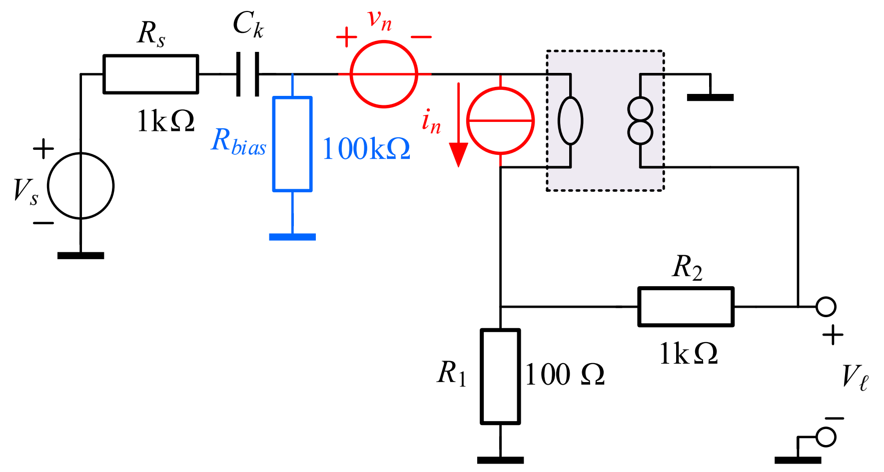
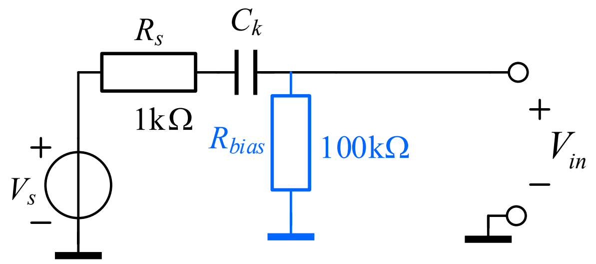
Exercise 1_8





$$H(s)=\frac{s(\dots)}{(\dots)}=\frac{s(\dots)}{1+(R_s+R_{bias})sC_k}=\frac{(R_{bias})sC_k}{1+(R_s+R_{bias})sC_k}$$

Propose a reasonable value for C_k considering the bandwidth requirements.

Is there a zero? $s=0$

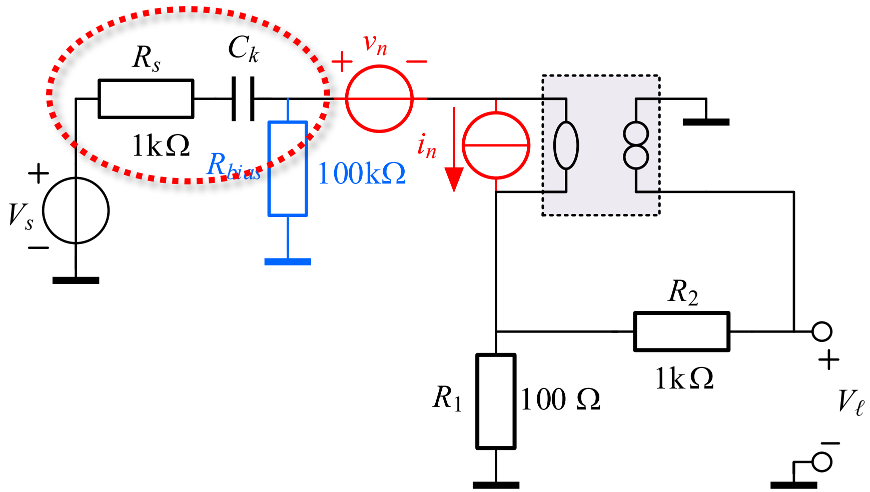
Is there a pole? 1 pole at: $s=\frac{1}{(R_s+R_{bias})C_k}$

Should be below 50Hz.

R_{bias} much larger than R_s .

What is the transfer for $s\to\infty$? $H(\infty)=\frac{R_{bias}}{R_s+R_{bias}}$

$$C_{k,BW}=\frac{1}{R_{bias}2\pi f_{\min}}=\frac{1}{10^5\cdot 2\pi 50}\approx 3.2\cdot 10^{-8}$$



$$R_s = \left| \frac{1}{sC_{k,noise}} \right|$$

$$C_{k,noise} = \frac{1}{2\pi f_{\min} R_s} = \frac{1}{2\pi 50 \cdot 10^3} \approx 3.2 \cdot 10^{-6}$$

C_k converts noise current i_n into an equivalent voltage source.

R_s converts noise current i_n into an equivalent voltage source. (we neglect the influence of R_1 and R_2)

Proposal: C_k and R_s have equal impedance at 50Hz for equal contribution.

1 pole at: $s = \dfrac{1}{(R_s + R_{bias})C_k}$ Should be below 50Hz.

$$C_{k,BW} = \frac{1}{R_{bias} 2\pi f_{\min}} = \frac{1}{10^5 \cdot 2\pi 50} \approx 3.2 \cdot 10^{-8}$$

Conclusion: Noise requirements can put a harsher constrain on the value of C_k than the bandwidth requirements.

Of course definite conclusions can only be drawn when the magnitude of all noise sources is known, because then the impact of C_k on the magnitude of the total equivalent noise source power at the input can be evaluated.