Midterm Friday

$G_m$

Biasing

Last time

$R_D = (1 + g_m R_0) R_s + r_0$

$= g_m R_0 R_s + R_s + r_0$

$= g_m R_0 R_s$ if $R_s \gg \frac{1}{g_m}$

$R_s = \frac{1}{g_m} \left(1 + \frac{R_D}{r_0}\right)$

$G_m$ for CS with degeneration

drawn matter (3)

Because

$V_0 = 0$

$V_i = 0$

$R_s$

$V_s$

$G_m = \frac{G_m}{r_0} = \frac{g_m}{1 + g_m R_s (1 + \frac{1}{g_m R_s})}$

$G_m = \frac{g_m}{1 + g_m R_s (1 + \frac{1}{g_m R_s})} = \frac{g_m}{1 + g_m R_s (1 + \frac{1}{g_m R_s})}$

$= \frac{g_m}{1 + g_m R_s (1 + \frac{1}{g_m R_s})}$

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$G_m$ for CS with drain impedance

KCL at $V_d$

$i_o = \frac{g_m}{r_0} (V_i - i_o R_s) + \frac{1}{r_0} \left[0 - i_o R_s\right]$

$\left[1 + g_m R_s + \frac{1}{r_0} R_s\right] = g_m V_i$

$G_m = \frac{g_m}{r_0} = \frac{g_m}{1 + g_m R_s (1 + \frac{1}{g_m R_s})}$

KCL at $V_s$

$i_o + g_m (V_i) + \frac{1}{r_0} \left[i_o R_0\right] = 0$

$i_o \left[1 + \frac{R_0}{r_0}\right] = -g_m V_i$

$G_m = \frac{g_m}{r_0} = \frac{g_m}{1 + g_m R_s (1 + \frac{1}{g_m R_s})}$

$R_0 \ll \frac{V}{r_0}$

$R_0 = V_0$

$R_0 \gg R_s$
Dioda connected
all look like I

kin on depend on stable
for diode, BJT's it's near 0.6, 0.7 above
for MOS, read V2
How low could $V_{S2}$ go?

What if it drops to everywhere?

drop $V_{O2}$ to 0.1 V?

All have same $\frac{V}{2}$. No gain, why?

Circe $\frac{V}{2}$.

Bias points?

$V_{S2} = 1$

$V_{S3} = \frac{1}{3}$

$V_{O3} = 2.5$ very tough

Gain? $g_{m1}(\frac{V_{S2}}{V_{S1}}) = \frac{V_{O2}}{V_{S1}} = \frac{1}{(\frac{V_{S2}}{V_{S1}})}$

Gain: $\frac{g_{m1}(\frac{V_{S2}}{V_{S1}})}{V_{S1}}$