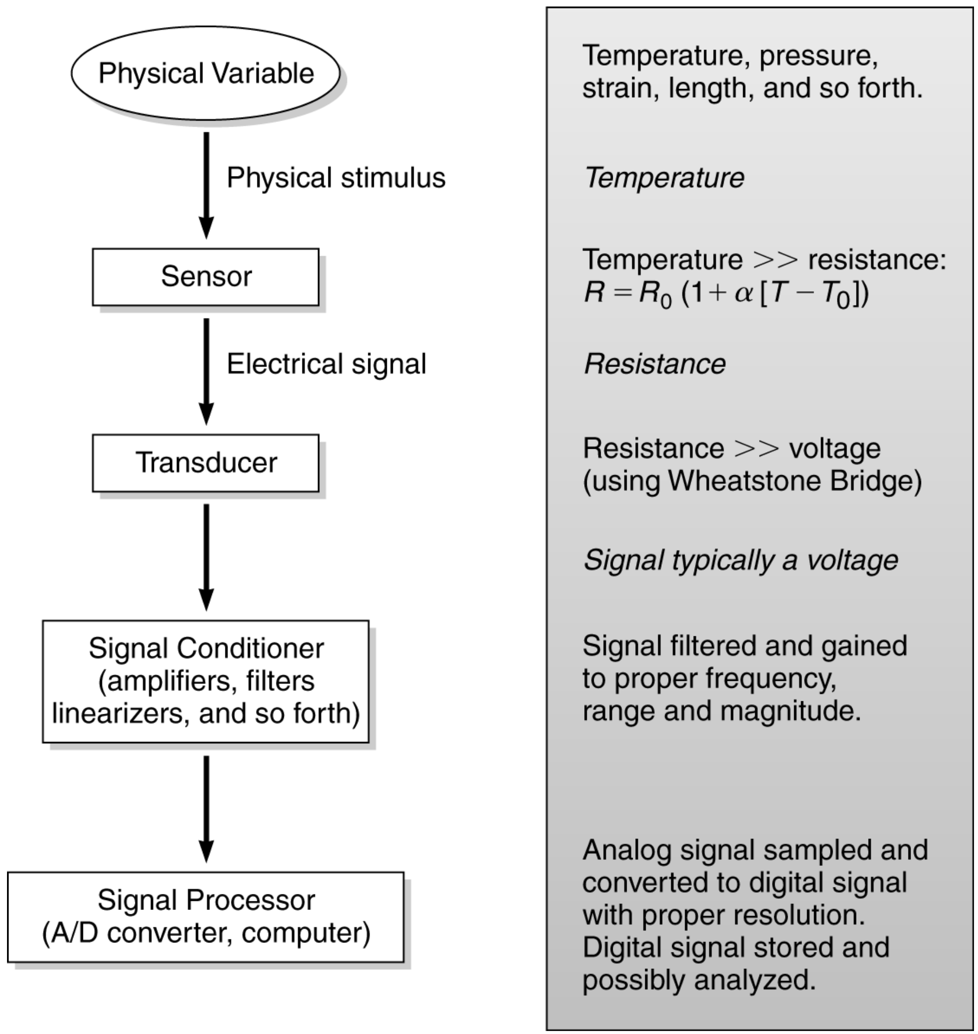
Amplifiers and Filters



Amplifiers

- An *amplifier* is an electronic component that scales the magnitude of a signal from its input value, E_i, to its output value, E_o.

Operational Amplifiers

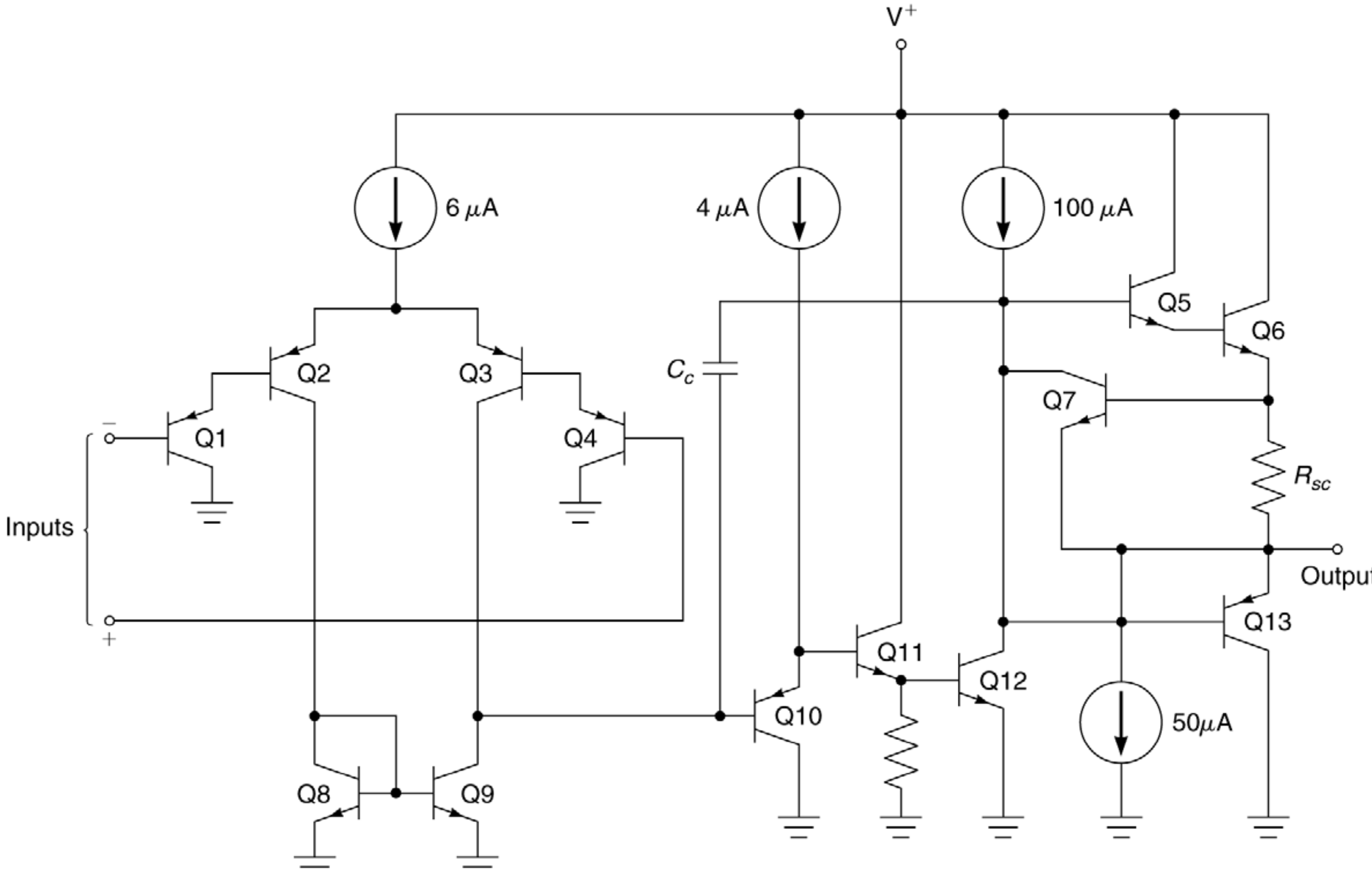


Figure 6.4: The LM124 Series Op Amp

Operational Amplifiers

• The complex circuit of the op amp can be modeled as a ‘black box’ having two voltage inputs and one voltage output.

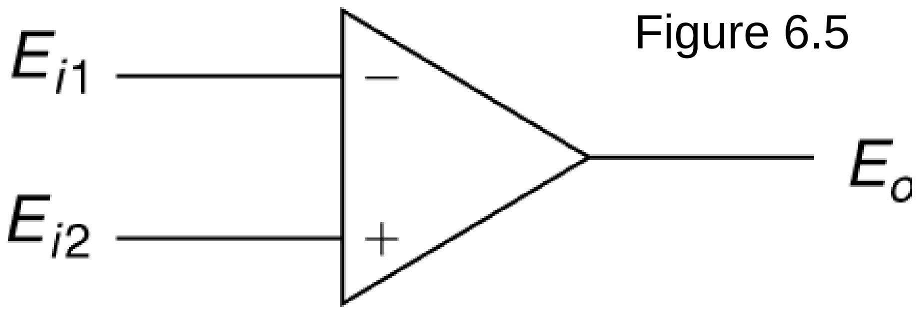
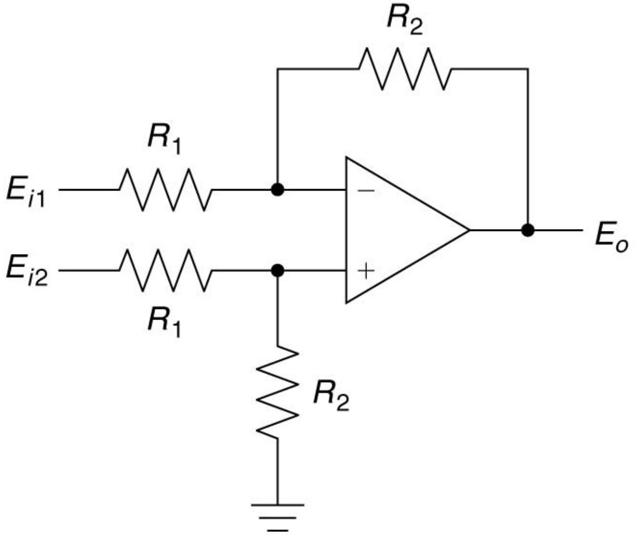


Figure 6.5

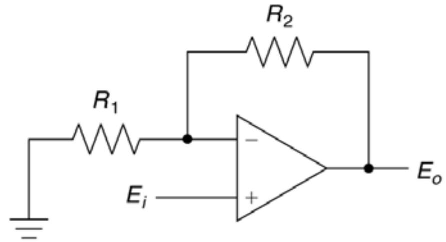
• It major attributes are:

Differential Op Amp Equation

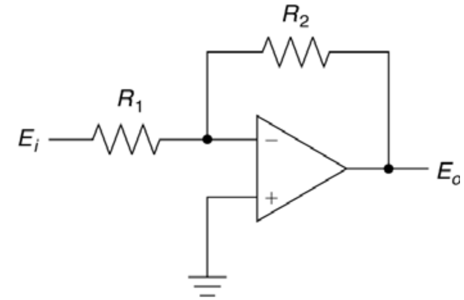
- Kirchoff's First Law can be applied to determine the amplification factor for this configuration.



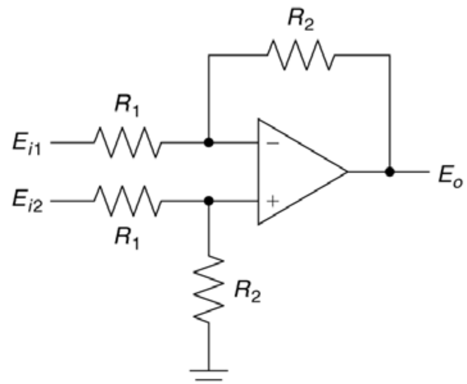
$E_o = (E_{i2} - E_{i1})[R_2/R_1]$
Differential Amplifier



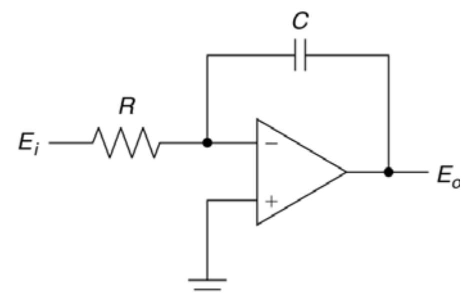
$E_o = E_i[R_1 + R_2]/R_1$
Noninverting Amplifier



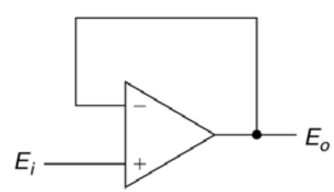
$E_o = -E_i[R_2/R_1]$
Inverting Amplifier



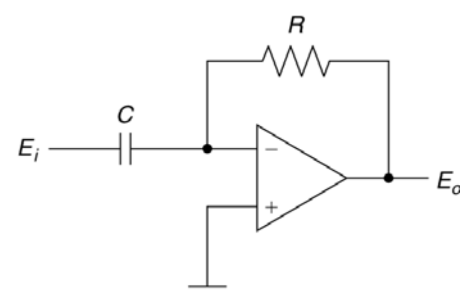
$E_o = (E_{i2} - E_{i1})[R_2/R_1]$
Differential Amplifier



$E_o = [1/RC] \int E_i(t)dt + \text{const.}$
Integrator



$E_o = E_i$
Voltage Follower

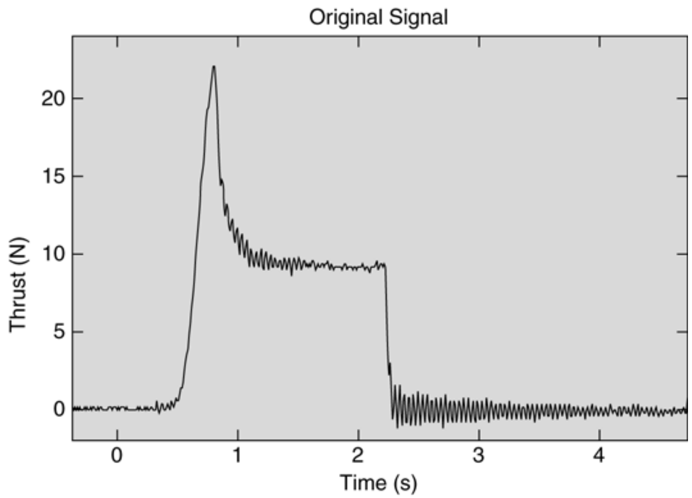


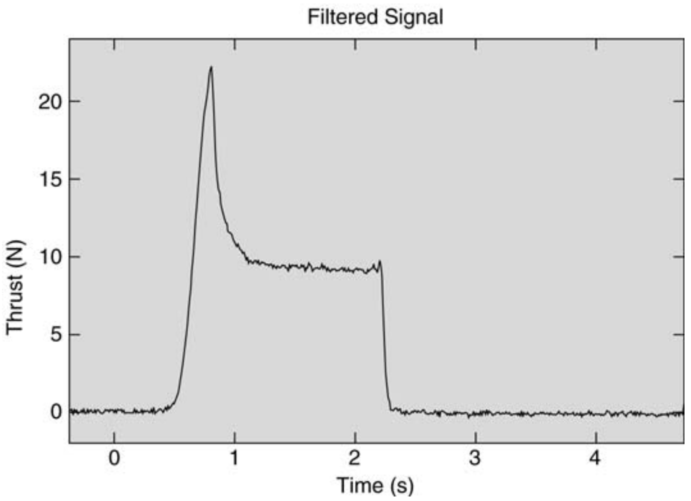
$E_o = -RC[dE_i(t)/dt]$
Differentiator

Figure 6.7

Filters

- A filter removes a signal's unwanted frequency components.





Filter Terminology

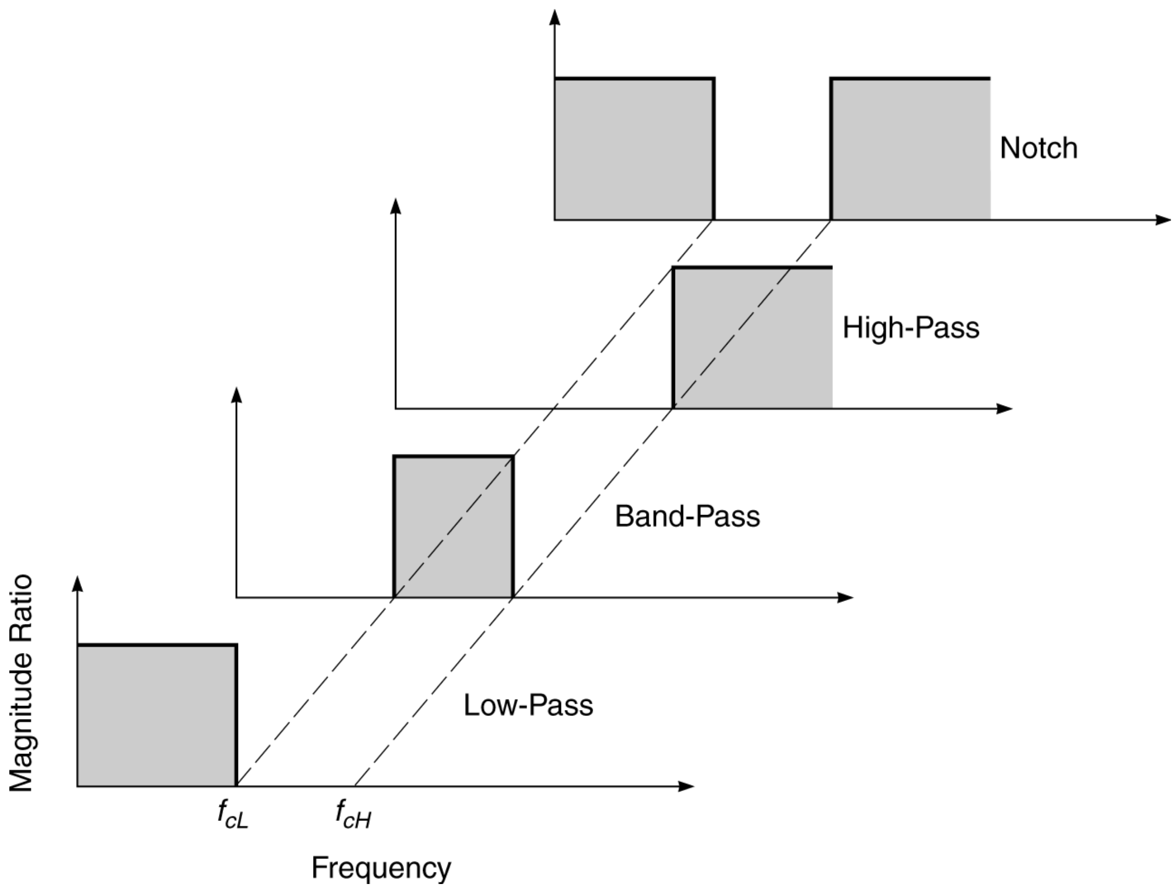


Figure 6.9

Simple RC Filters

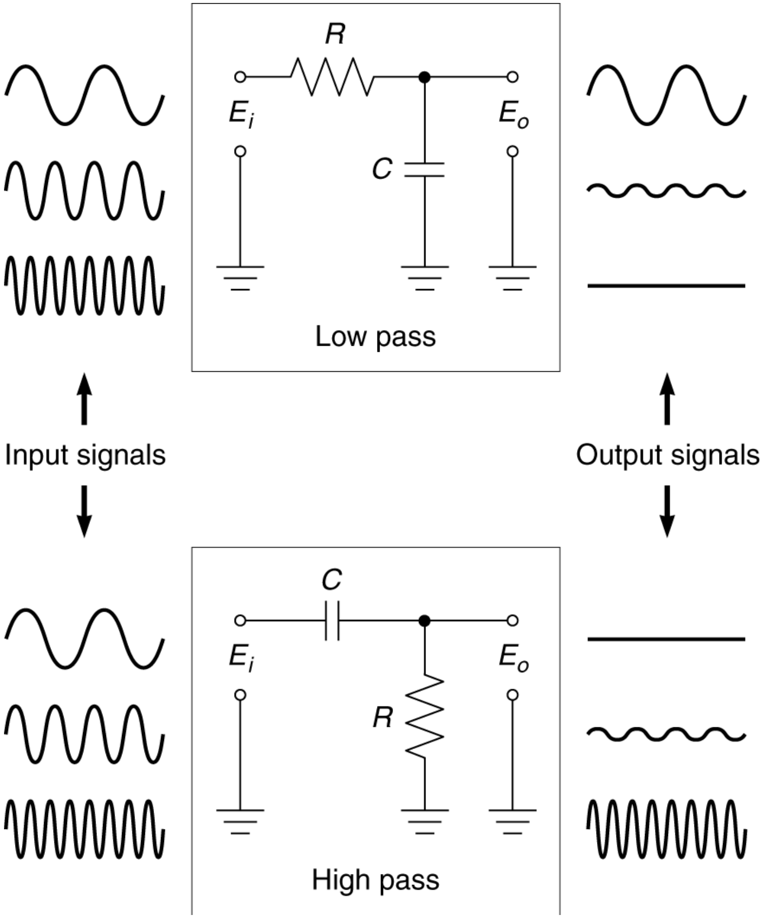


Figure 6.10

Filter Distortion of Signal

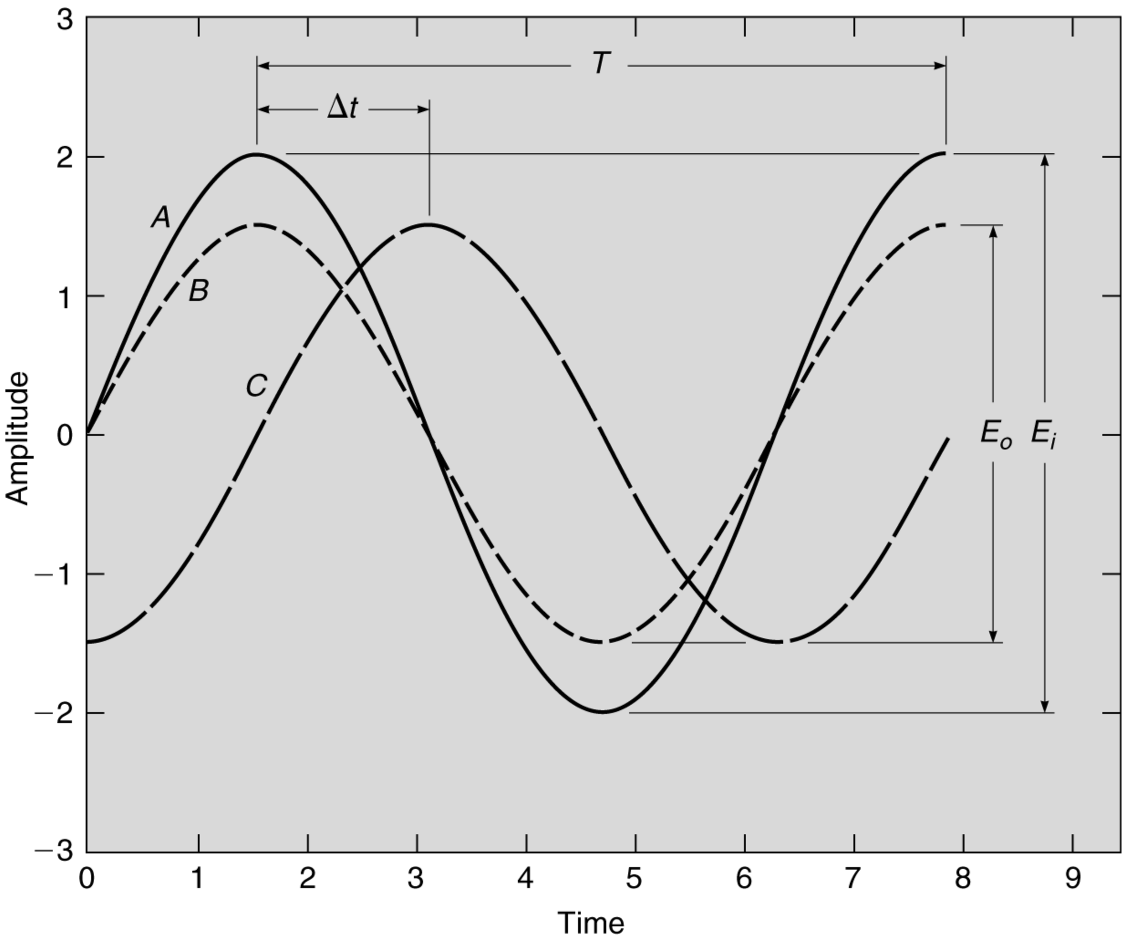


Figure 6.11

cyclic frequency for this signal =

circular frequency for this signal =