`ee101_osc_2.sqproj`

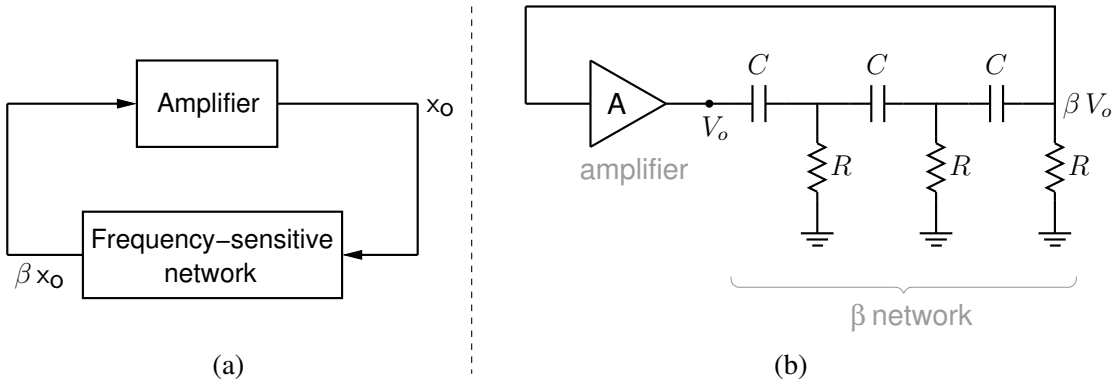


Figure 1: (a) Block diagram of a sinusoidal oscillator, (b) A specific example of the $\beta$ network.

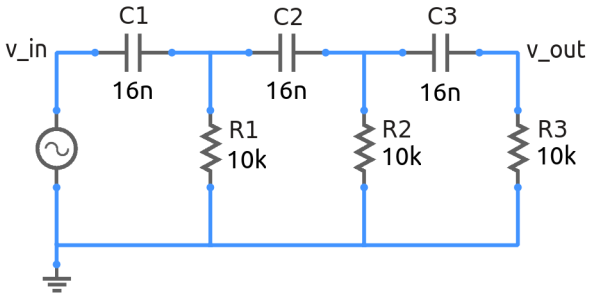


Figure 2: Circuit diagram of $\beta$ network with component values.

Fig. 1 shows the block diagram of a sinusoidal oscillator based on positive feedback. It consists of an amplifier with gain $A$ and a feedback network which is characterised by $\beta = v_{\text{out}}/v_{\text{in}}$ (see Fig. 2). The condition for oscillation is given by the Barkhausen criterion, viz.,

$$A(j\omega)\,\beta(j\omega) = 1\,. \tag{1}$$

(See `ee101/ee101_osc_2a.sqproj` for an oscillator circuit using the above $\beta$ network.)

## Exercise Set

1. Apply the Barkhausen criterion and find the condition for oscillation, i.e., the frequency of oscillation and the condition to be satisfied by $A$ for oscillations to occur (assuming $A$ to be real).

2. Simulate the circuit and plot the magnitude and phase of $\beta$ as a function of frequency. From the plots, find the numerical value of $A$ that is required for the circuit to oscillate.

3. Compare the values you obtained in (1) with the simulation results.

## References


1. S. Franco, *Design with Operation Amplifiers and Analog Integrated Circuits,* McGraw-Hill, 1998.

2. J. Millman and A. Grabel, *Microelectronics,* McGraw-Hill, 1988.