 NOISE GENERATORS

An oscillator is designed to produce a periodic waveform with well-defined spectral components. The spectrum is a discrete spectrum, that is, the energy is concentrated on a few components instead of being spread out over a continuous range of frequencies. When a signal is passed through a noise generator, the output is a series of random, short-duration bursts of energy.

4.8C Vibrato Simulation by Frequency Modulation

When a modulating signal is applied to the frequency input of a carrier oscillator, frequency modulation occurs. The amplitude and frequency of the carrier can be varied, either independently or in a desired pattern. The frequency modulation index, $f_v$, is a measure of the amount of frequency deviation from the carrier frequency $f_c$. The instantaneous frequency of the carrier is given by $f_c + f_v$. The vibrato width is usually specified as a proportion or function of the fundamental frequency $f_v$. For example, a vibrato rate of 1 Hz at a depth of 10% results in a frequency deviation of 0.1 Hz, or 10% of the carrier frequency.

When a sound is modulated in this way, the resulting output is heard as a periodic variation in pitch. The rate of this variation is determined by the vibrato rate $f_v$, and its depth or extent is determined by the vibrato depth $f_v$. The vibrato is characterized by the vibrato rate, the vibrato depth, and the vibrato width. The vibrato rate is the rate at which the frequency is modulated. The vibrato depth is the maximum deviation from the carrier frequency. The vibrato width is the range of frequencies over which the modulation occurs. The vibrato is a complex vowel formant that is perceived as a periodic variation in pitch.