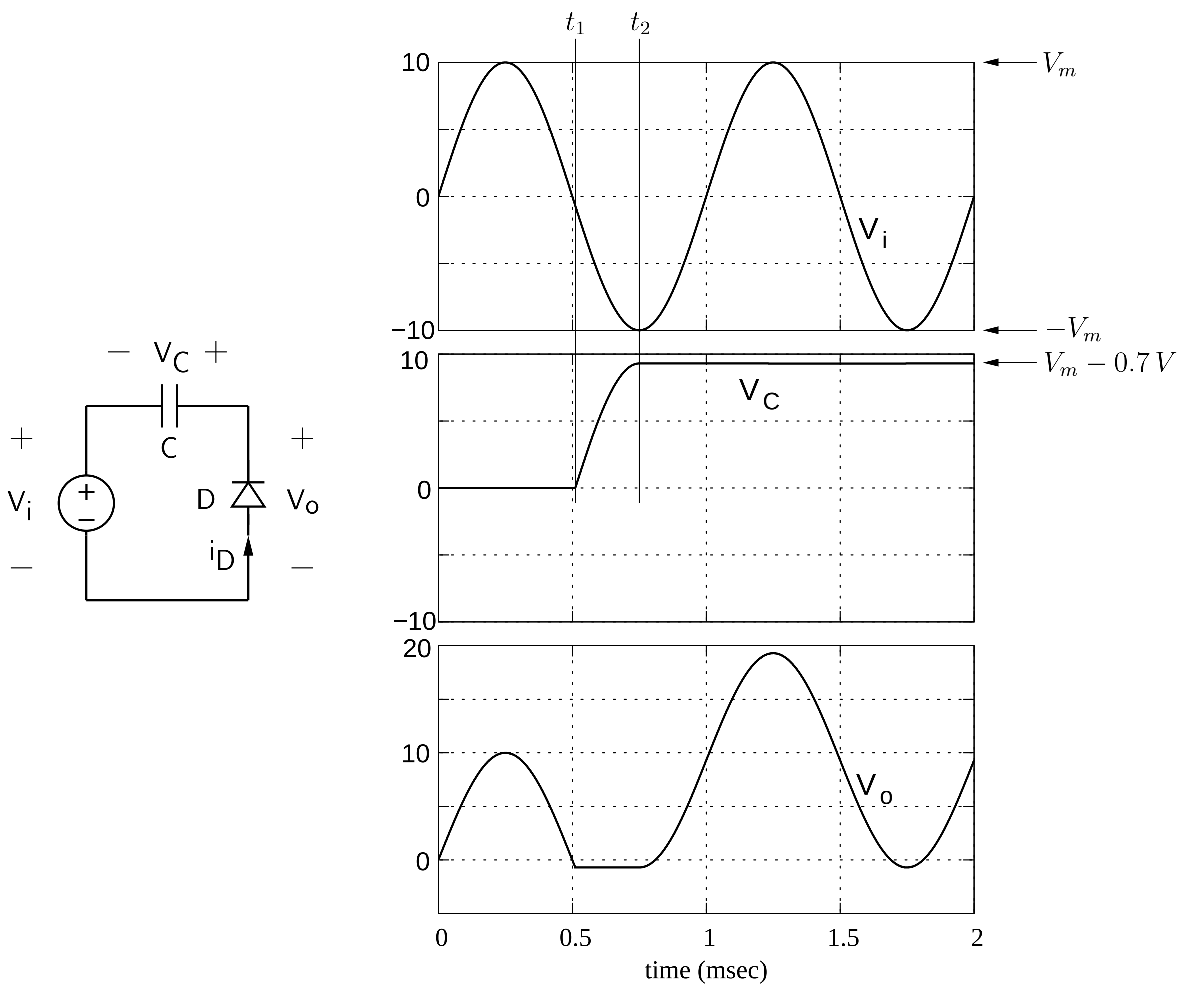
ee101_diode_circuit_6.sqproj

Description



In the circuit shown in the figure, let V_C be $0\,V$ at $t = 0$, and V_D, the diode on voltage, be $0.7\,V$. Up to time t_1, the diode does not conduct, and the capacitor voltage remains at $0\,V$. At $t = t_1$, the diode starts conducting, and the capacitor charges. The charging process is instantaneous because of the very small diode resistance. In other words, $V_C(t) = -V_i(t) + 0.7\,V$. At $t = t_2$, V_C has reached its maximum value. The capacitor subsequently holds this voltage since any decrease in V_C would require the diode to conduct in the reverse direction, which is not possible. As a result, beyond $t = t_2$, we have

$$V_o(t) = V_i(t) + V_C(t) = V_m \sin \omega t + (V_m - 0.7)\,, \tag{1}$$

i.e., the output voltage gets clamped at a minimum value of $-0.7\,V$.

Exercise Set

1. Simulate the circuit and observe the V_C and V_o waveforms along with V_i for $C=1\,\mu F$, $V_m=10\,V$, $f=1\,\text{kHz}$.
2. How will the waveforms change if C is decreased by a factor of 2? Increased by a factor of 2?
3. How will the waveforms change if the input voltage V_i has an offset voltage of $5\,V$? An offset voltage of $-5\,V$?

Verify your answers with simulation.