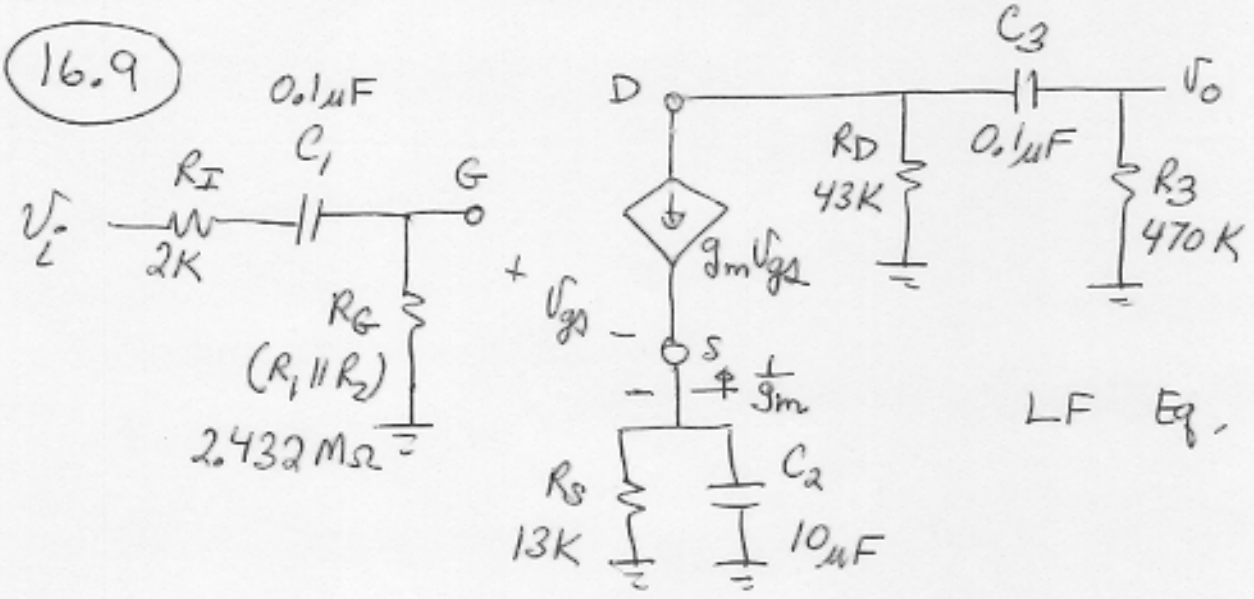
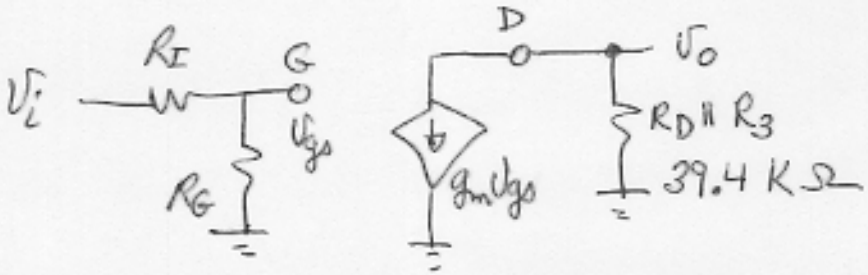
Jaeger 3rd ed

(16.9)



LF Eq.

(a)



MB Eq.

$I_D = 0.2\text{mA}$

$V_{DS} = 5V$

$(V_{GS} - V_{TN}) = 1\,V.$

$$g_m = \frac{2I_D}{V_{GS} - V_{TN}} = 0.4\text{mS}$$

(b) $$A_m = \left.\frac{V_o}{V_i}\right|_{\text{midband}} = -g_m (R_D \| R_3) \frac{R_G}{R_G + R_I} = -15.7$$

Three lf poles at:

$$\omega_{P1} = \frac{1}{C_1(R_I + R_G)} = 4.10\,s/s \qquad \omega_{P3} = \frac{1}{C_3(R_D + R_3)} = 19.5\,s/s$$

$$\omega_{P2} = \frac{1}{C_2\left(R_S \| \frac{1}{g_m}\right)} = 47.7\,s/s$$

16.9 cont

three corresponding lf zeros are:

$$\omega_{z1} = 0 \qquad \omega_{z3} = 0 \qquad \omega_{z2} = \frac{1}{R_S C_2} = 7.69 \text{ /s}$$

$$F_L(s) = \frac{s}{s+\omega_{p1}} \; \frac{s+\omega_{z2}}{s+\omega_{p2}} \; \frac{s}{s+\omega_{p3}}$$

find f_L exactly, solve

$$\frac{1}{2} = \frac{\omega_L^2}{\omega_L^2+\omega_{p1}^2} \; \frac{\omega_L^2+\omega_{z2}^2}{\omega_L^2+\omega_{p2}^2} \; \frac{\omega_L^2}{\omega_L^2+\omega_{p3}^2} \qquad \text{(3rd order)}$$

the approximation

$$\omega_L \cong \sqrt{\sum_i \omega_{pi}^2 - 2\sum_i \omega_{zi}^2} = 50.5 \text{ rad/s}$$

$$f_L = 8.0 \text{ Hz}$$

(c) $V_{DD} = I_D(R_D+R_S) + V_{DS} = +16.2 \text{ V}$