Op Amp Circuits: Precision Rectifiers

Experiment: Procedure/Observation

(I) Half-wave precision rectifier

1. Wire up the half-wave rectifier shown in the figure. Use $\pm 12\,\text{V}$ supply for the op amp. With a sinusoidal input V_i ($1\,\text{V}$ peak, $100\,\text{Hz}$), observe the output $V_o(t)$. Display V_o versus V_i using the X-Y mode of the oscilloscope and verify that the circuit performs half-wave rectification.

   Use of X-Y mode: Ground CH1 and CH2, put the scope in X-Y mode, and bring the beam to the centre of the screen (or a suitable location on the screen). Put CH1 and CH2 back in DC mode. Make good use of the scope resolution using the V/div knobs.

2. Increase the frequency of the input signal to $5\,\text{kHz}$ and observe $V_o(t)$. Explain your observation with reference to the waveform $V_{o1}(t)$ at the op amp output terminal.

(II) Improved half-wave precision rectifier-A

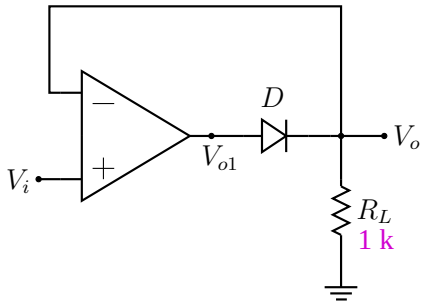
1. Repeat (I)-1 for the improved half-wave rectifier (A) shown in the figure.
2. Do you observe any distortion in the output waveform as the frequency is increased to $5\,\text{kHz}$? Explain your observation with reference to the waveform $V_{o1}(t)$ at the op amp output terminal.

(III) Improved half-wave precision rectifier-B

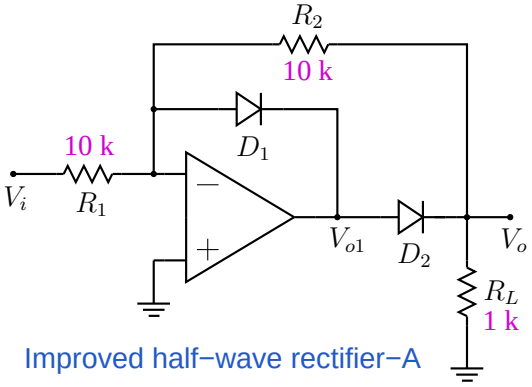
Repeat (I)-1 and (I)-2 for the improved half-wave rectifier (B) shown in the figure.

(IV) Full-wave precision rectifier

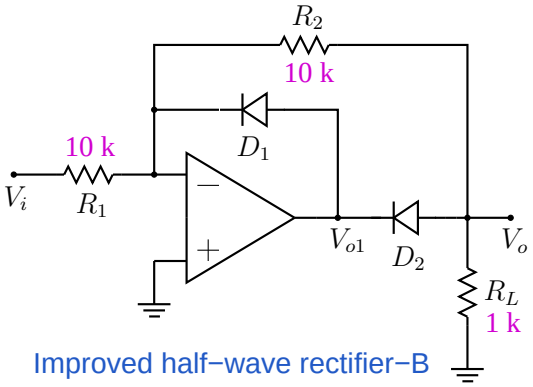
1. Wire up the full-wave rectifier circuit shown in the figure and verify its operation with a sinusoidal input voltage ($1\,\text{V}$ peak, frequency ranging from $100\,\text{Hz}$ to $5\,\text{kHz}$).
2. Observe the waveform $V_o'(t)$ at the output terminal of the op amp and comment on whether the op amp is working in the linear or saturation region.



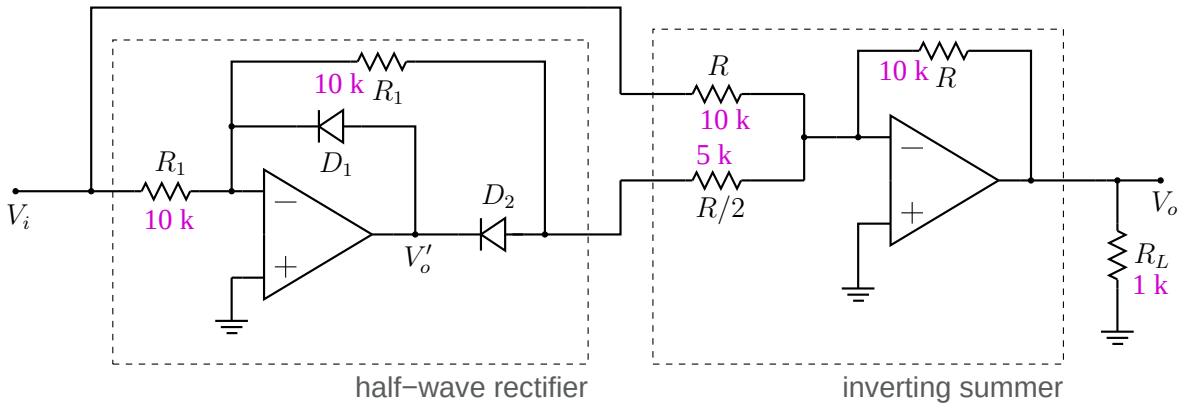
Half−wave rectifier



Improved half−wave rectifier−A



Improved half−wave rectifier−B



Full−wave rectifier