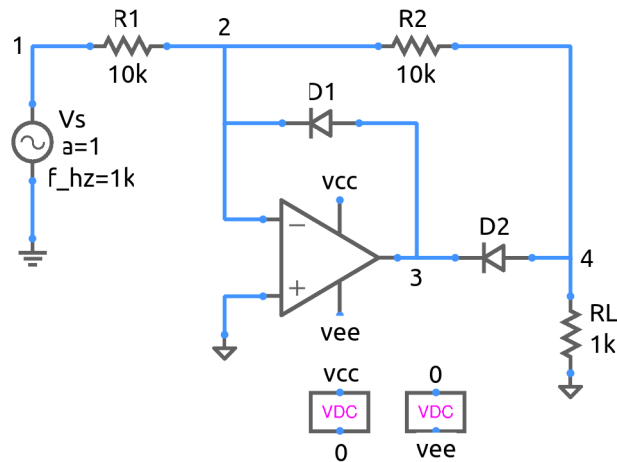# precision_half_wave_2.sqproj

A precision half wave rectifier circuit is shown in the figure. In this circuit, the feedback loop is closed either with D_1 conducting or D_2 conducting, and the Op Amp operates in the linear regime (which is a desirable feature since the Op Amp does not need to come out of saturation when the input voltage changes sign). The inverting terminal of the Op Amp is therefore at virtual ground.

When D_1 conducts, $V_3 = 0.7\,\text{V}$. In this situation, D_2 cannot conduct (show this), and the output voltage V_4 is zero. This happens when $V_i < 0\,\text{V}$.

In the other case ($V_i > 0\,\text{V}$), D_2 conducts, and the circuit operates like an inverting amplifier, with $V_o = -\dfrac{R_2}{R_1} V_i$.

Exercise Set

1. For the parameters shown in the figure, plot (on paper) V_o, I_{D1}, I_{D2} versus time. Verify with simulation.

2. Plot (on paper) the output of the Op Amp (V_3) versus time. Verify with simulation. Note that the Op Amp does not enter saturation.

3. How will the above plots change if R_2 is doubled? Verify with simulation.

References

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

2. A. S. Sedra, K. C. Smith, and A. N. Chandorkar, *Microelectronic Circuits: Theory and Applications*, Fifth edition, Oxford University Press, 2009.

3. J. Millman and A. Grabel, *Microelectronics,* McGraw-Hill, 1988.