ee101_osc_3.sqproj

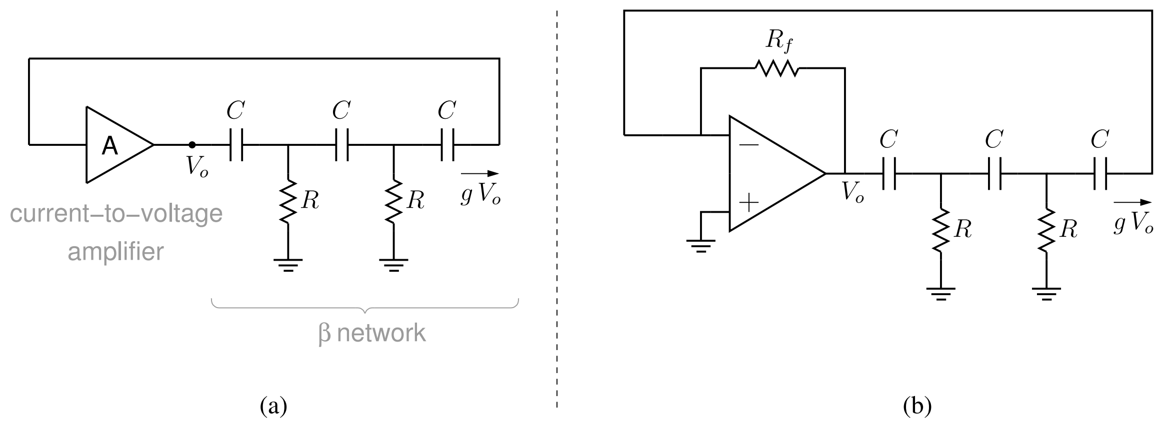

Figure 1: Phase-shift oscillator circuit: (a) block diagram, (b) Op Amp based circuit.

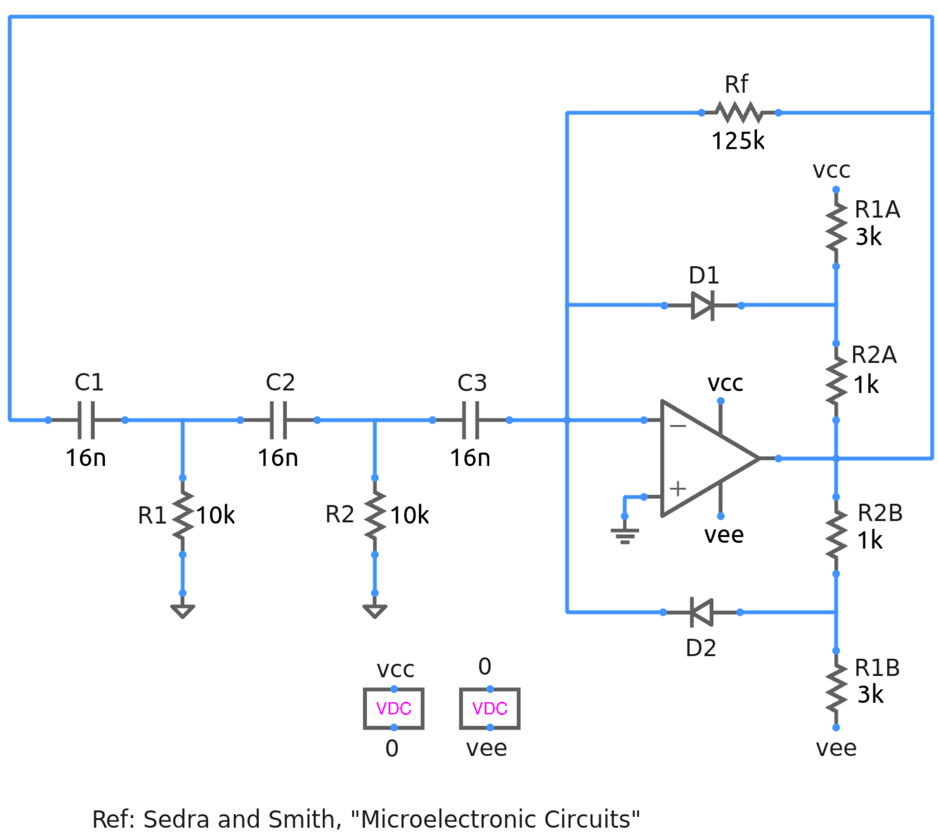

Figure 2: Complete phase-shift oscillator circuit including gain-limiting network.

Fig. 1 shows the phase-shift oscillator. The circuit oscillates at frequency $f = \dfrac{1}{2\pi RC\sqrt{3}}$ if the gain provided by the amplifier (a current-to-voltage or "transresistance" amplifier) is equal to

$-12R$ (see ee101_osc_4.sqproj). Note that the β network in ee101_osc_4.sqproj and the one appearing in 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

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