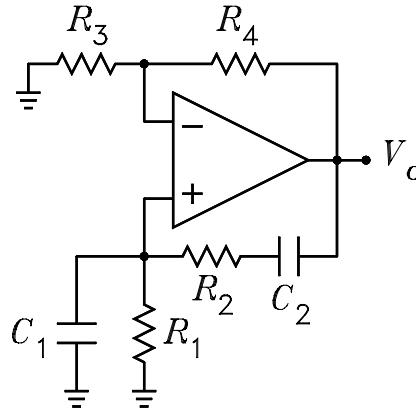
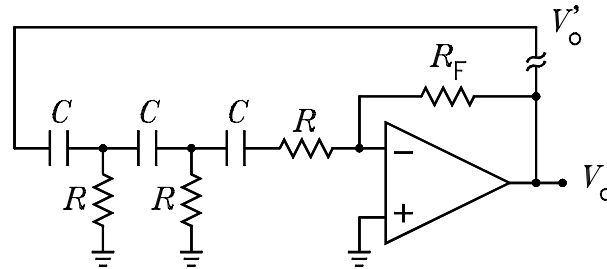


ECE3050 Assignment 19

1. The circuit shows a Wein bridge oscillator. If $R_1 = R_2$, $C_1 = 0.1 \mu\text{F}$, $C_2 = 0.22 \mu\text{F}$, and $R_4 = 10 \text{ k}\Omega$, specify R_1 , R_2 , and R_3 for the circuit to have stable oscillations at $f = 1000 \text{ Hz}$. Answers: $R_1 = R_2 = 1073 \Omega$ and $R_3 = 6875 \Omega$.



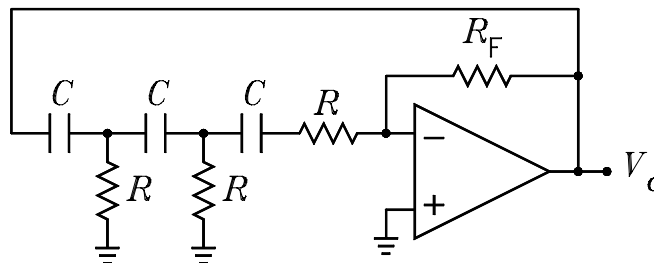
2. The figure shows a phase-shift oscillator with the feedback loop broken.



By writing node equations, it can be shown that the loop-gain transfer function is given by

$$\frac{V'_o}{V_o} = -\frac{R_F}{R} \frac{(RCs)^3}{(RCs)^3 + 6(RCs)^2 + 5(RCs) + 1}$$

- (a) To solve for the frequency of oscillation, what do you set V'_o/V_o equal to? Answer: $1\angle 0^\circ$. (b) Use the transfer function to solve for the frequency of oscillation. Answer: $f_0 = 1/(2\pi\sqrt{6}RC)$. (c) Use the transfer function to solve for value of R_F/R in order for $|V'_o/V_o| = 1\angle 0^\circ$ at $f = f_0$. Answer: $R_F/R_1 = 29$.
3. The figure shows a phase shift oscillator. If $C = 0.1 \mu\text{F}$, specify R and R_F for the circuit to have stable oscillations at $f = 200 \text{ Hz}$. Answers: $R = 3249 \Omega$ and $R_F = 94.21 \text{ k}\Omega$.



4. The loop-gain transfer function of a particular oscillator circuit is given by

$$\frac{V_o}{V'_o} = K \frac{s}{(s/100)^2 + 0.5(s/100) + 1}$$

At what frequency does the circuit oscillate and what must be the value of K for stable oscillations? Answers: $f = 15.9\text{ Hz}$ and $K = 0.005$.