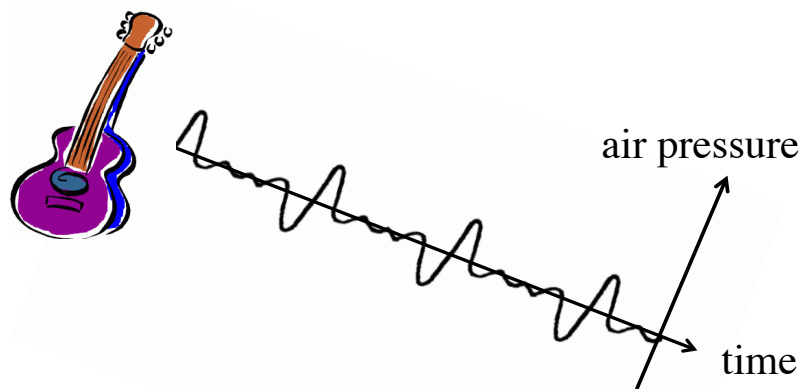
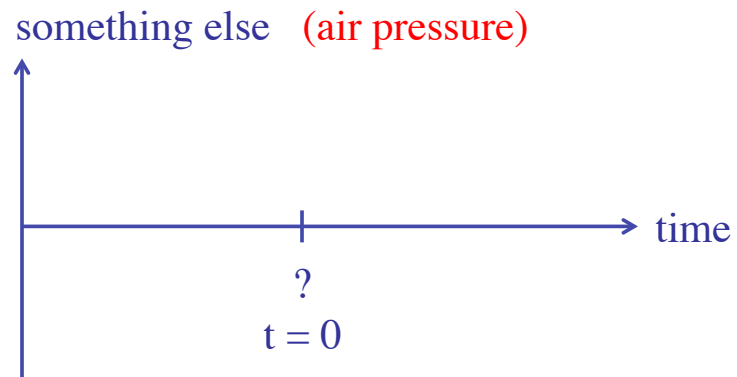


Fundamentals of Musical Acoustics

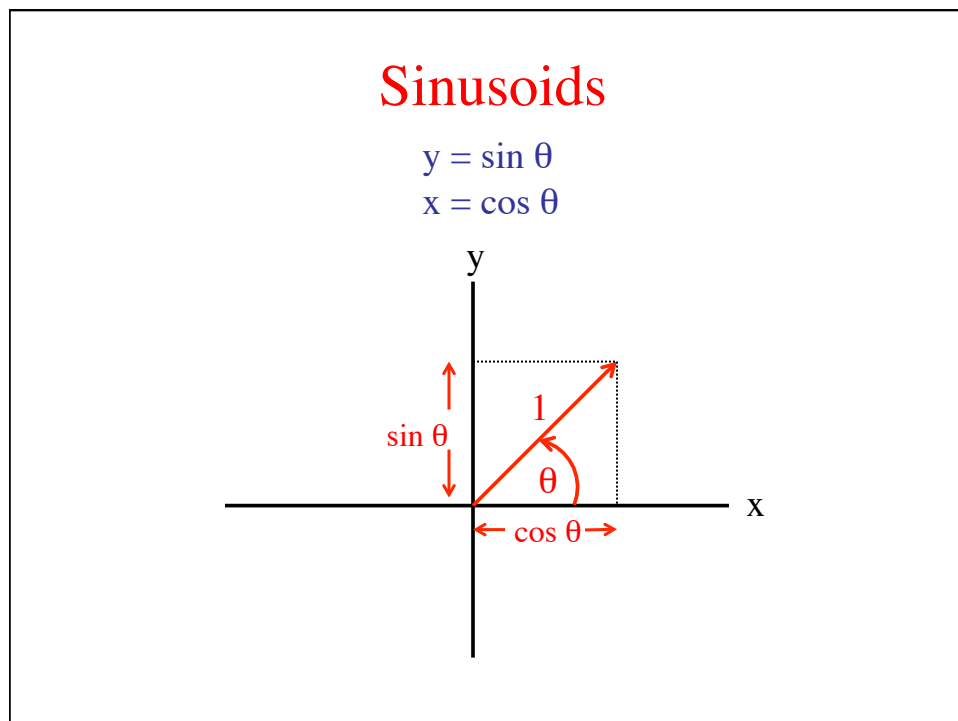
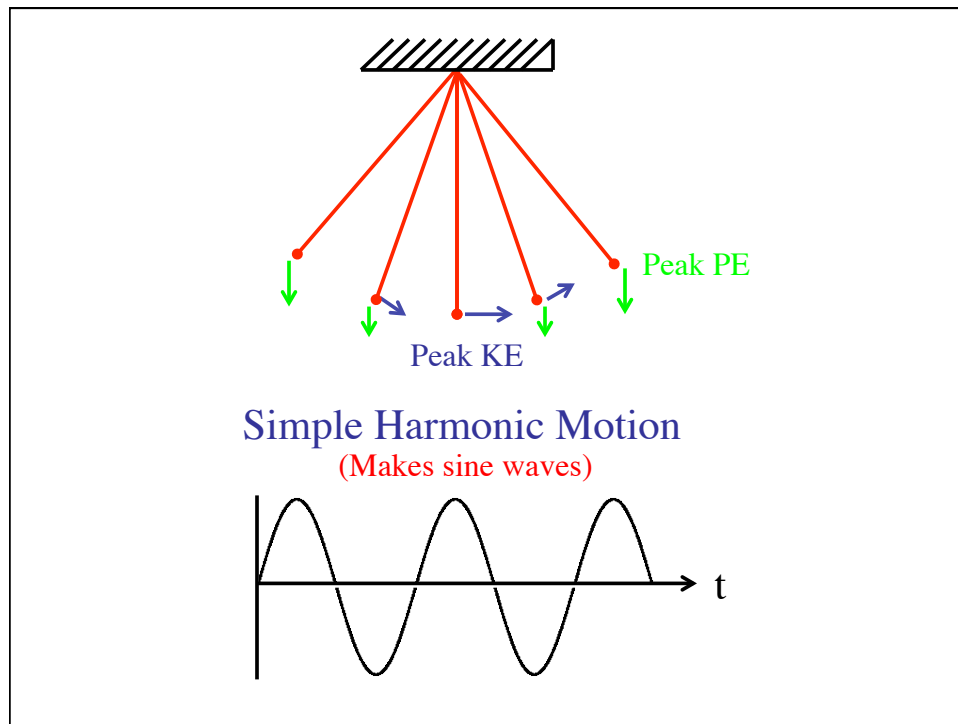
What is sound?

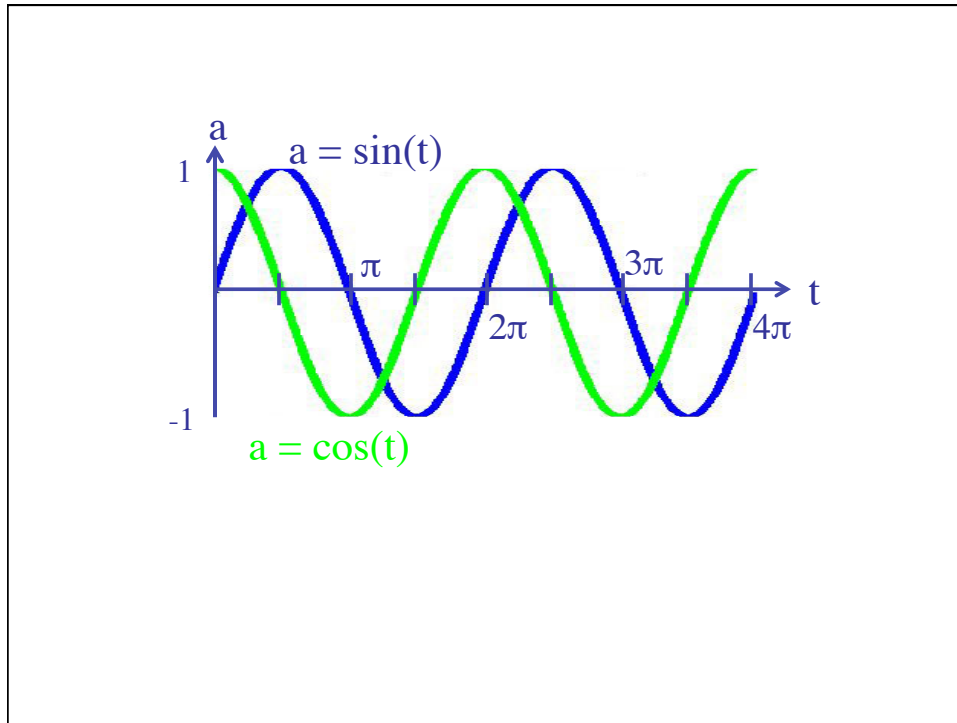


Time

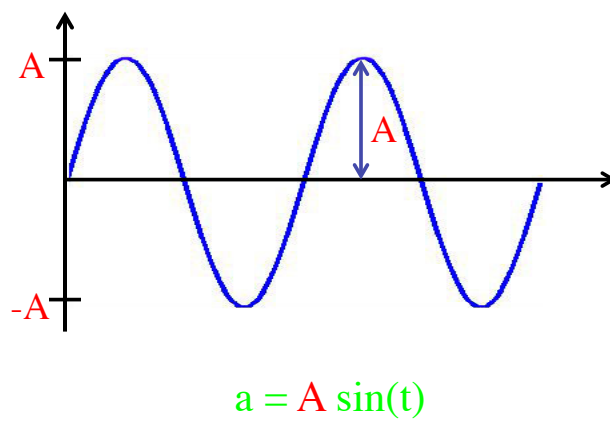


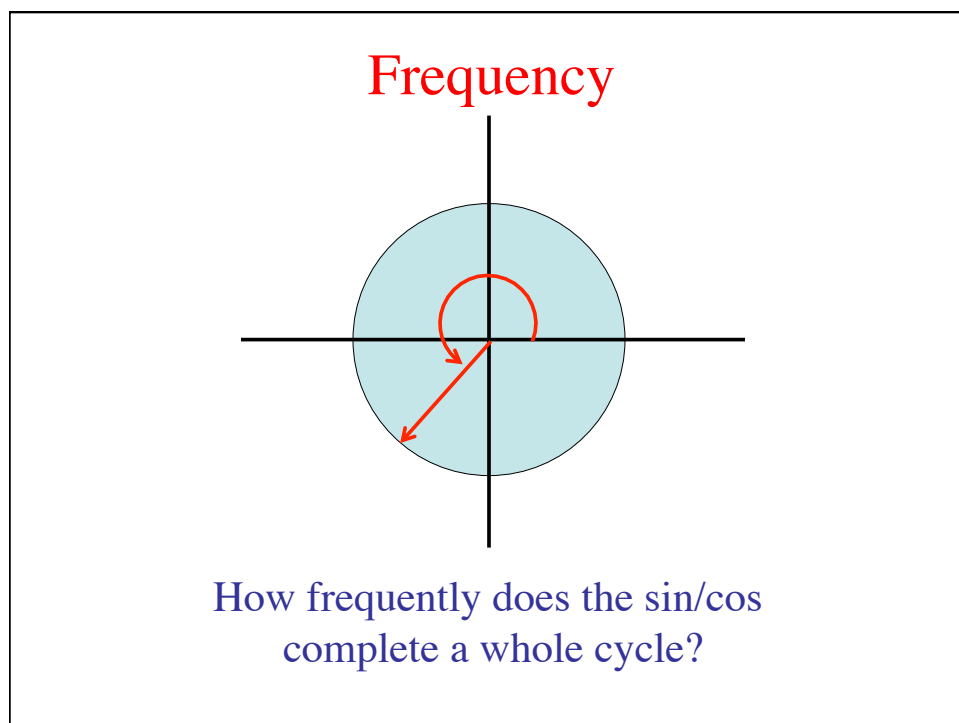
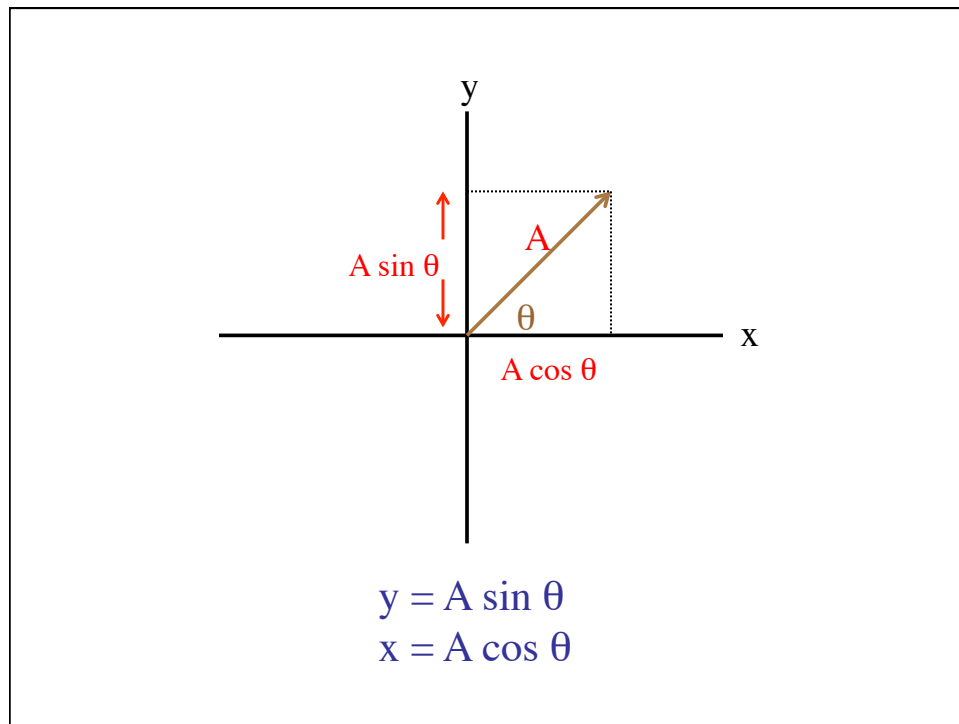
These variations in air pressure
over time can be decomposed into
sine waves
with
amplitude and frequency

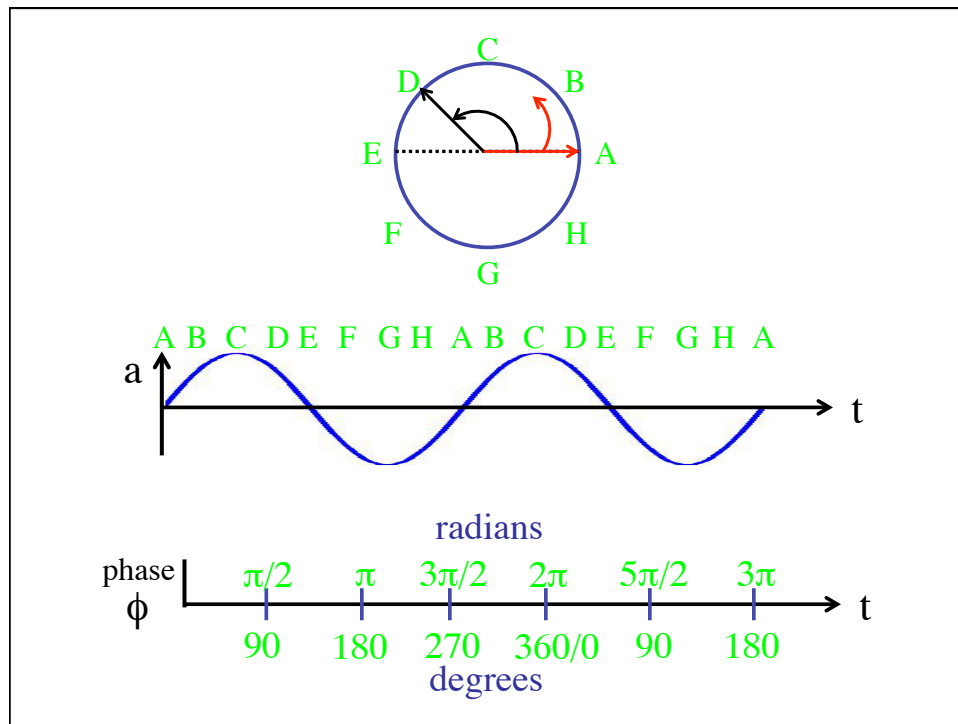




Amplitude







Frequency

1 cycle 2π

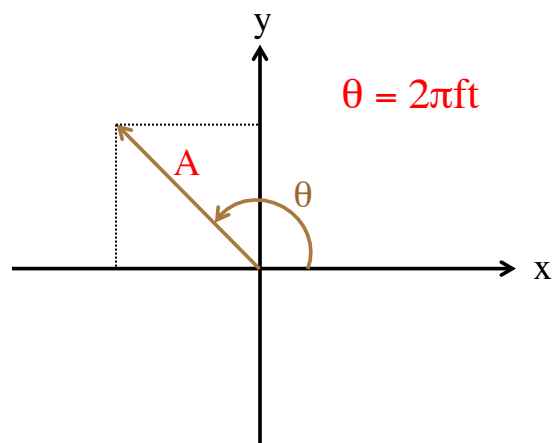
1 cycle / sec. 2π / sec.

f cycles / sec. $f \cdot 2\pi$ / sec.

Radian Frequency

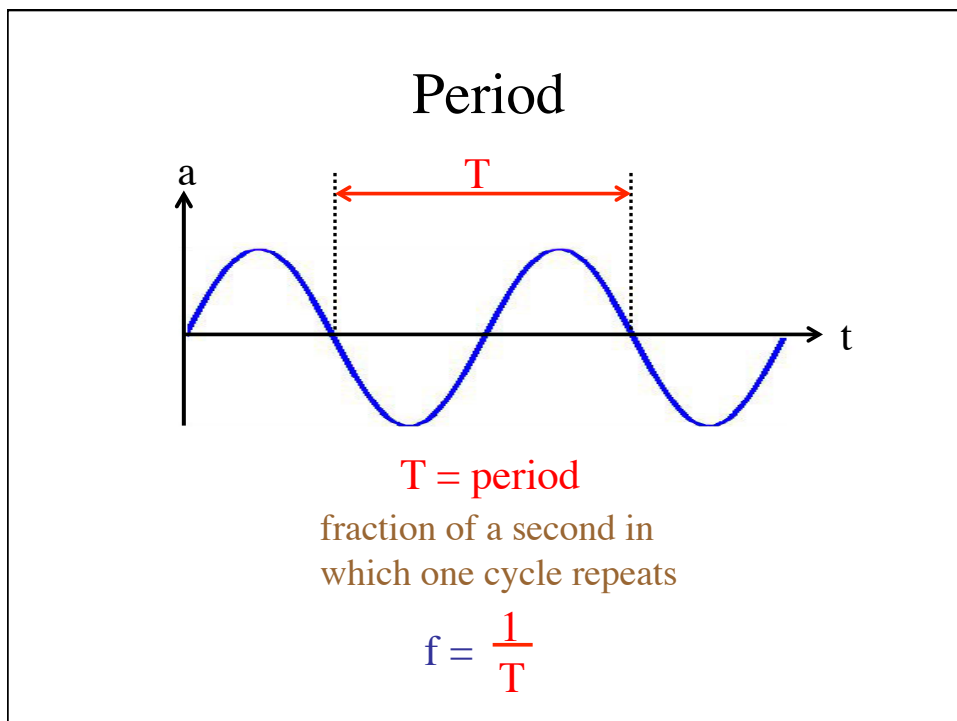
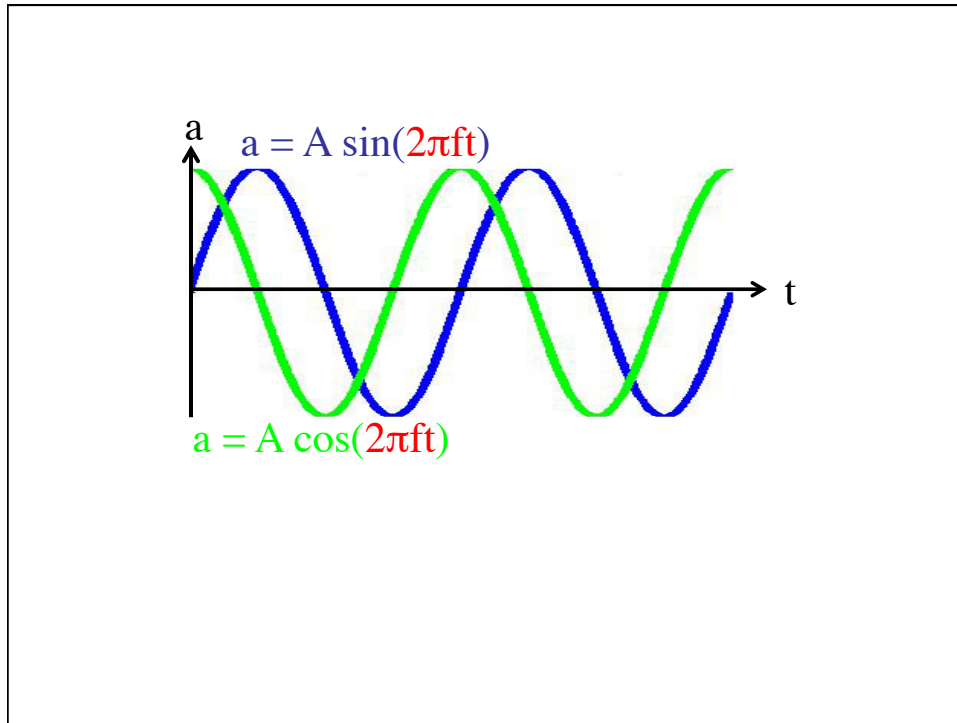
$$\omega = 2\pi f$$

$$f = \omega/2\pi$$

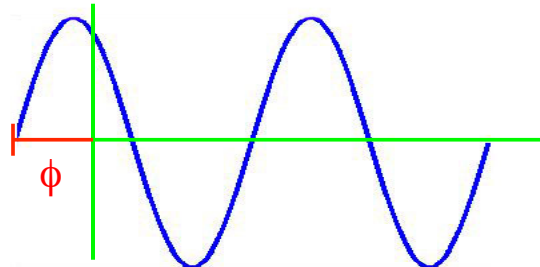


$$y = A \cos(2\pi f t)$$

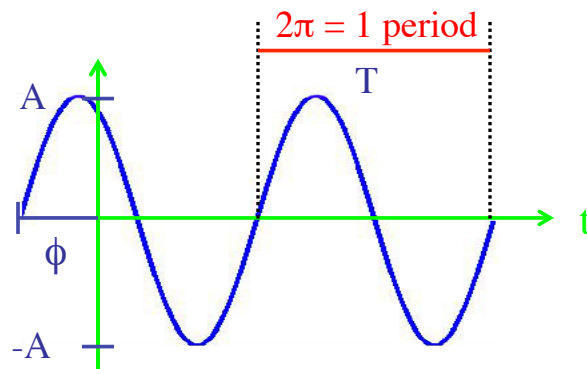
$$x = A \cos(2\pi f t)$$



Phase



$$a = A \sin(2\pi ft + \phi)$$

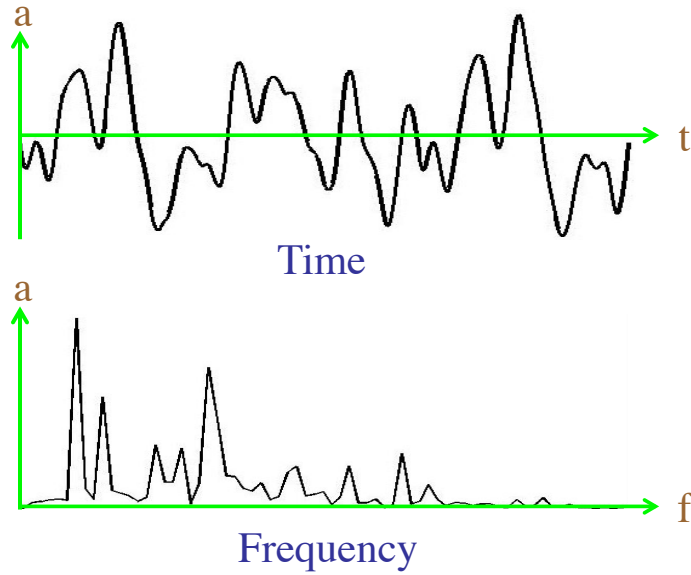


$$\underline{a = A \sin(2\pi ft + \phi)}$$

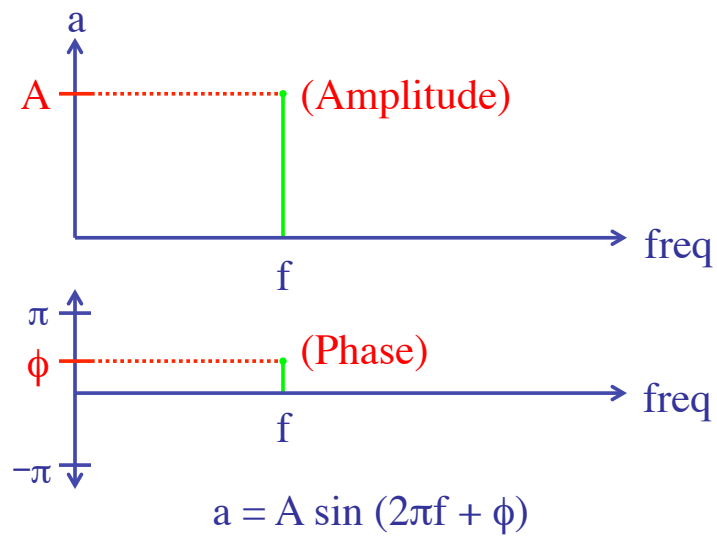
phase

$$f = \frac{1}{T}$$

Two Domains of Description

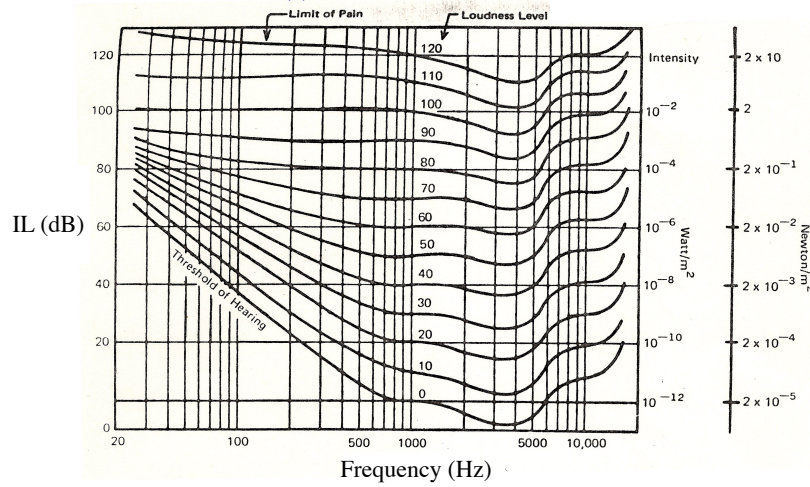


Frequency Domain Representation



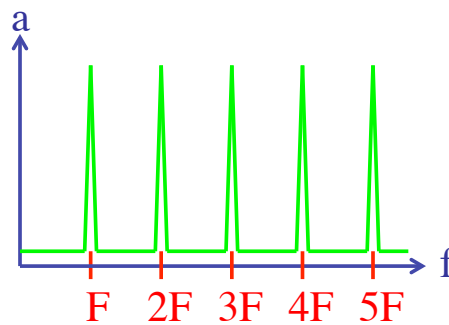
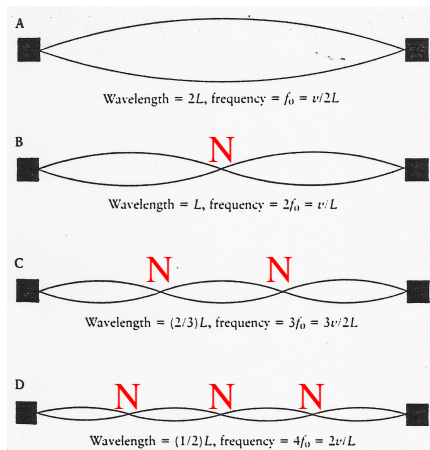
Frequency Domain

What can I hear?

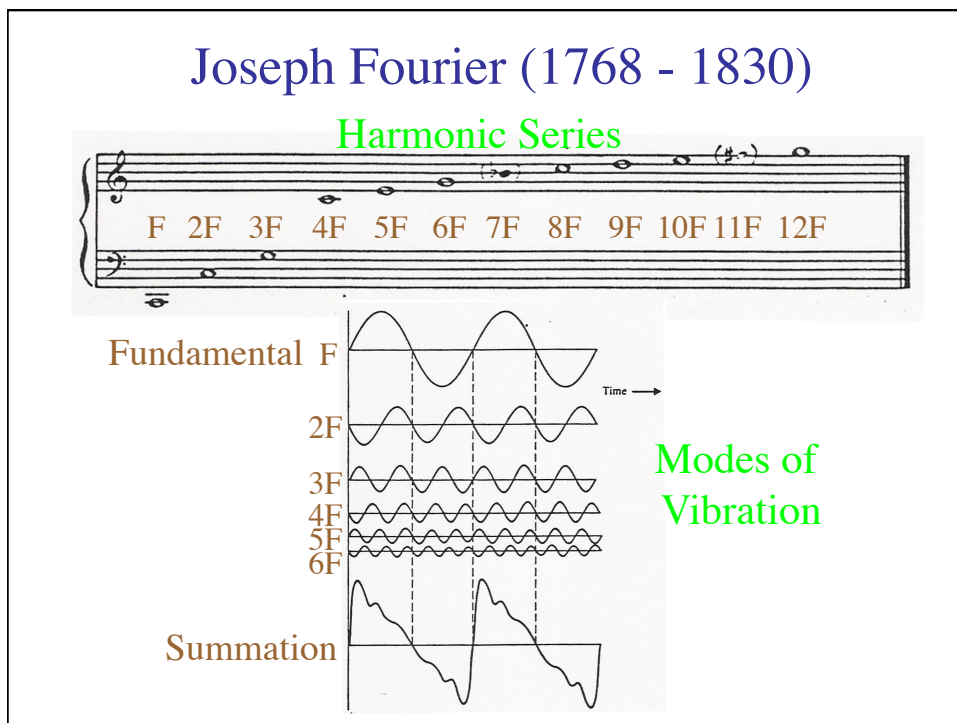
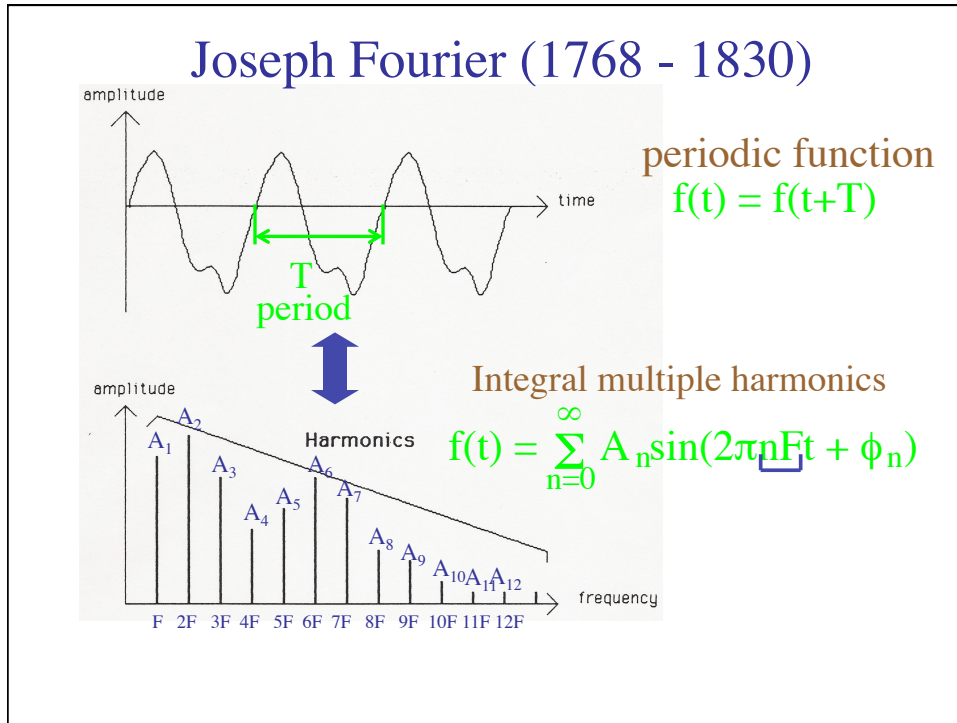


Fletcher & Munson

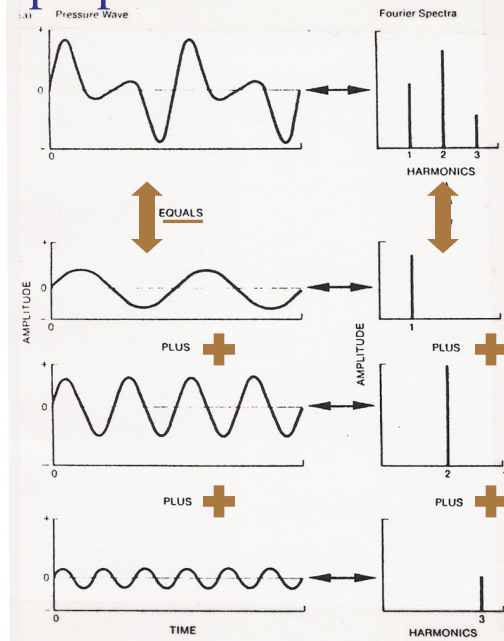
Modes of Vibration



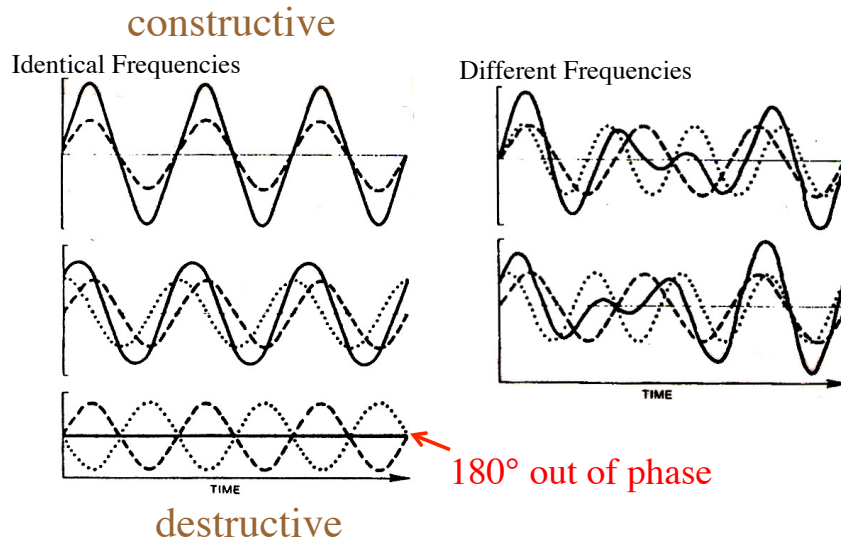
N = node

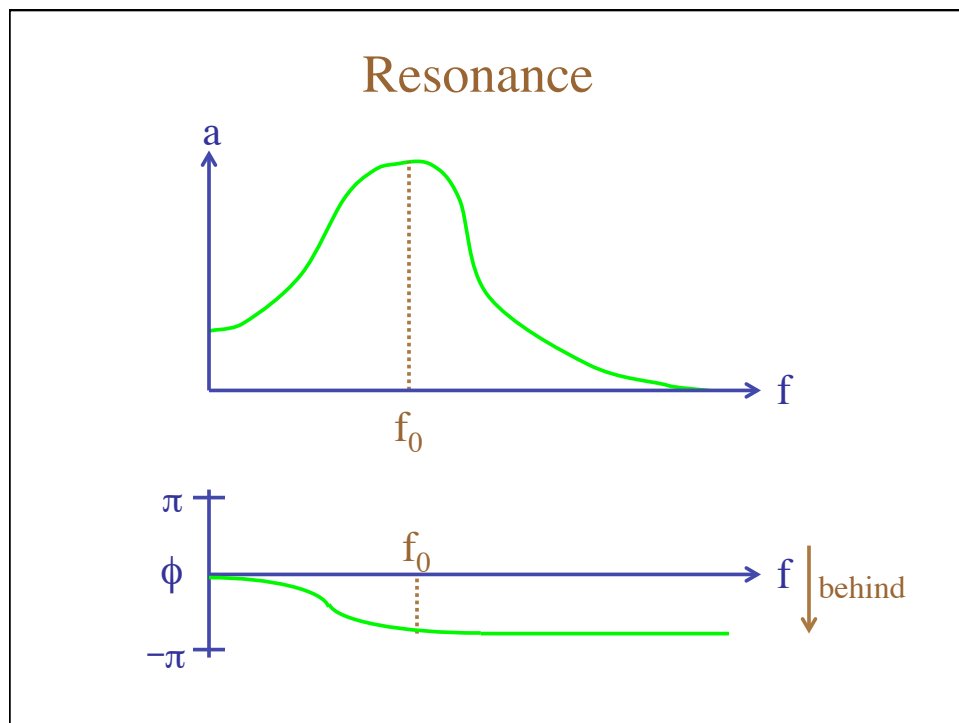
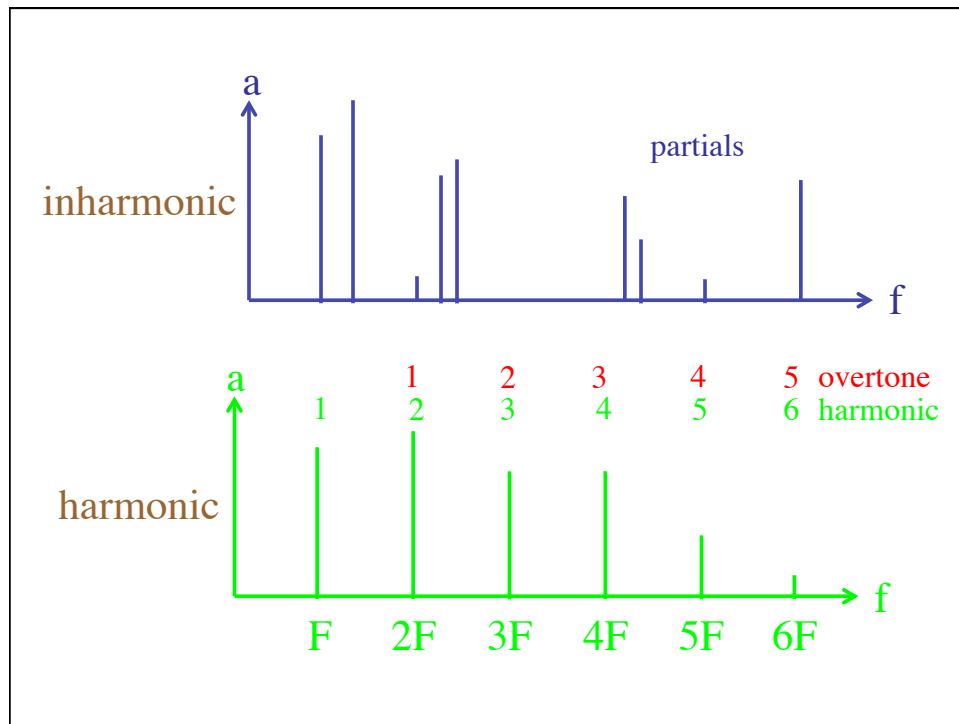


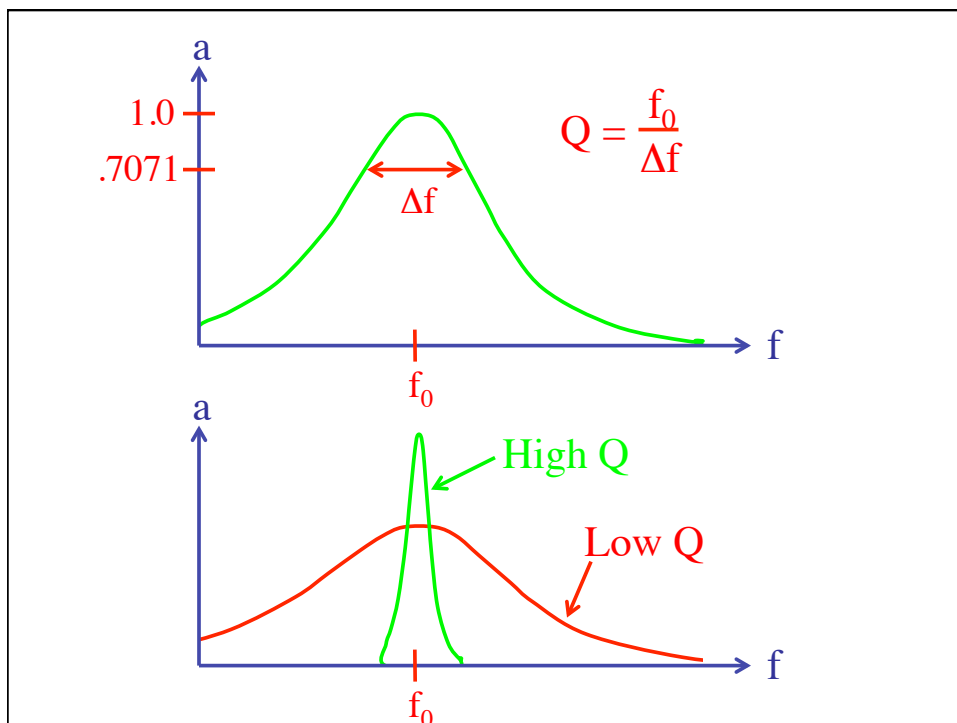
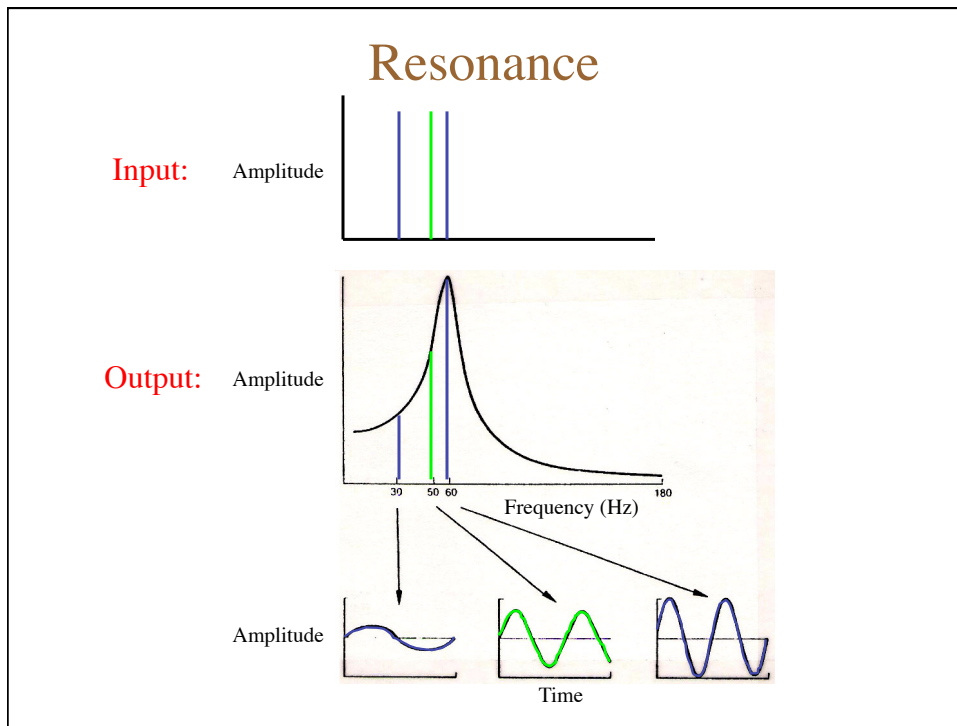
Superposition of Harmonics



Ongoing Superposition / Interference







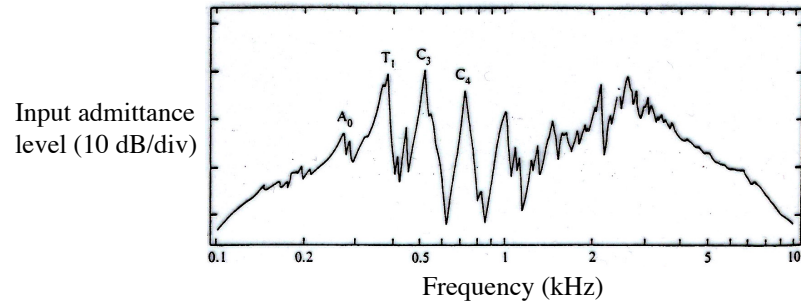


FIG. 10.14
Input admittance (driving point mobility) of
a Guarneri violin driven on the bass bar side
(Alonso Moral and Jansson, 1982b)

Time Domain

Real world Sounds

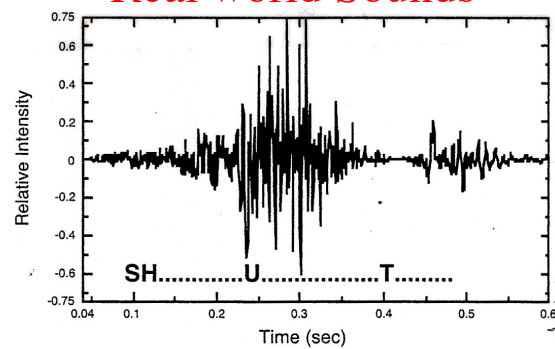


FIGURE 1.12. A waveform plot of the spoken word "shut." A noise-like (aperiodic) portion for the "sh" sound precedes the more pitched "u" sound, while the "t" is transient.

