Outline

- Diodes and Power supplies

Power Supplies

- Consists of
  - Transformer: transform 110-V AC to 6.3-V AC.
  - Diode: rectify (only one side of sine
  - Capacitor to remove the “ripples.”

- How do they work together?

Transformer

- When there is a coil (inductor), with applied voltage of \( V_{in}(t) = V_0 \cos \omega t \), then
  \[ N_1 \frac{d\Phi}{dt} = V_{in}(t), \]
  where \( N_1 \) is the number of turns in the coil.
- Now, add another coil on the same core.
- Each turn of the 2\textsuperscript{nd} coil sees \( B \) flux of
  - \( \Phi \)
- Then \( V_{out}(t) = \)
  - \( -N_2 \frac{d\Phi}{dt} = (N_2/N_1)V_{in}(t). \)

Rectifier (diode)

- It is a short circuit in one direction, and
- Open circuit in the other direction.
- So if 6.3-V AC comes out of the transformer,
- \( V_D \) will look like:

- If you need to deal with more precise I-V characteristics, it’s
  \( I = I_0 [e^{(eV/kT)} - 1] \), where \( I_0 \) is minority carrier current ~ reverse current. For a typical forward current \( V = kT/e \) \ln(II_0) ~ 0.7 (0.5) V for silicon (germanium) diodes.
• $V_D =$
• What does the capacitor do?

Finally w/load (resister)
• When $V_{out}$ is low, the resister draws charges from the capacitor, so …
A bit more efficient

If you have two windings on the secondary side of the transformer, this circuit gives you less ripple because
• Instead of getting sine-wave signal from transformer into a diode, if some signal input is differentiated before it is fed to a diode (like above), what does this do?
• Can this circuit be used for an oscilloscope trigger circuit?
• Crystal radio example! LC circuit-resonance and rectifying.