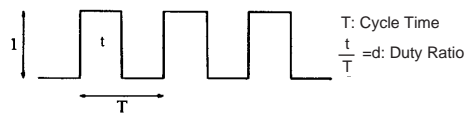


1 Noise Sources in Digital Equipment
 1.1 Digital Signals and Harmonic Components

Digital Signals and Harmonic Components

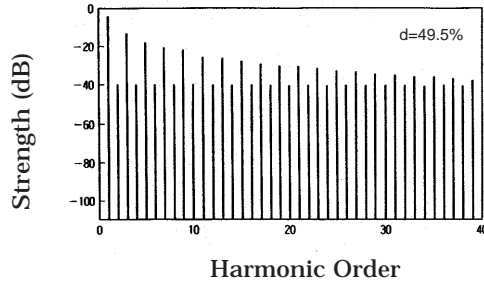
2

Digital Signal's Higher Harmonics Analysis Model

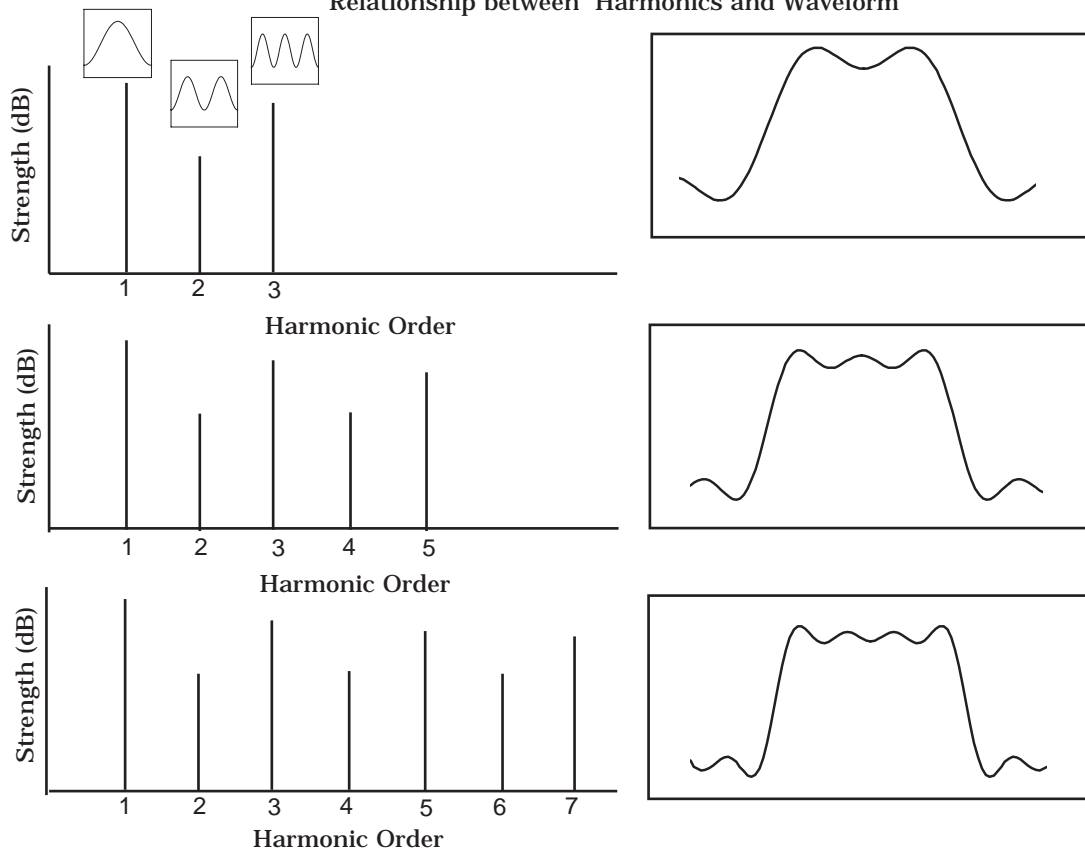


$$f(x) = d(1 + 2A_1 \cos \omega_0 t + 2A_2 \cos 2\omega_0 t + \dots)$$

$$\omega_0 = 2\pi/T, A_k = \frac{\sin k\pi d}{k\pi d} \quad (k=1, 2, \dots)$$



Relationship between Harmonics and Waveform



Digital signals are rectangular waves made up of a large number of sine waves. (Digital signal's waveform contains fundamental waves whose frequency is the signal's cycling frequency and harmonic waves whose frequencies are integer-multiples of the fundamental wave's frequency.) Above illustrations show how the addition of harmonic waves causes the combined waveform to approach the shape of rectangular wave.

When the duty ratio is 50%, only the odd order harmonics are included; otherwise, some even order harmonics are also included.

[Memo]