Electronic Devices and Circuits

EME306

(Summer 2021-2022)

Lecture 4

Diode Applications

INSTRUCTOR

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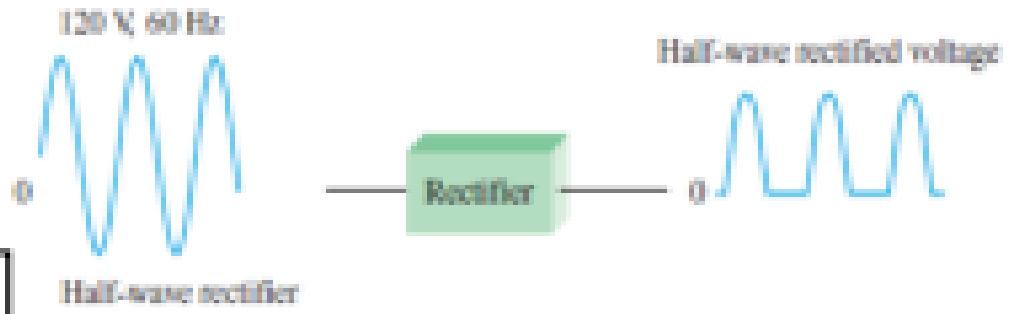
The Half-Wave Rectifier

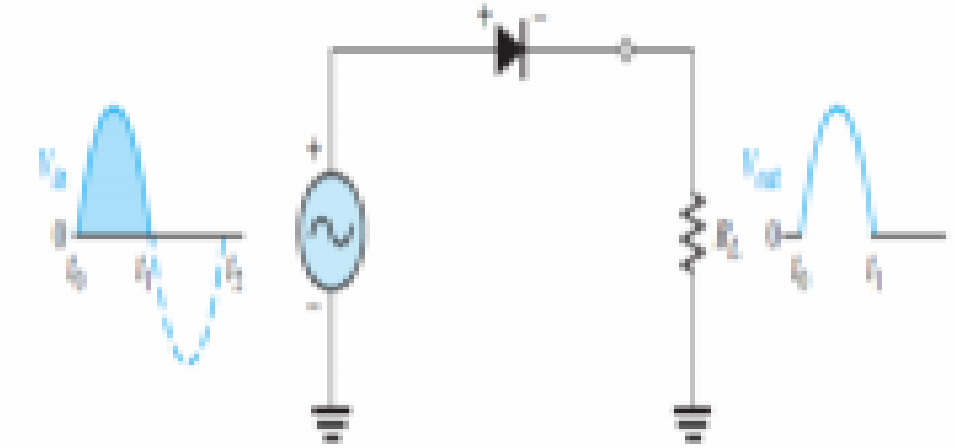
- A half-wave rectifier allows current through the load only during one-half of the cycle.



During +ve half cycle (t_0-t_1)

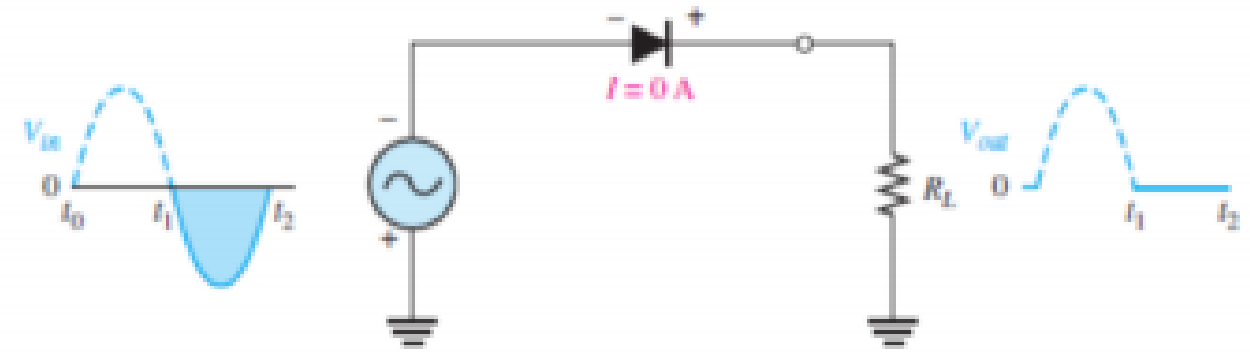
- For diode is ideal, so it is on, and be like short circuit

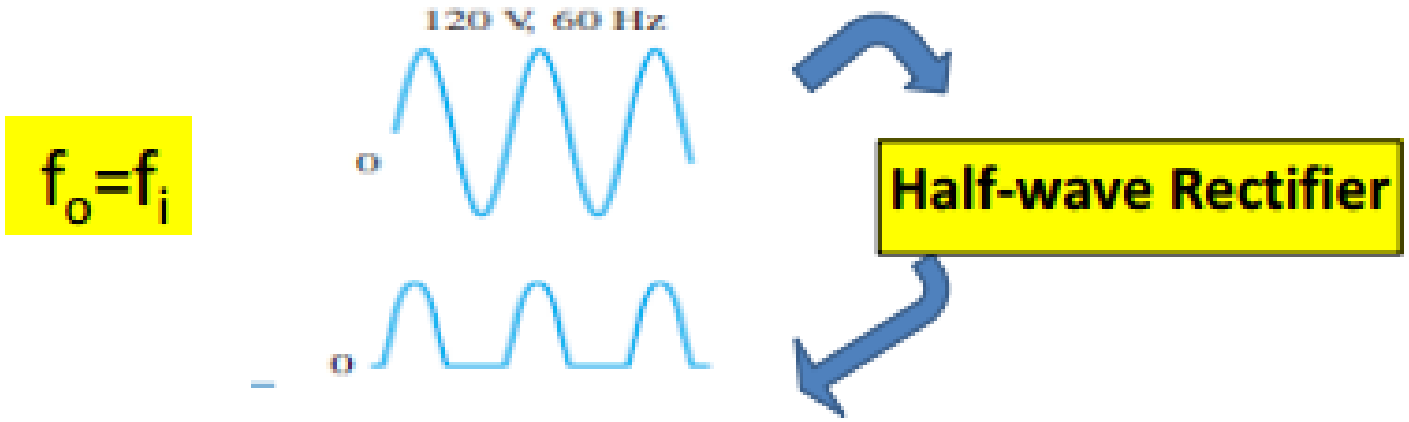
Then $V_o=V_i$



During -ve half cycle (t_1-t_2)

- Diode is off, so no current pass and voltage drop on resistor is zero Then V_o=0 V





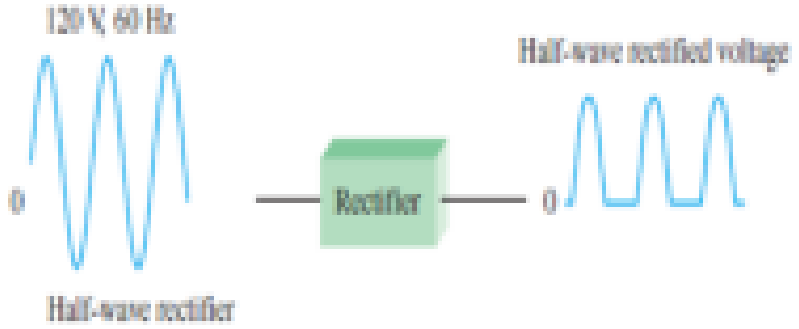
Average value

- Corresponding to how much the Dc value obtained form an alternating signal

For half-wave rectifier

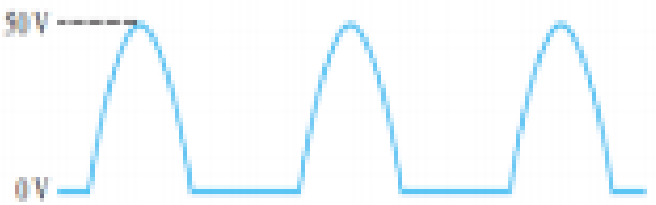
$$V_{avg} = \frac{1}{T}\int_0^T V(t)\,dt$$

$$V_{avg} = \frac{v_p}{\pi} = 0.318 v_p$$



Example

What is the average value of the half-wave rectified voltage shown?



$$V_{avg} = \frac{v_p}{\pi} = \frac{50}{\pi} = 15.9v$$

Effect of the Barrier Potential (VD=0.7v) on the Half Wave Rectifier output

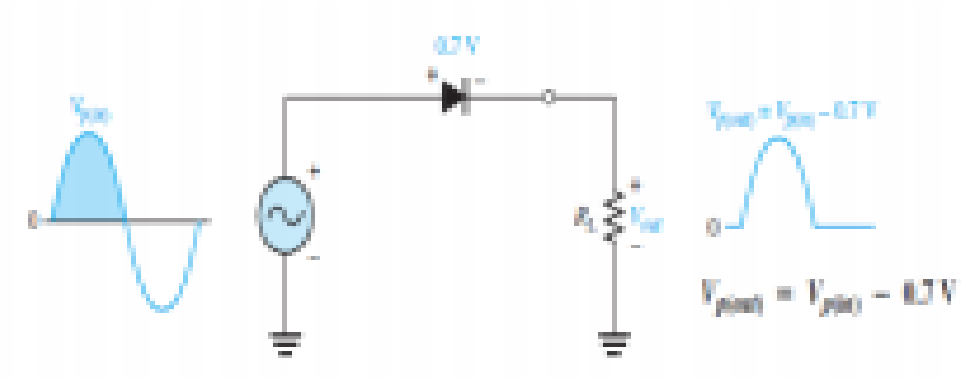
During +ve half cycle

For V_D=0.7 v,

- When V_i< 0.7 v,

then diode off and V_o=0

- When $V_i \geq$ 0.7 v, then diode on and $V_o=V_i-0.7$



During -ve half cycle

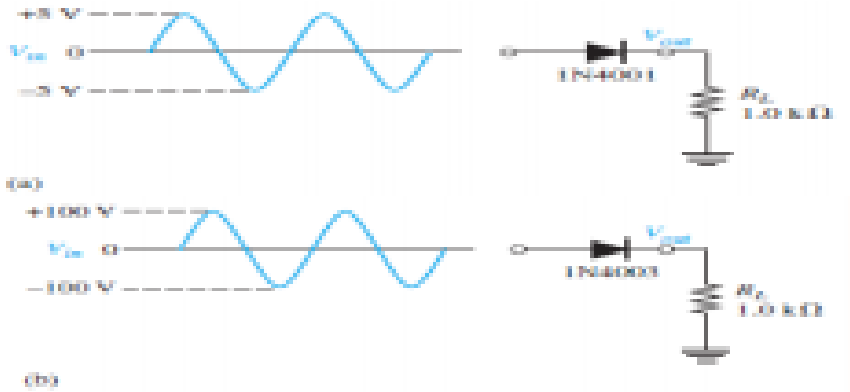
diode is off, so no current pass and voltage drop on resistor is zero , Then V_o=0 V

Example

Draw the output voltages of each rectifier for the indicated input voltages, as shown in Figure, where 1N4001 and 1N4003 are specific rectifier diodes with V_D=0.7 when be on

For circuit in Fig (a)

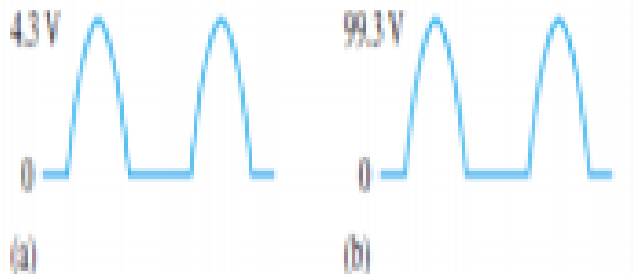
$$V_{p(out)} = V_{p(in)} - 0.7\ \text{V}$$
$$= 5\ \text{V} - 0.7\ \text{V} = \mathbf{4.30\ V}$$



For circuit in Fig (b)

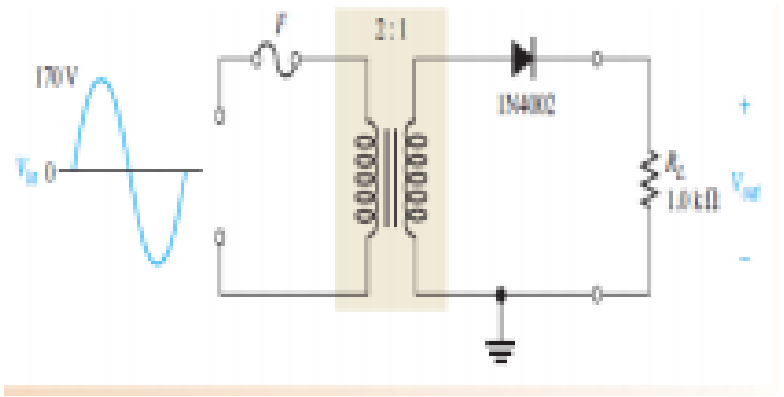
$$V_{p(out)} = V_{p(in)} - 0.7\ \text{V}$$
$$= 100\ \text{V} - 0.7\ \text{V} = \mathbf{99.3\ V}$$

For –ve half cycle, both circuits are off



Example

Determine the peak value of the output voltage.

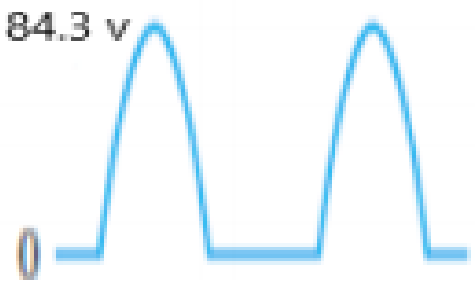


The peak secondary voltage is

$V_{p(sec)} = 0.5(170\ V) = 85\ V$

$V_{p(out)} = V_{p(sec)} - 0.7\ V$

$= 85\ V - 0.7\ V = 84.3\ V$



Thank you