

ee101_osc_2a.sqproj

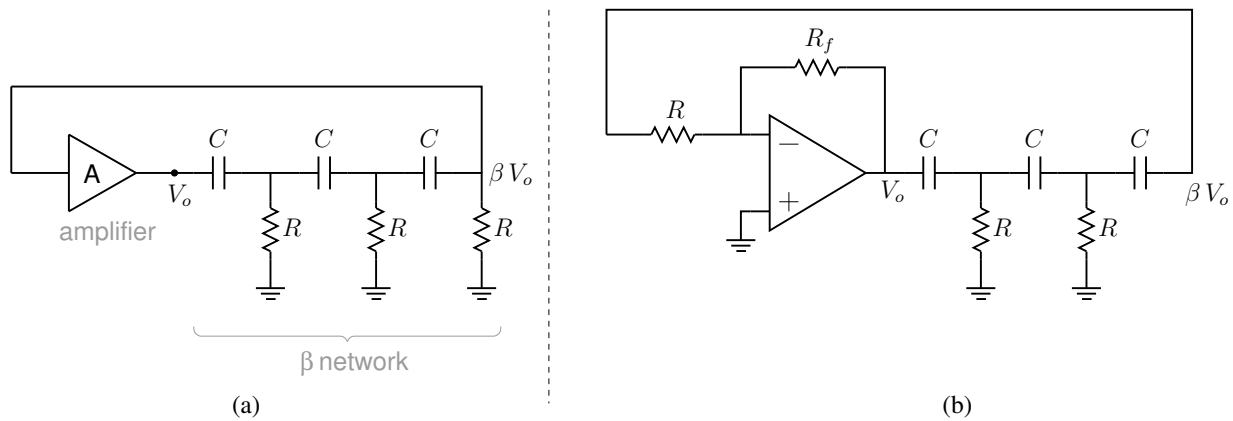


Figure 1: Phase-shift oscillator circuit: (a) block diagram, (b) Op Amp based circuit.

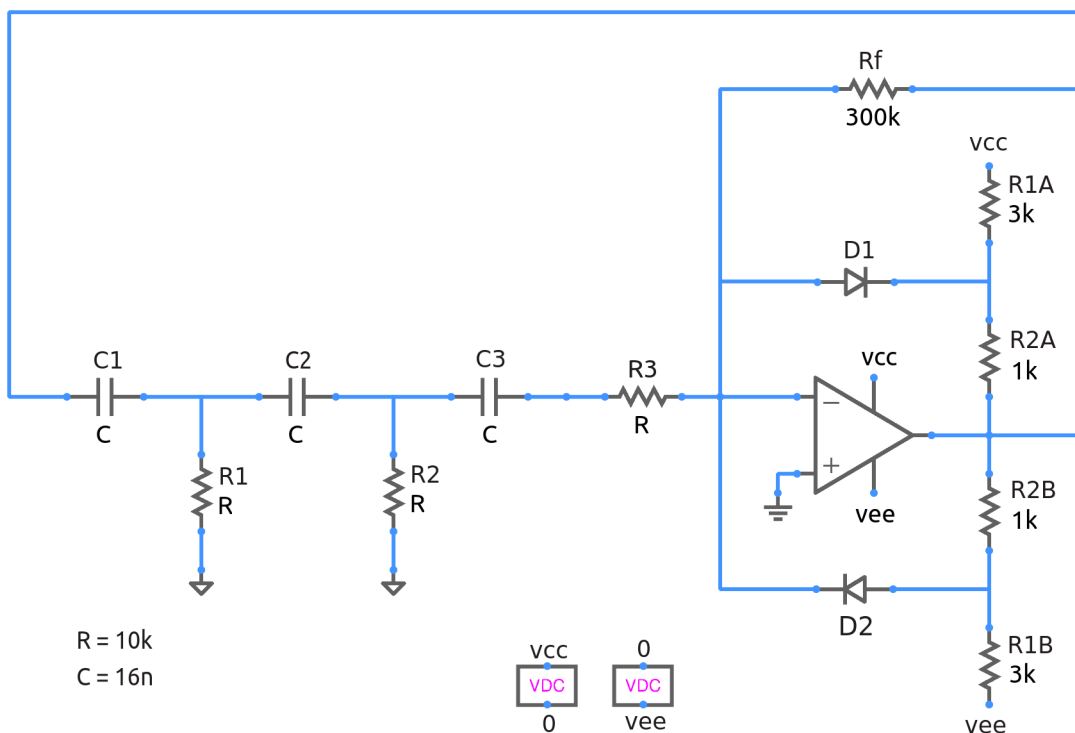


Figure 2: Complete phase-shift oscillator circuit including gain-limiting network.

Fig. 1 shows the phase-shift oscillator. The circuit oscillates at frequency $f = \frac{1}{2\pi RC \sqrt{6}}$ if the gain provided by the amplifier (implemented here with an inverting Op-Amp amplifier configuration) is equal to -29 (see ee101/ee101_osc_2.sqproj). Note that the two β

networks shown in Fig. 1 (a) and Fig. 1 (b) are equivalent since the inverting terminal of the Op Amp is at virtual ground.

In practice, a gain limiting block is also required to limit the amplitude of the oscillations.

Fig. 2 shows the complete oscillator diagram where gain limiting is achieved with a diode-resistor network.

Remark: The β networks in `ee101_osc_2a.sqproj` and `ee101_osc_3.sqproj` are different, leading to different oscillation frequencies.

Exercise Set

1. Simulate the circuit and verify that the frequency of oscillation is what you would expect from the Barkhausen criterion.
2. Decrease the capacitances in the β network by a factor of 2 and see its effect on the frequency of oscillation.

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.
3. A. S. Sedra, K. C. Smith, and A. .N. Chandorkar, *Microelectronic Circuits*, Oxford University Press, 2004.