`opamp_osc_2.sqproj`

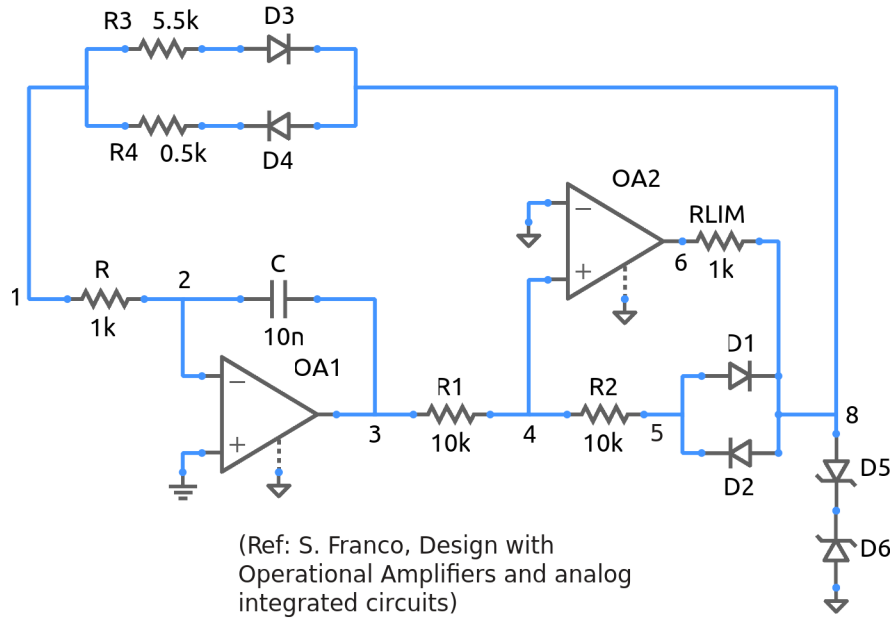(Ref: S. Franco, Design with
Operational Amplifiers and analog
integrated circuits)

An Op Amp oscillator circuit with individually controllable high and low time intervals is shown in the figure. The `OA1` part of the circuit is an integrator, and the `OA2` part works as a Schmitt trigger. The `D5`-`D6` combination clamps the output voltage V_8 to $\pm V_m$ with $V_m = (V_Z + V_D)$, where V_Z is the Zener voltage and V_D is the forward turn-on voltage of `D5` and `D6`.

Exercise Set

1. Run the simulation, and plot V_3 and V_8 versus time to get an idea of the working of the circuit.

2. Show that the threshold voltages for the Scmitt trigger are $V_T^+ = \dfrac{R_1}{R_2} (V_m - V_D)$ and $V_T^- = -\dfrac{R_1}{R_2} (V_m - V_D)$, where V_D is the turn-on voltage of the diodes (about $0.7\,\mathrm{V}$).

3. When $V_8 = V_m$, what is the capacitor current? (Note that node 2 is at virtual ground.)

4. When $V_8 = -V_m$, what is the capacitor current?

5. Using the above information and the fact that V_3 varies between V_T^+ and V_T^-, show that the high and low time intervals of V_8 are given by
$$T_H = 2\,C\,\frac{R_1}{R_2}\,(R + R_4), \quad T_L = 2\,C\,\frac{R_1}{R_2}\,(R + R_3).$$

6. Verify your T_H and T_L values with simulation.

References

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