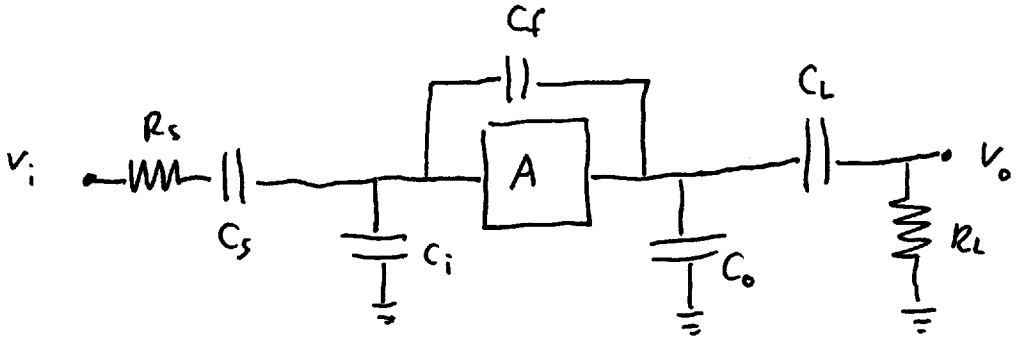
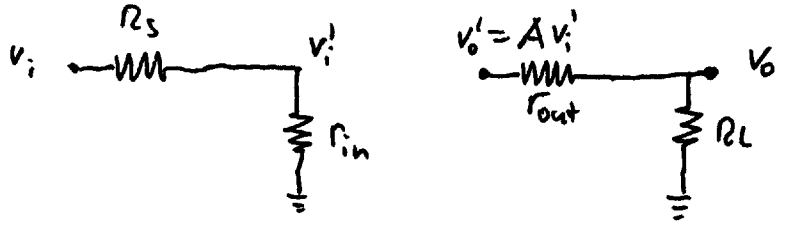


Mid frequencies : no capacitor limits the gain

C_S, C_L : short circuit (HPF)

C_f, C_i, C_o : open circuit (LPF)



$R_S = 1k\Omega$

$R_L = 3k\Omega$

$r_{in} = 5k\Omega$

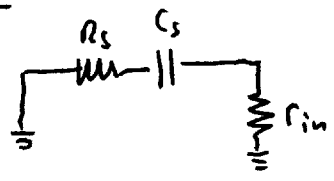
$r_{out} = 1k\Omega$

$$A_V = \frac{V_o}{V_i} = \frac{V_o}{V_o'} \cdot \frac{V_o'}{V_i'} \cdot \frac{V_i'}{V_i}$$

$$= \frac{R_L}{R_L + r_{out}} \cdot A \cdot \frac{r_{in}}{r_{in} + R_S} = \frac{3}{4} \times (-100) \times \frac{5}{6} = -62.5$$

low frequencies

τ_S =

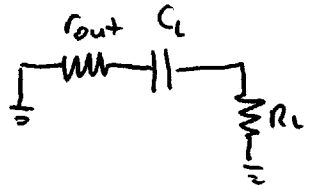


$= C_S \times (R_S + r_{in})$

$= 10\,\mu F \times (1k\Omega + 5k\Omega)$

$= 60$ ms , $f_S = \frac{1}{2\pi\tau_S} = 2.65$ Hz

τ_L =



$= C_L \times (r_{out} + R_L)$

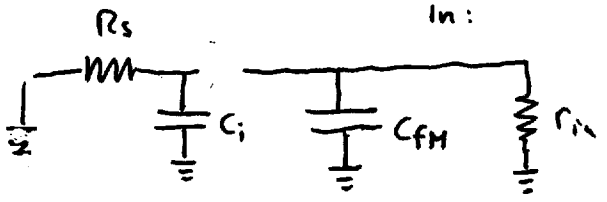
$= 10\,\mu F \times (1k\Omega + 3k\Omega)$

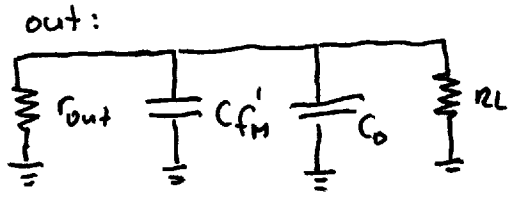
$= 40$ ms , $f_L = \frac{1}{2\pi\tau_L} = 4.0$ Hz

$$\frac{1}{\tau_{tot}} = \frac{1}{\tau_L} + \frac{1}{\tau_S} = \frac{1}{40\ ms} + \frac{1}{60\ ms} = \frac{1}{24\ ms}$$

$$f_{L\,tot} = \frac{1}{2\pi\,\tau_{tot}} = f_S + f_L = 6.6\ Hz$$

High frequencies



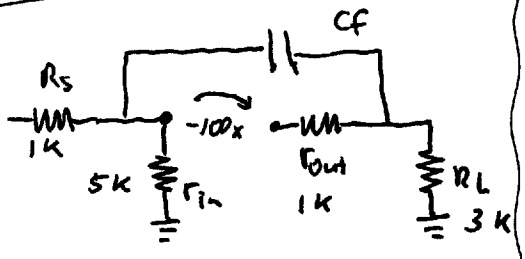


$C_{fM} = (1 - A') \times C_f = 760\ pF$

$C_{f'M} = (1 - \frac{1}{A'}) \times C_f = 10.13\ pF$

$$A' = -100 \times \frac{R_L}{R_L + r_{out}} = -75$$

(see drawing)



$$\tau_{in} = (C_{fM} + C_i) \times R_S \,//\, r_{in} = 770\ pF \times (1\,k\Omega \,//\, 5\,k\Omega) = 6.42 \times 10^{-7}\ s$$

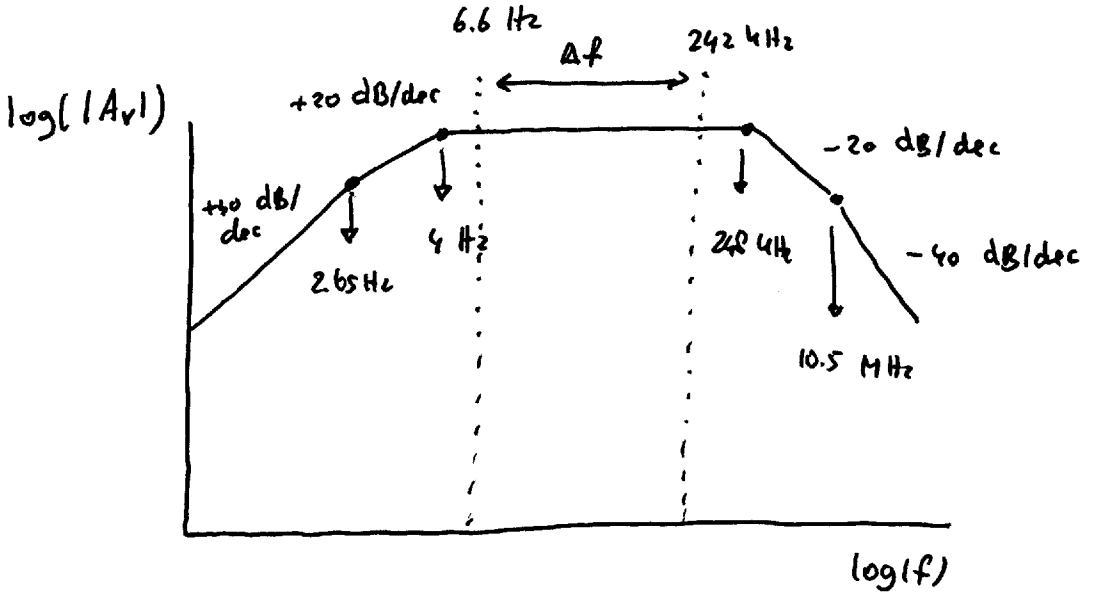
$$f_{in} = \frac{1}{2\pi\,\tau_{in}} = 248\ kHz$$

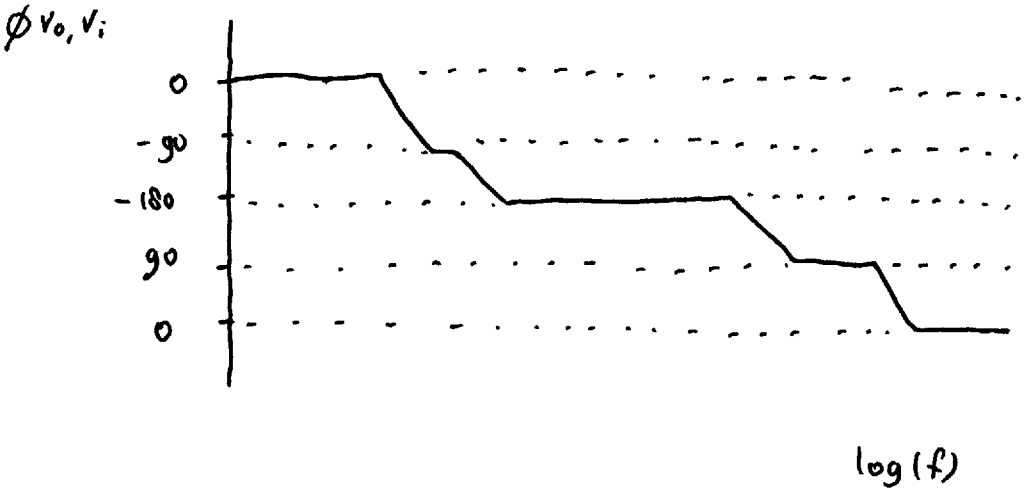
$$\tau_{out} = (C_{f'M} + C_o) \times (r_{out} \,//\, R_L) = 20.1\ pF \times (1\,k\Omega \,//\, 3\,k\Omega) = 1.5 \times 10^{-8}\ s$$

$$f_{out} = \frac{1}{2\pi\,\tau_{out}} = 10.5\ MHz$$

$$f_{total,H} = \frac{1}{2\pi\,(\tau_{in} + \tau_{out})} = 242\ kHz \quad (\approx f_{in})$$

c) bandwidth: $\Delta f = 242\ kHz - 6.6\ Hz$


6.6 Hz
Δf
242 kHz
log(|Av|)
+20 dB/dec
-20 dB/dec
+40 dB/dec
-40 dB/dec
265 Hz
4 Hz
248 kHz
10.5 MHz
log(f)


∅ Vo, Vi
0
-90
-180
90
0
log(f)