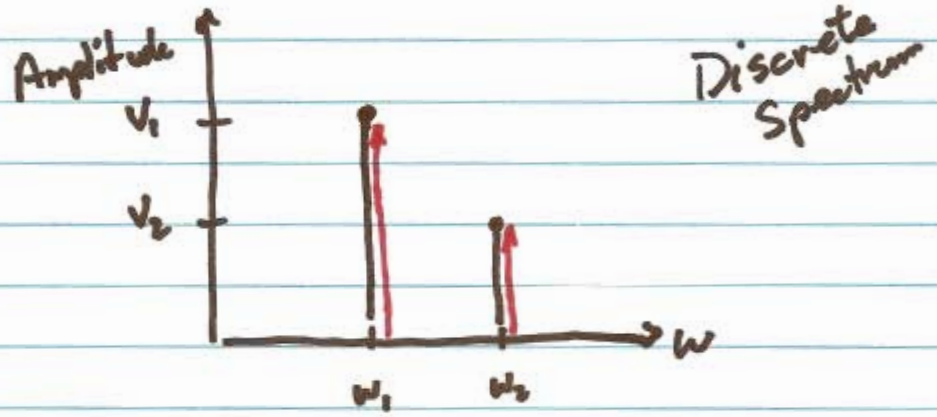
$f(t) = v(t) = V_m \sin(\omega t)$

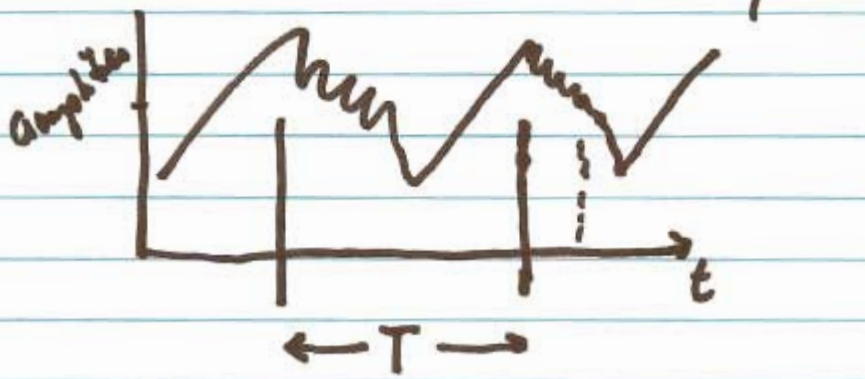
↑ constant ↑ variable

$v(t) = V_1 \sin(\omega_1 t) + V_2 \sin(\omega_2 t)$



$v(t)$ is periodic: $f(t) = f(t+T)$

↑ period



FOURIER SERIES

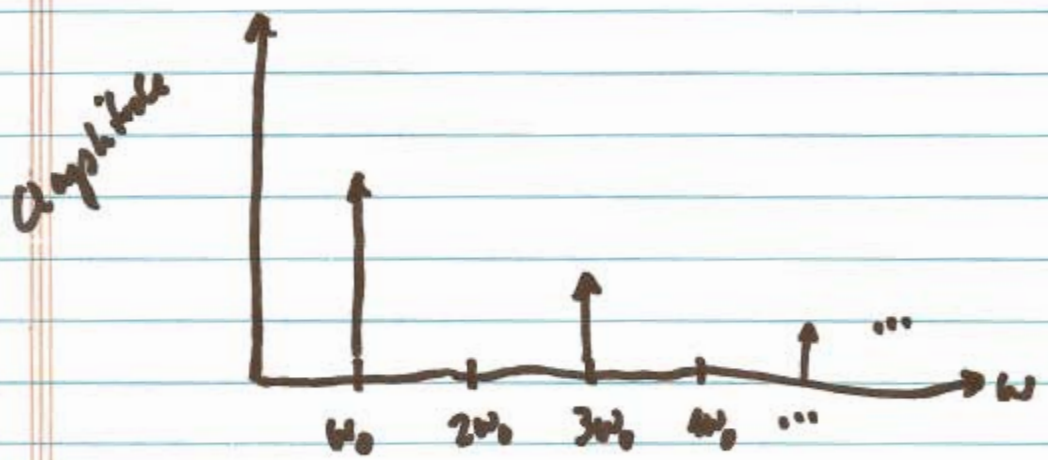
$$\omega_0 = \frac{2\pi}{T}$$

$$f(t) = v(t) = \sum_{n=1}^{\infty} \left(a_n \cos(n\omega_0 t) + b_n \sin(n\omega_0 t) \right)$$

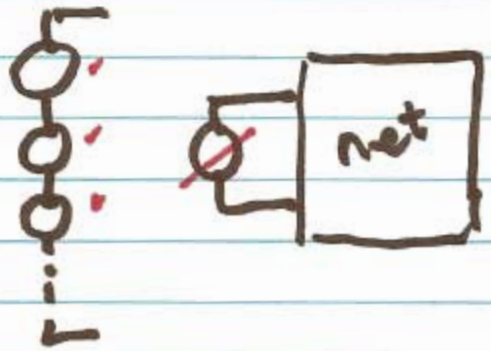
symmetric wave

10^{-3} s ↔ 1 mS ↔ 1 kHz $\left(f = \frac{1}{T}\right)$

$\omega_0 = 6.28 \times 10^3$ rad/sec



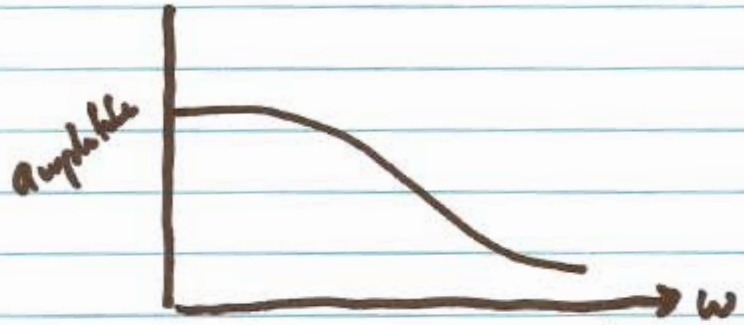
Superposition of sinusoids



8/29/07 3/8

APERIODIC

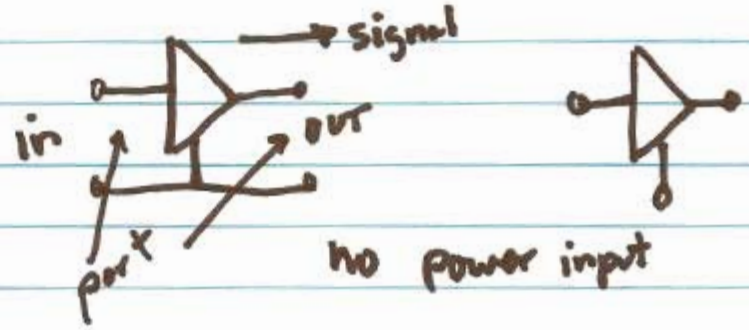
infinitely wide spectrum



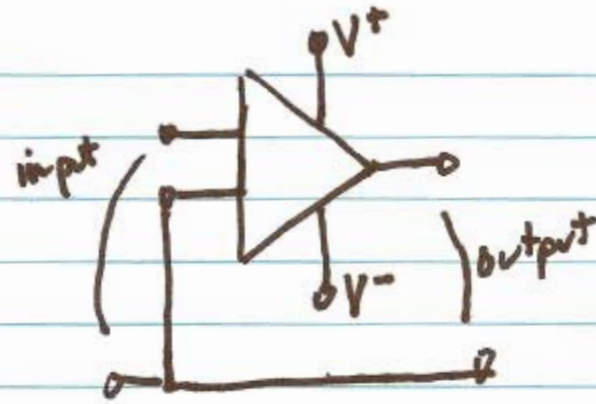
[redacted] BROADBAND

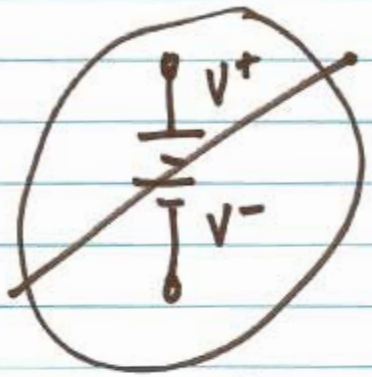
→ Signal flow

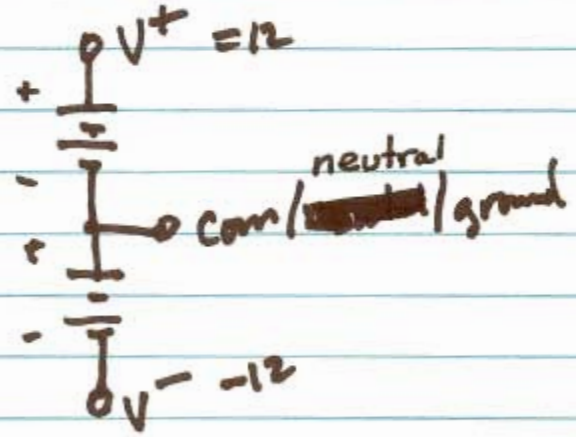
special meaning



8/29/07 H8







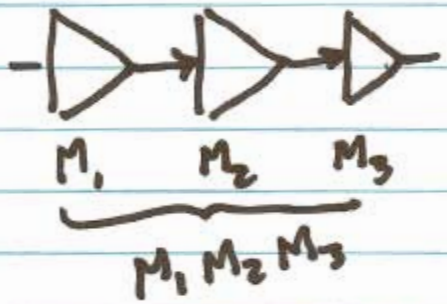
Complimentary Supply

8/29/07 5/8

$$\text{Gain} = Me^{j\phi} = M\angle\phi$$

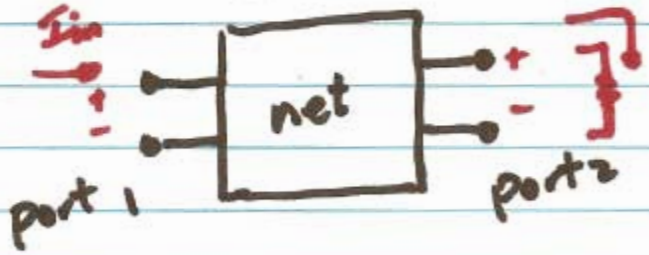
$20\log_{10}(\text{Gain}) \overset{20}{=} \log_e M + j\phi \overset{20}{\leftarrow} \text{ignore}$ ($\log_{10} e$ ← omitted in lecture)

$\Rightarrow$ log magnitude + phase angle



$M_1(dB) + M_2(dB) + M_3(dB)$

Two Port



port ≡ terminal pair

linear network

reciprocal

$V \to V \quad V \to I \quad \frac{I}{V} = Y \mid G$

$I \to I \quad I \to V \quad \frac{V}{I} = z \mid R$

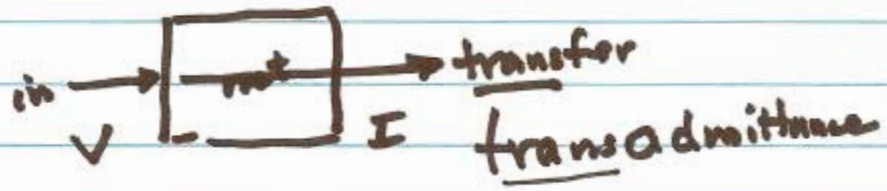
$\text{Gain} = \frac{\text{out}}{\text{in}}$

8/29/07 6/8

$$Z = R + jX$$
$$Y = G + jB$$

$$\frac{V}{I} = Z = R + jX$$

"trans"



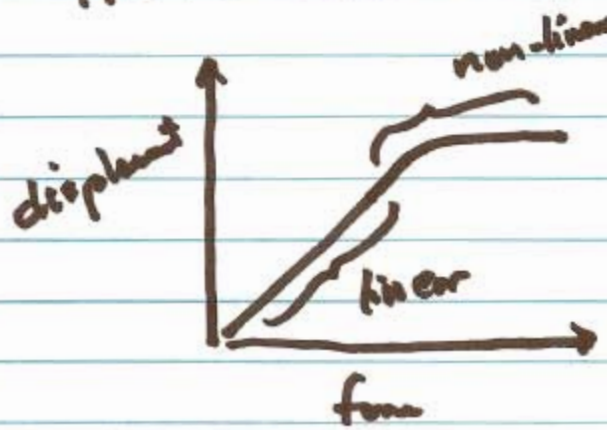
$$Z_T = \frac{V_{out}}{I_{in}} \ \Omega$$

$$Y_T = \frac{I_{out}}{V_{in}} \ \mho$$

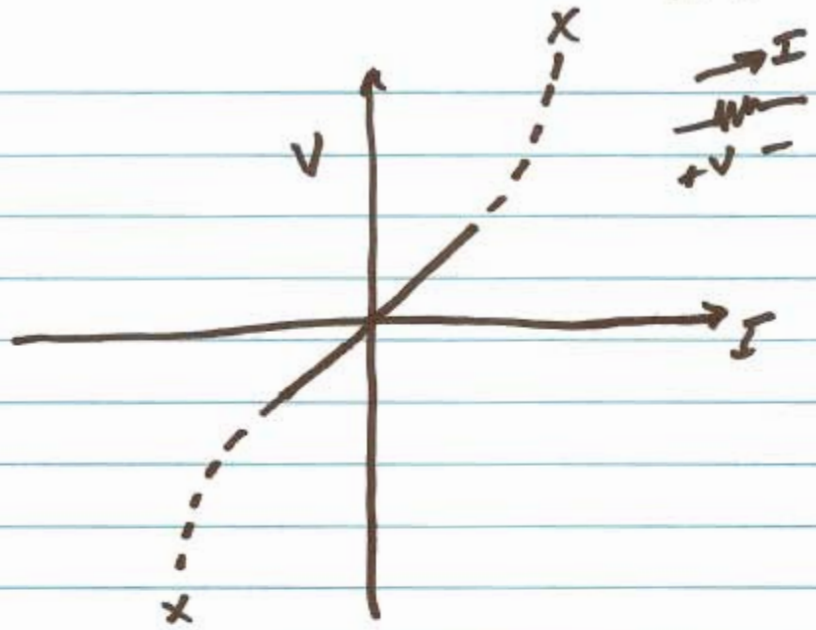
$$A_V = \frac{V_{out}}{V_{in}} \ -$$

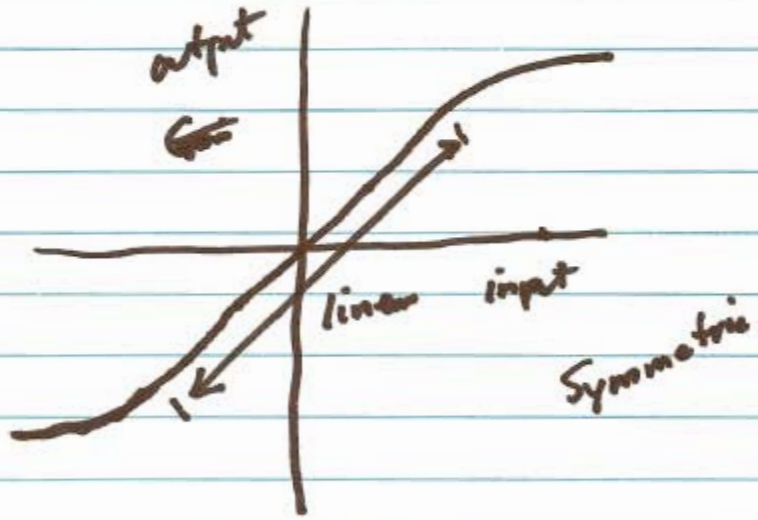
$$A_I = \frac{I_{out}}{I_{in}} \ -$$

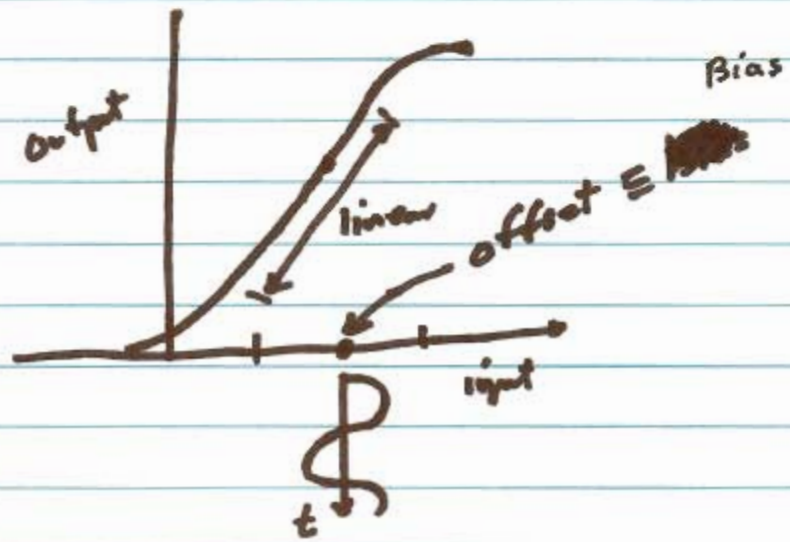
Pretend World Is Linear



8/29/03 7/8


X
V
I
+V -
I
X

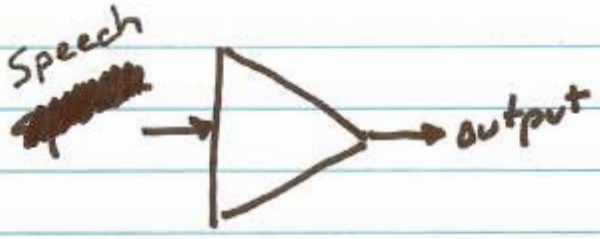

output
linear
input
Symmetric

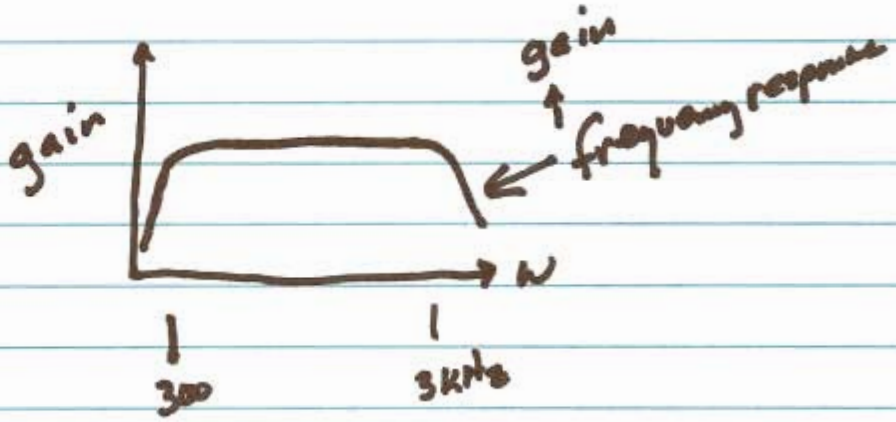

output
linear
offset ≡ Bias
input
t

8/29/07 8/8

Speech [redacted] : 300Hz - 3000Hz (AT&T)

3KHz BANDWIDTH





Bode Plot