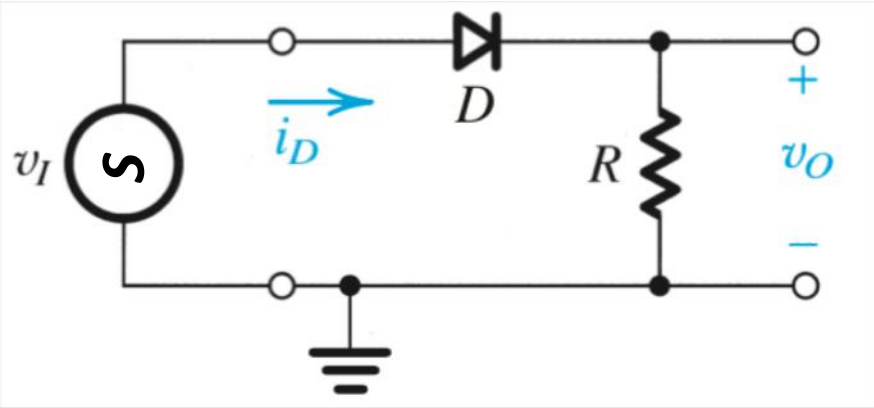
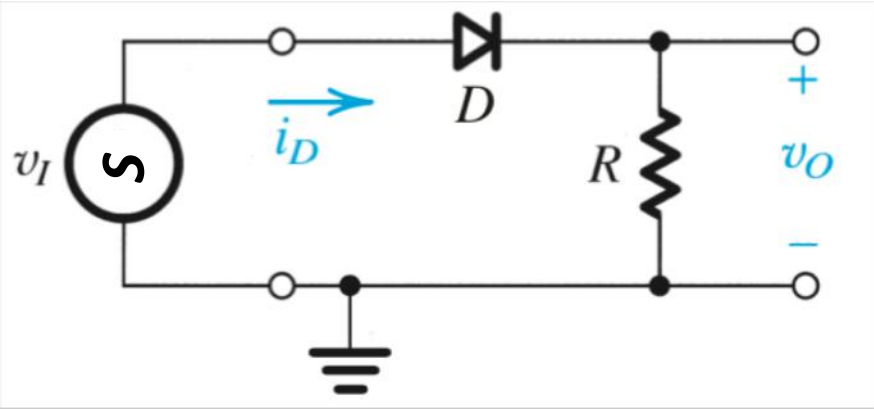
Rectifiers Revisited 1

Improvements

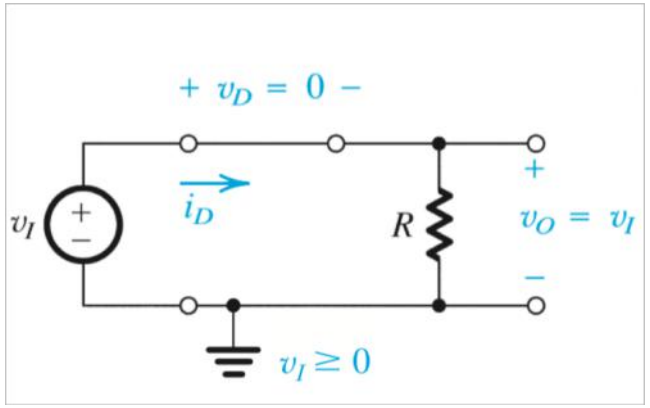
Half wave rectifier



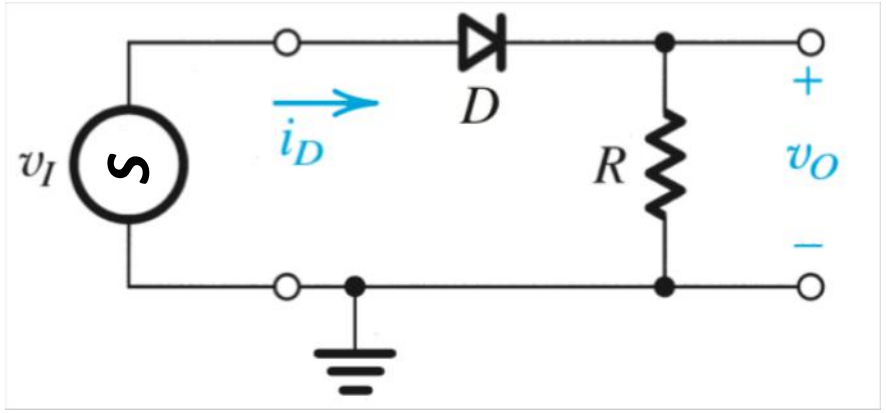
Half wave rectifier



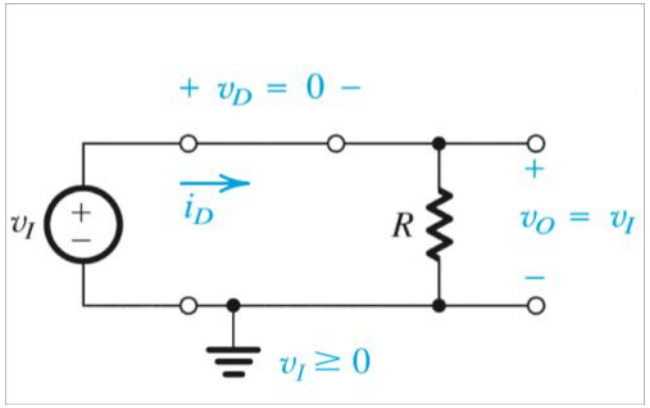
Assuming ideal diode

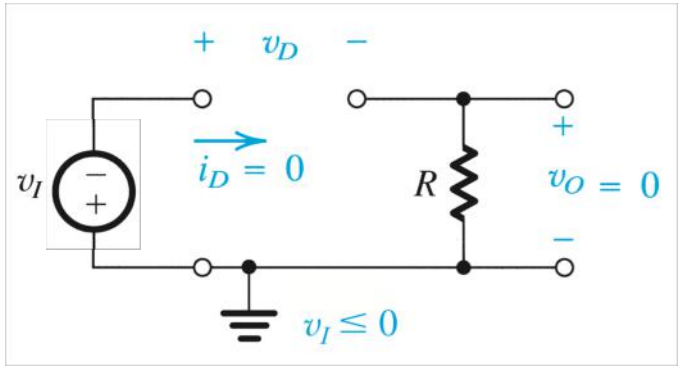


Half wave rectifier

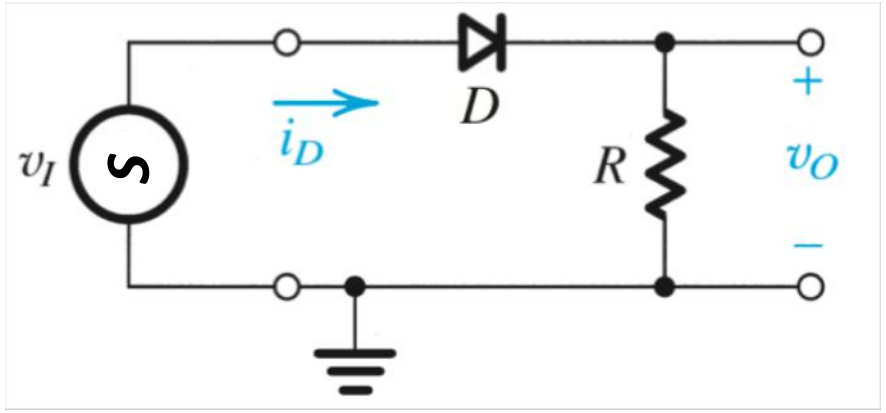


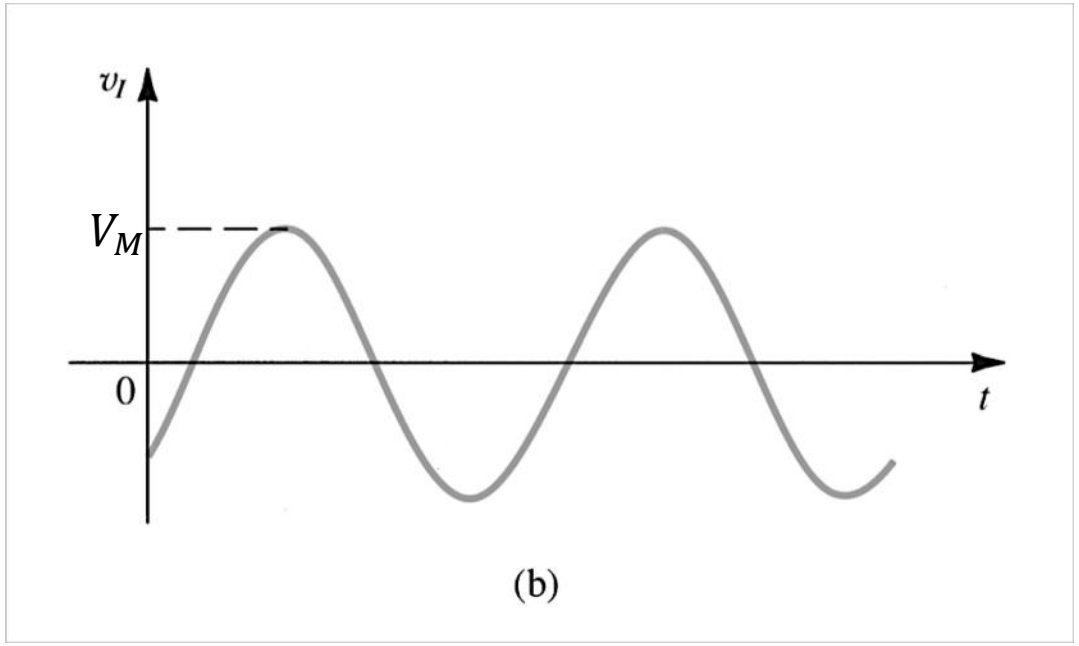
Assuming ideal diode



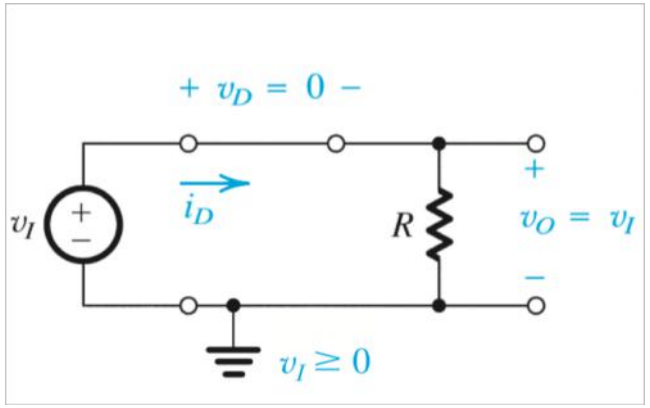


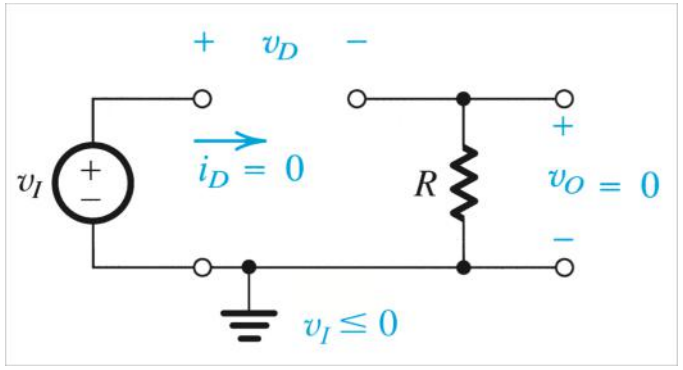
Half wave rectifier



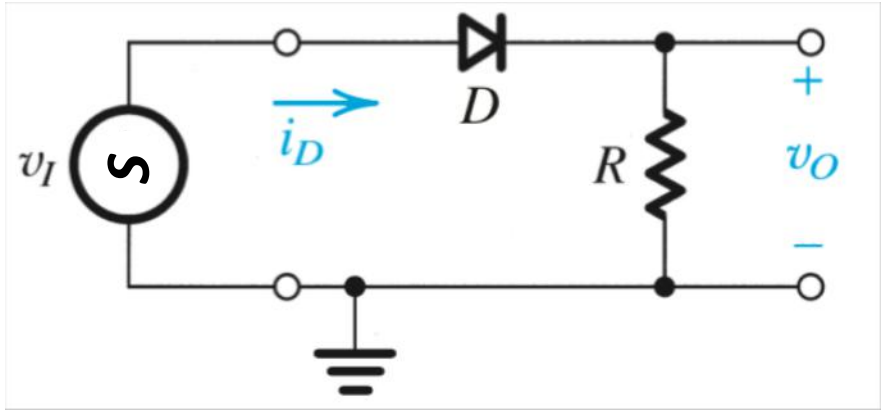


Assuming ideal diode

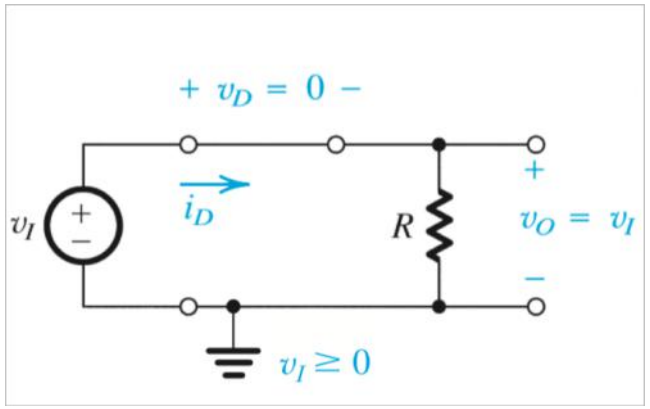


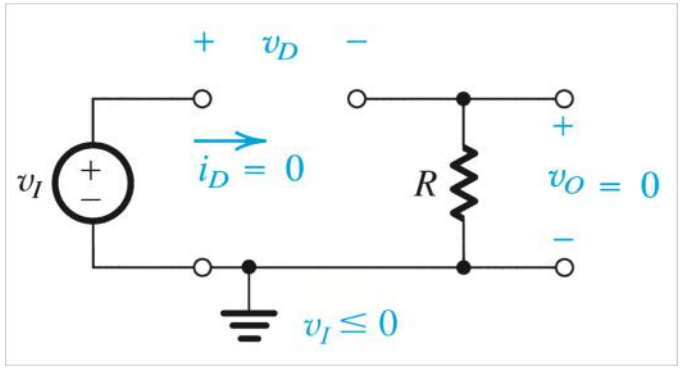


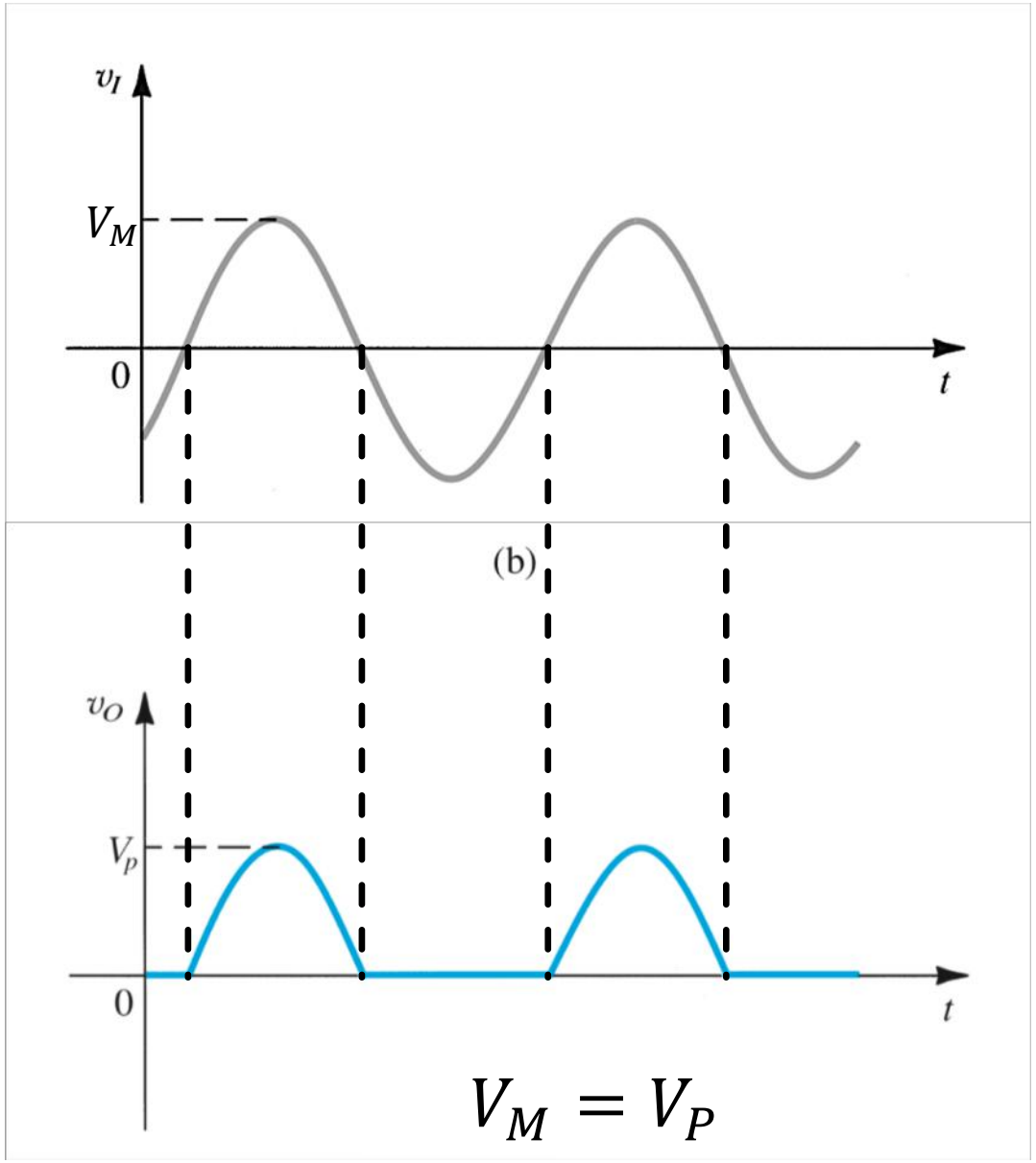
Half wave rectifier



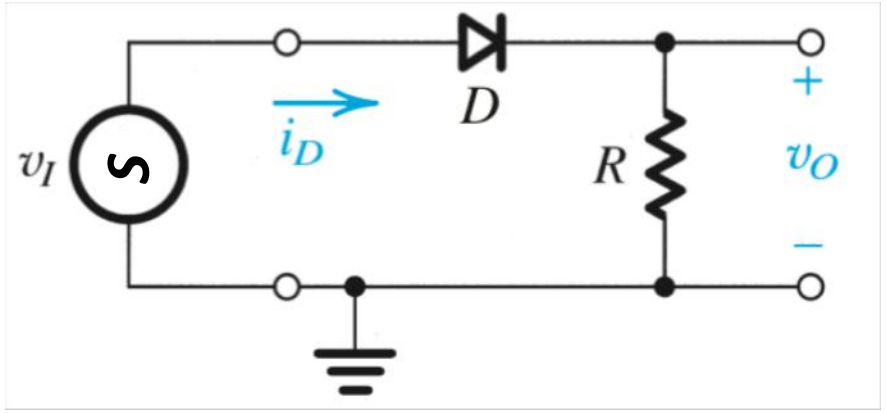
Assuming ideal diode



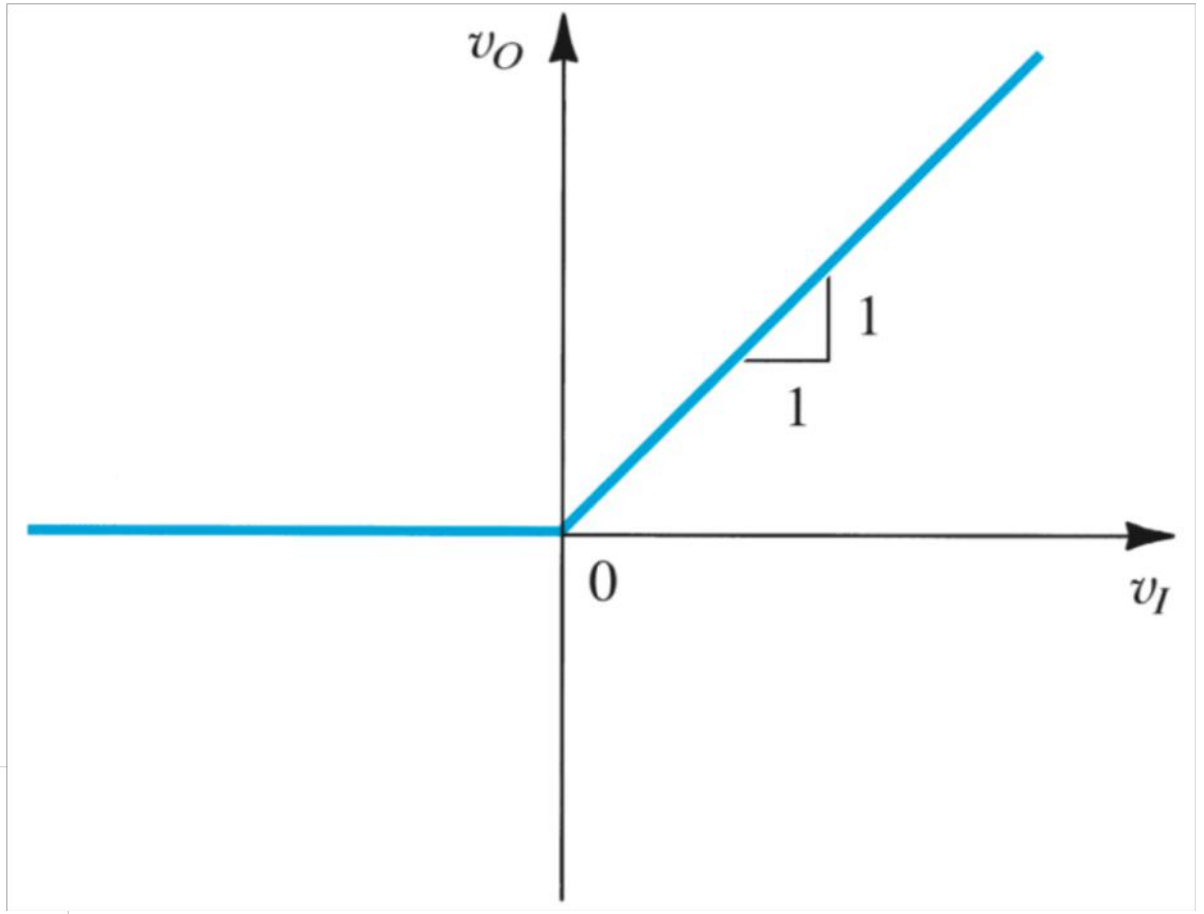




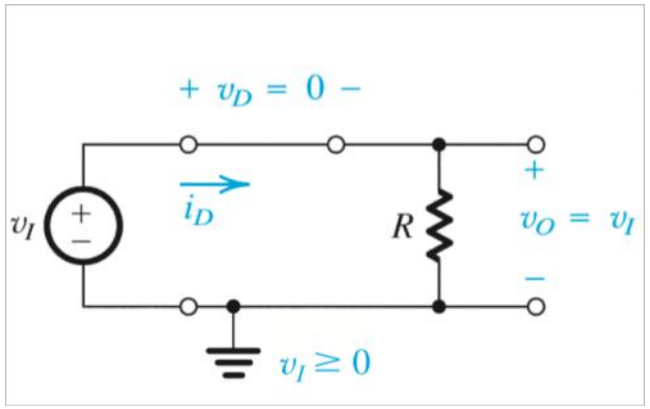
Half wave rectifier

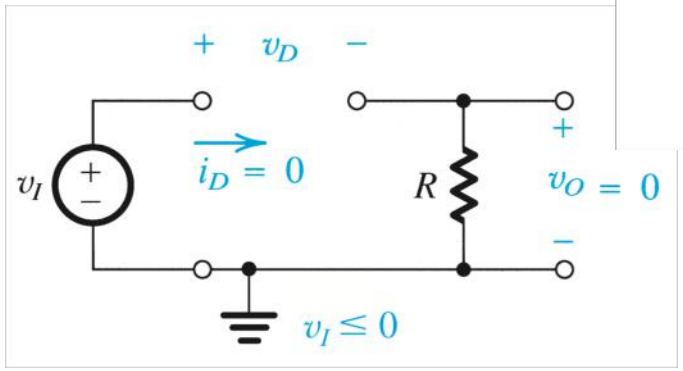


Transfer Characteristics

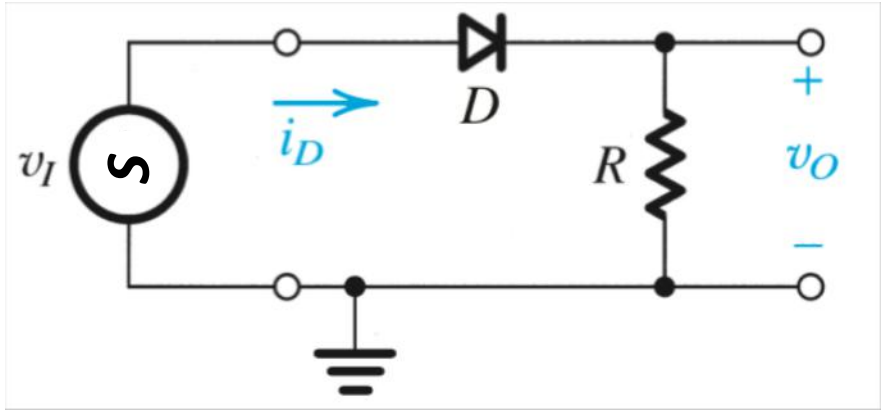


Assuming ideal diode

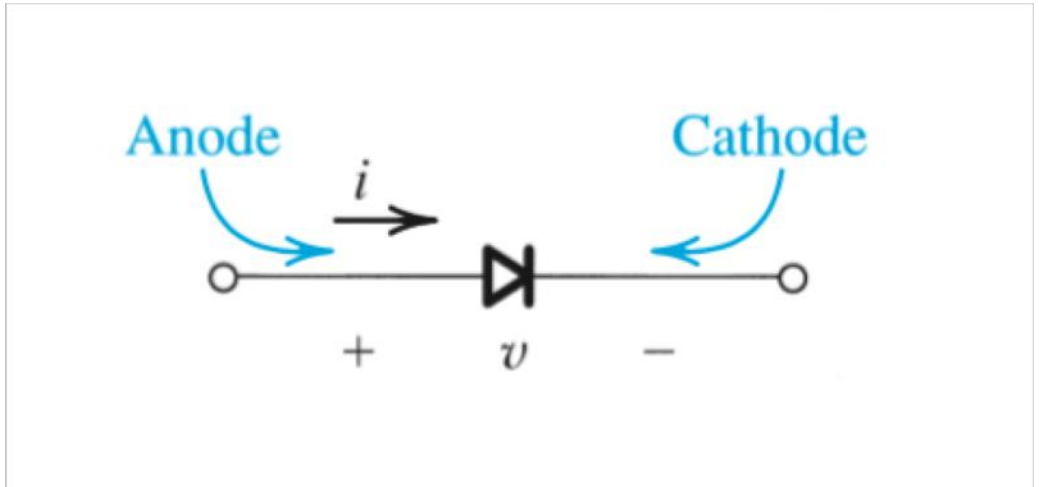


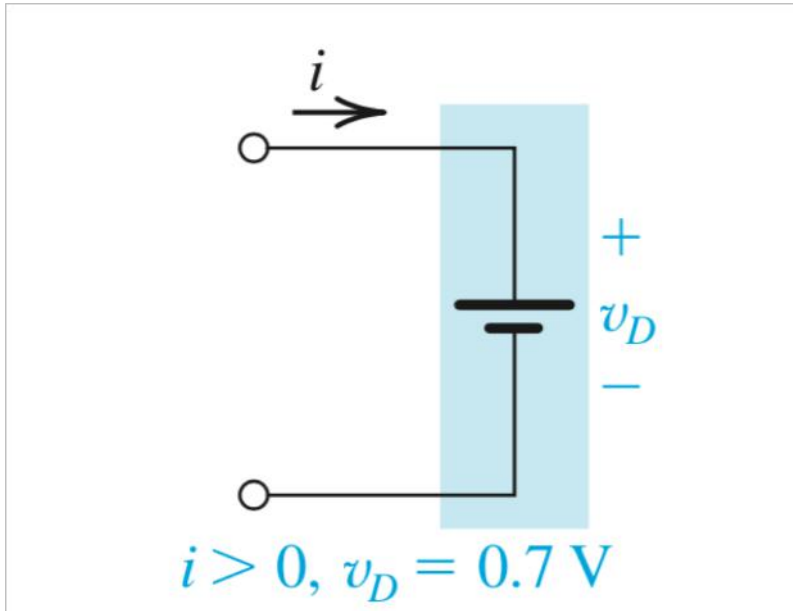


Half wave rectifier

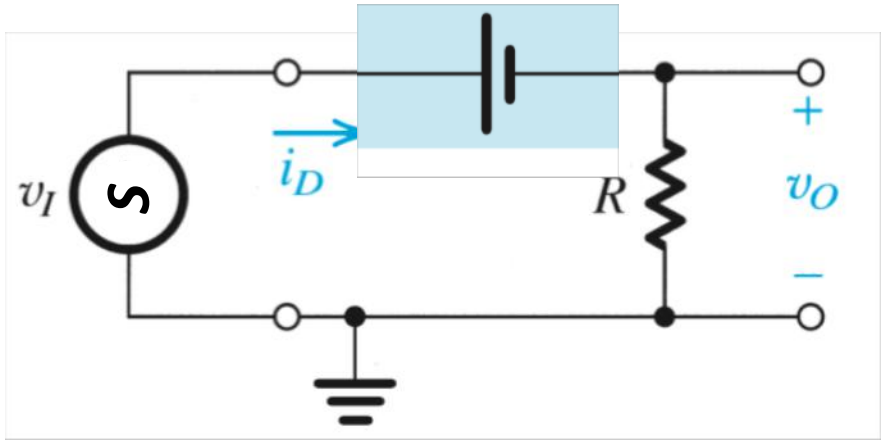


Real diode

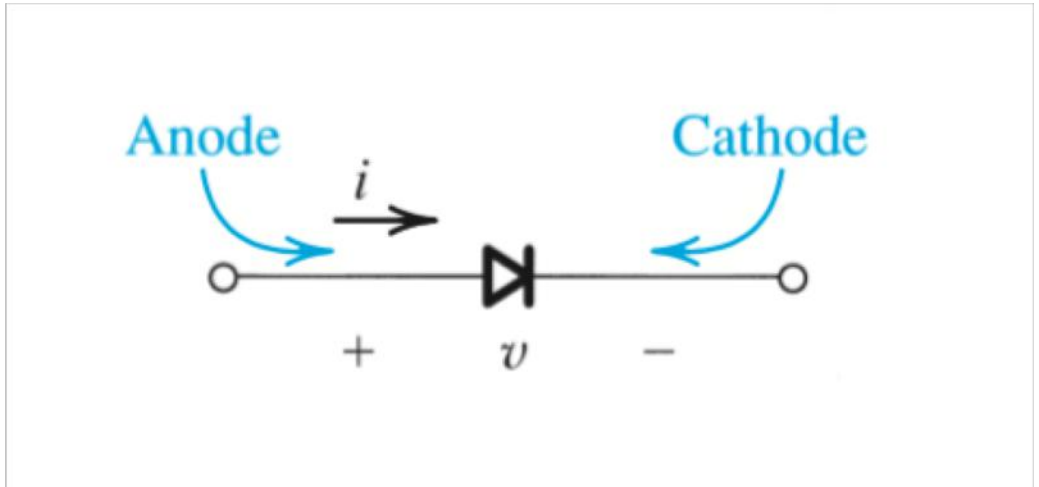


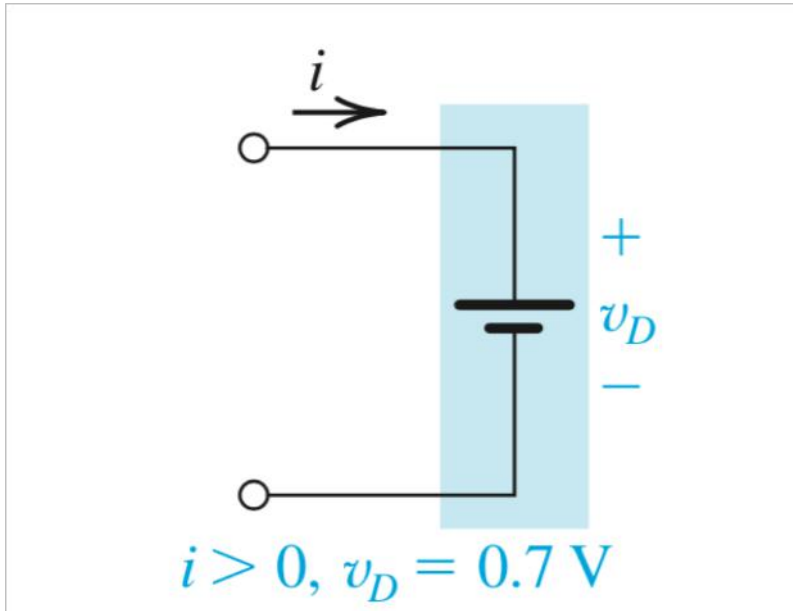


Half wave rectifier

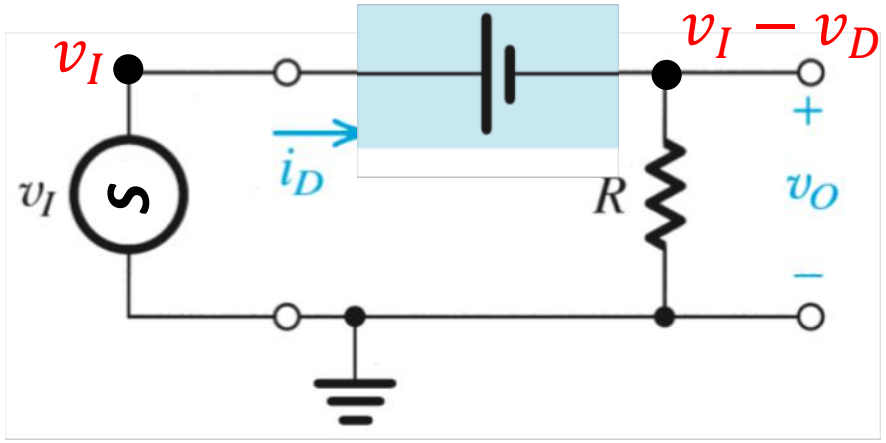


Real diode

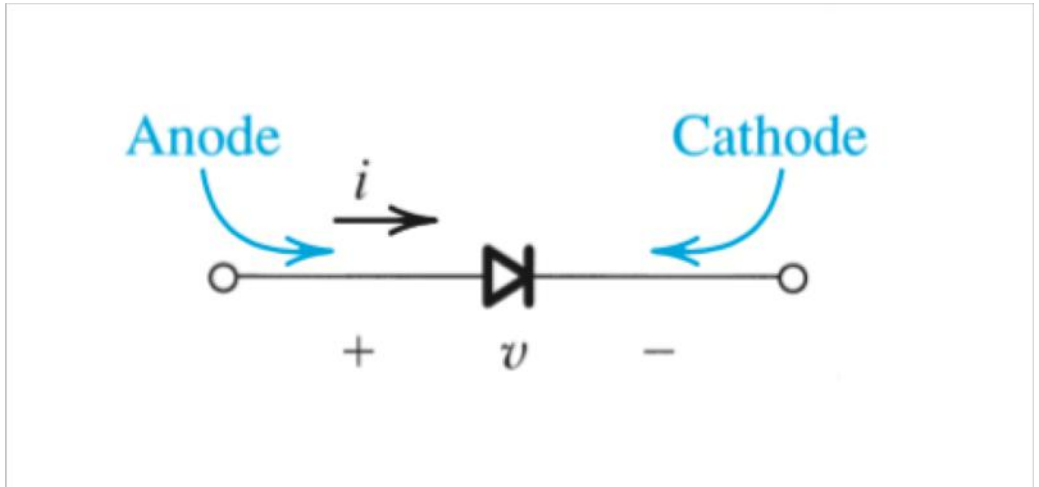


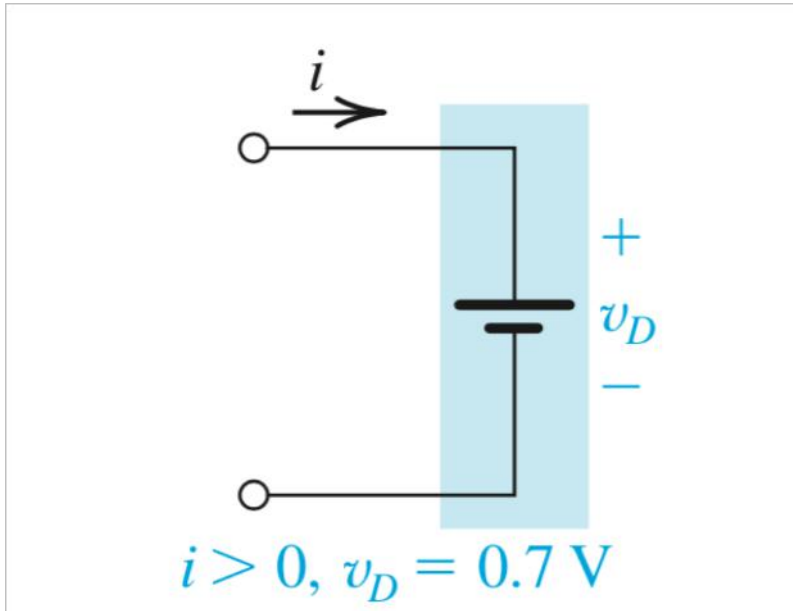


Half wave rectifier

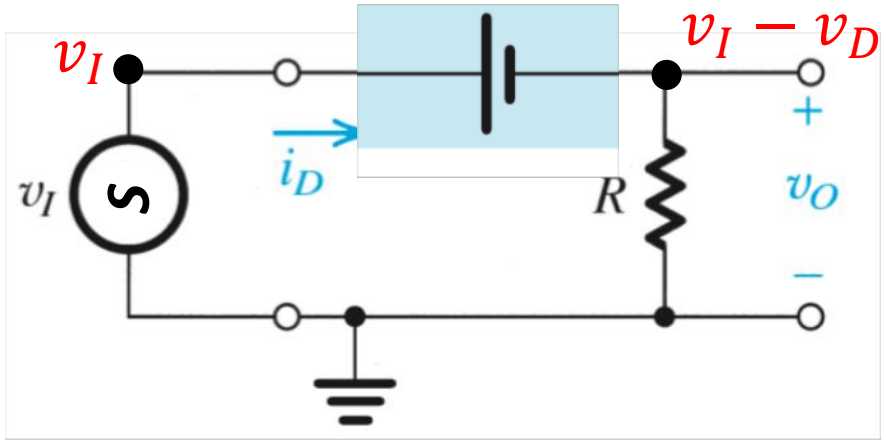


Real diode



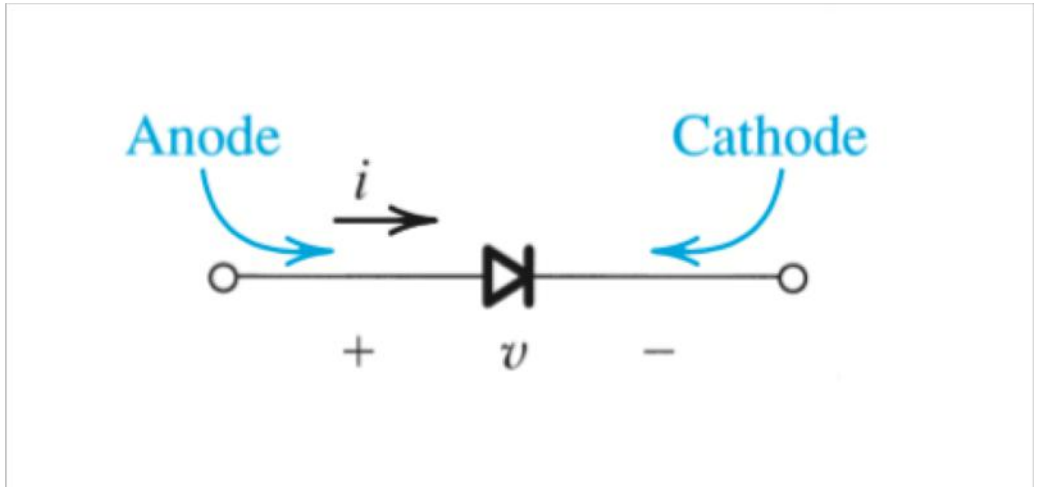


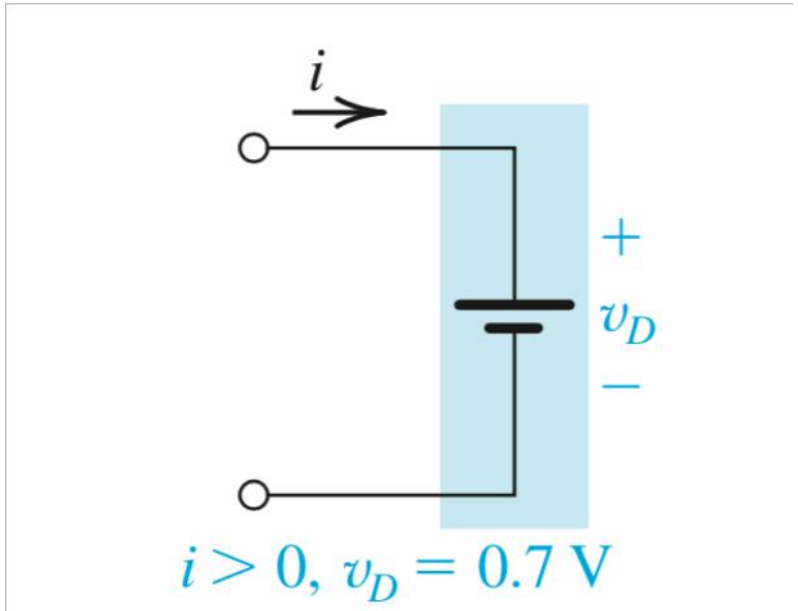
Half wave rectifier



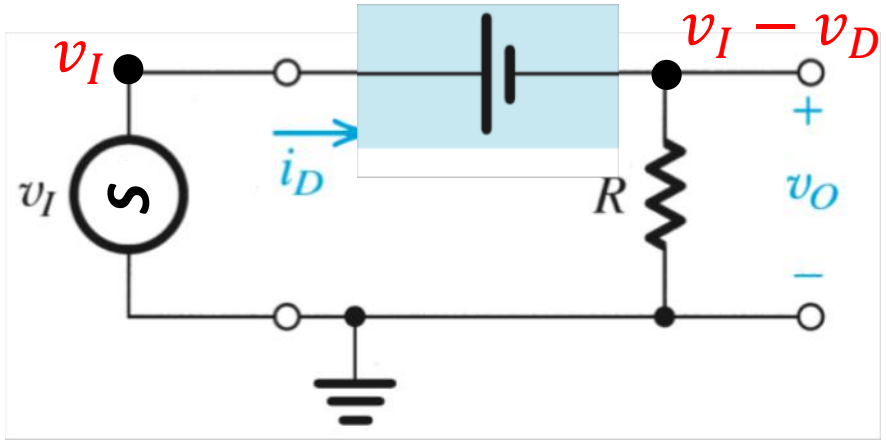
$$I_R = \frac{v_I - V_D}{R}$$

Real diode





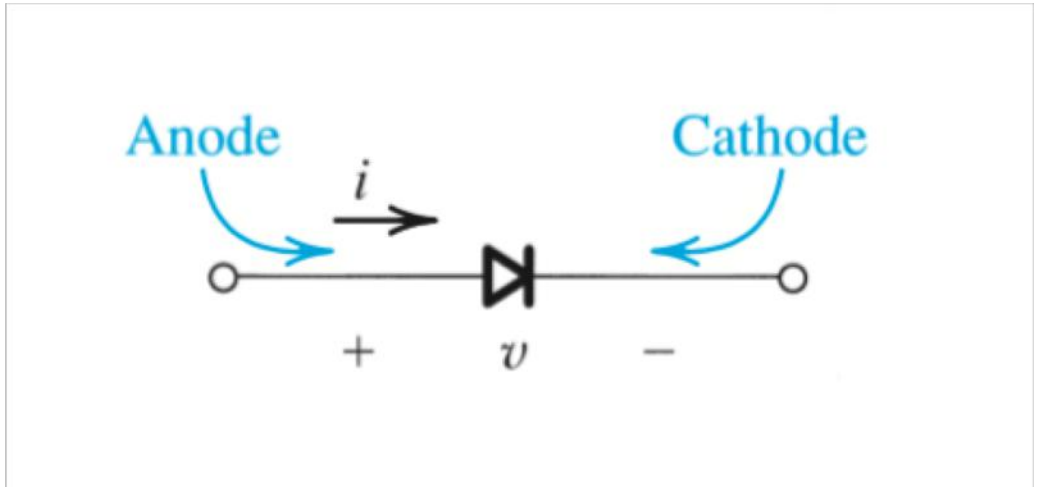
Half wave rectifier

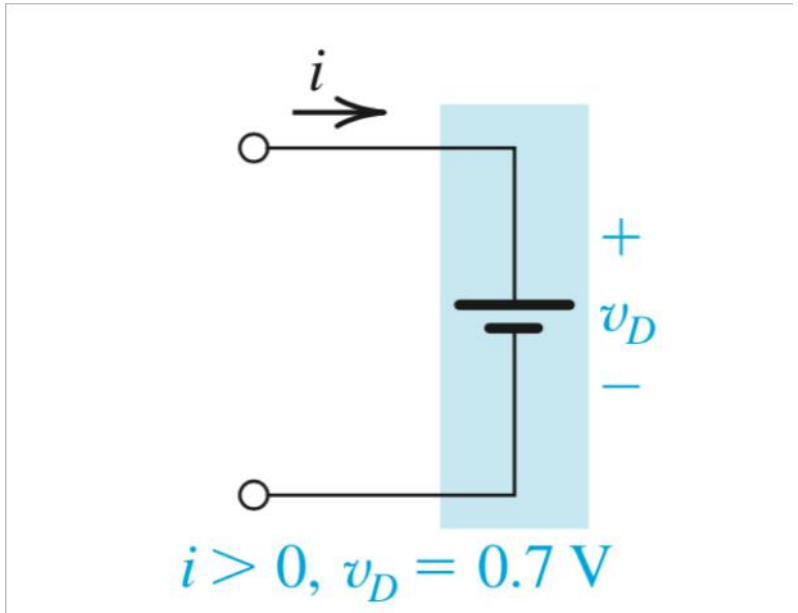


$$I_D = \frac{v_I - v_D}{R}$$

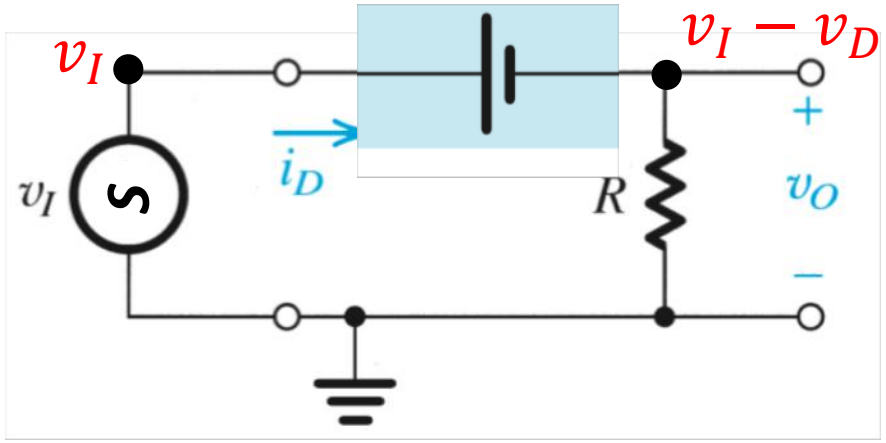
So diode on when $I_D > 0$ hence when $v_I > v_D$

Real diode





Half wave rectifier

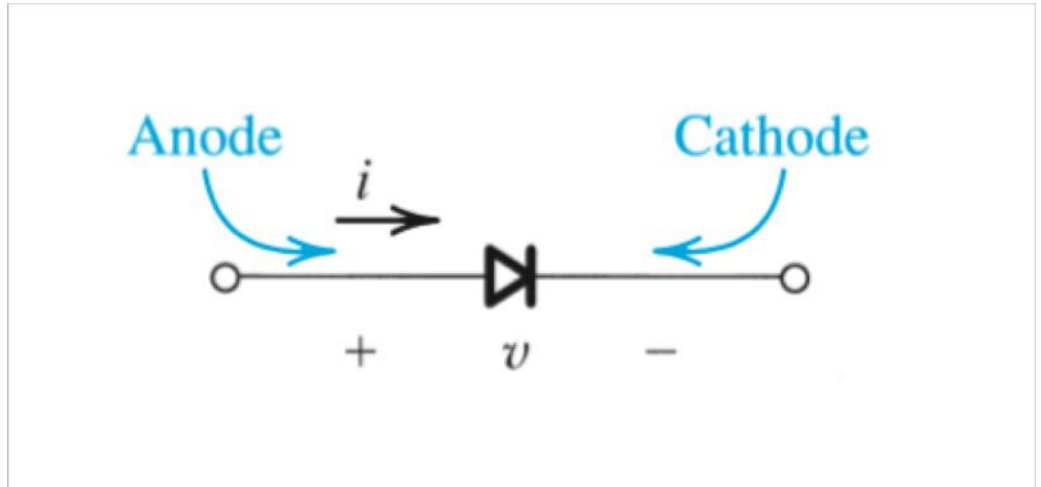


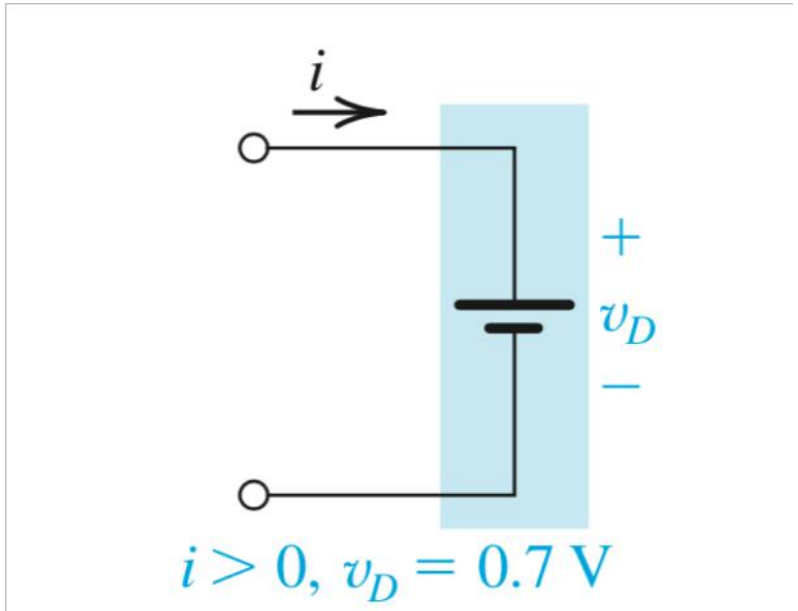
$$I_D = \frac{v_I - v_D}{R}$$

So diode on when $I_D > 0$ hence when $v_I > v_D$

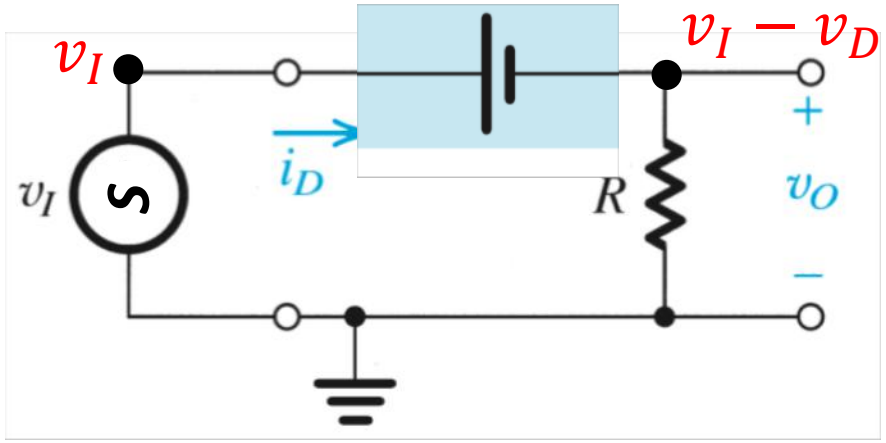
When on, $v_o = v_I - v_D$

Real diode





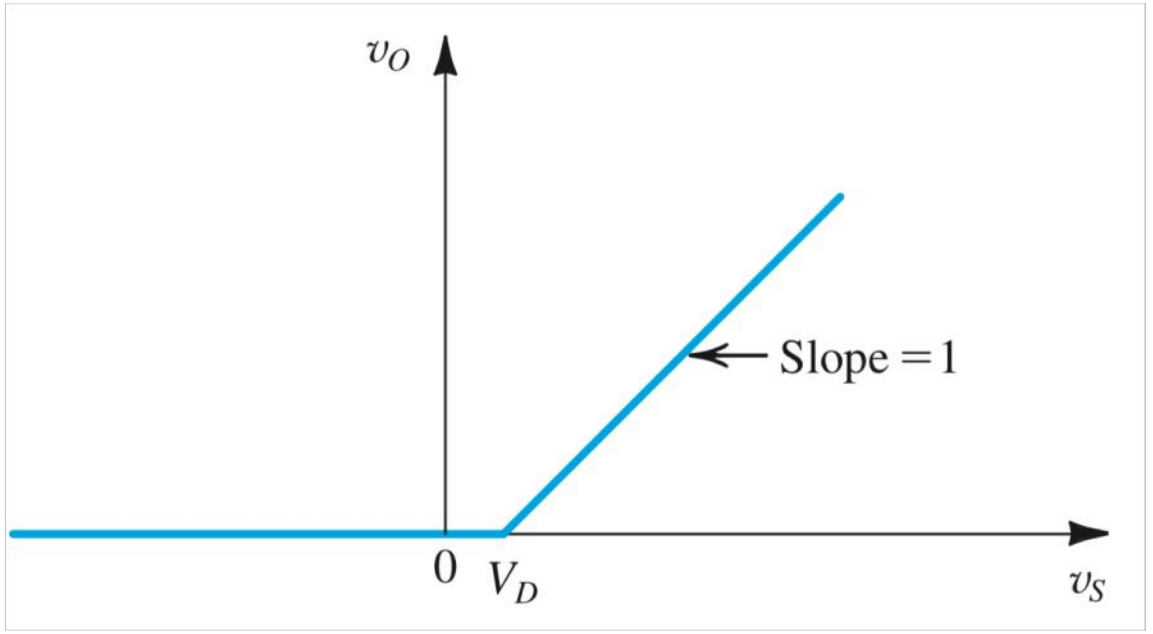
Half wave rectifier



$$I_D = \frac{v_I - v_D}{R}$$

So diode on when $I_D > 0$ hence when $v_I > v_D$

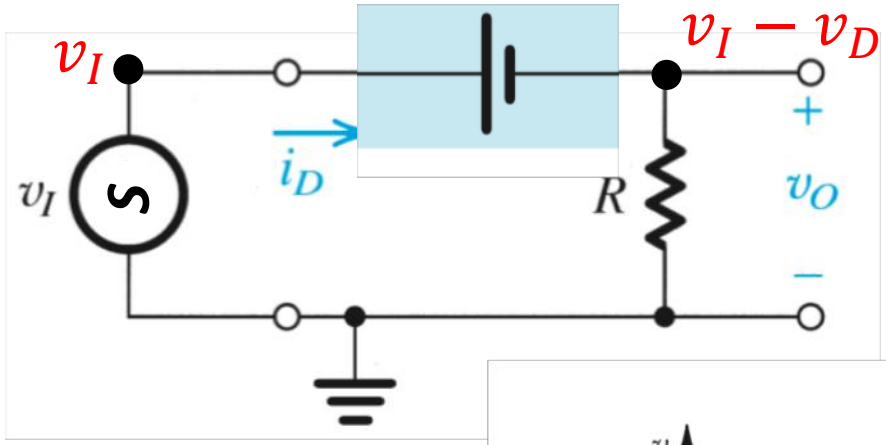
When on, $v_o = v_I - v_D$



$$y = x - v_D$$

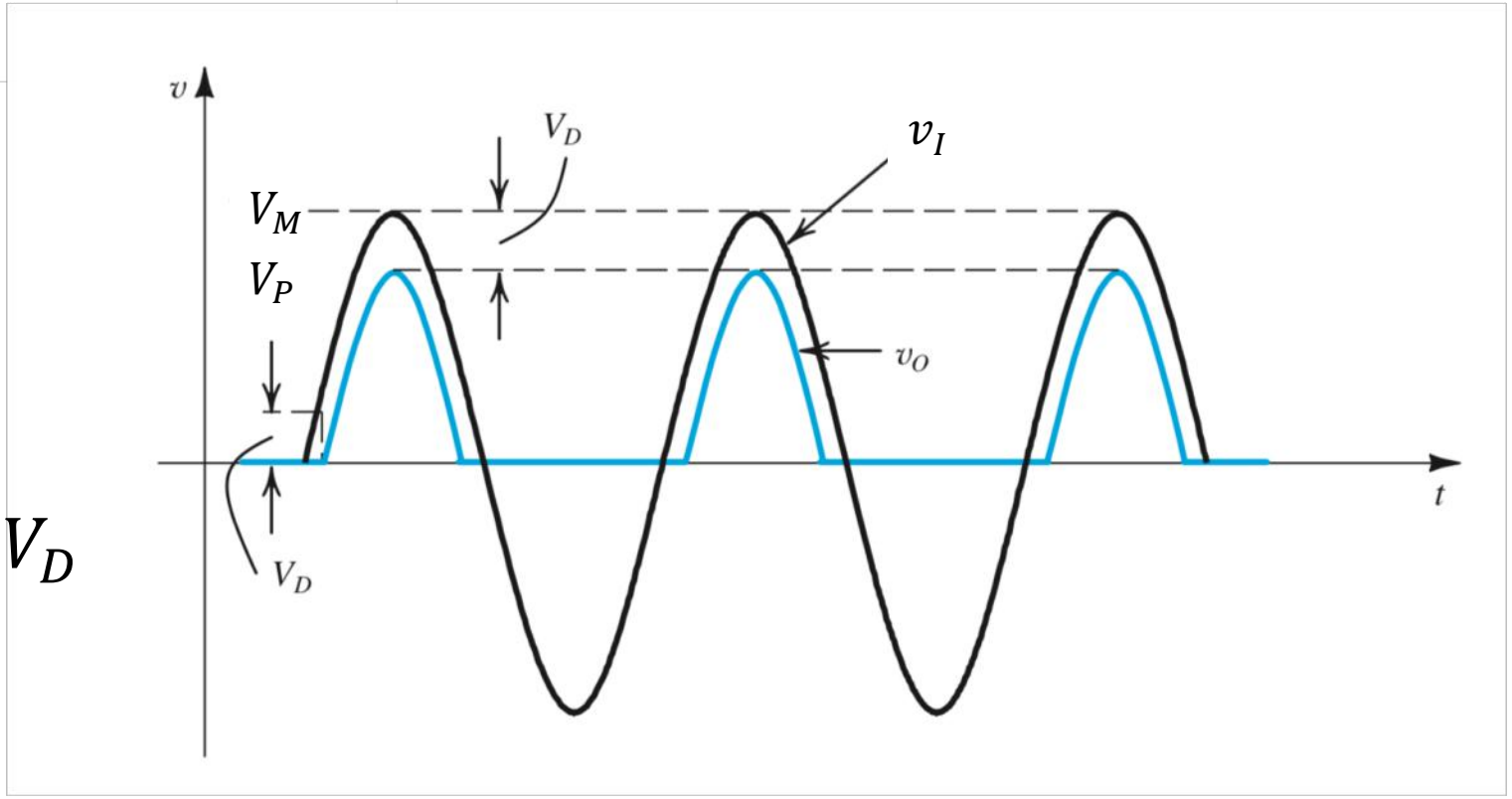
Half wave rectifier

$$I_D = \frac{v_I - v_D}{R}$$



So diode on when $I_D > 0$ hence when $v_I > v_D$

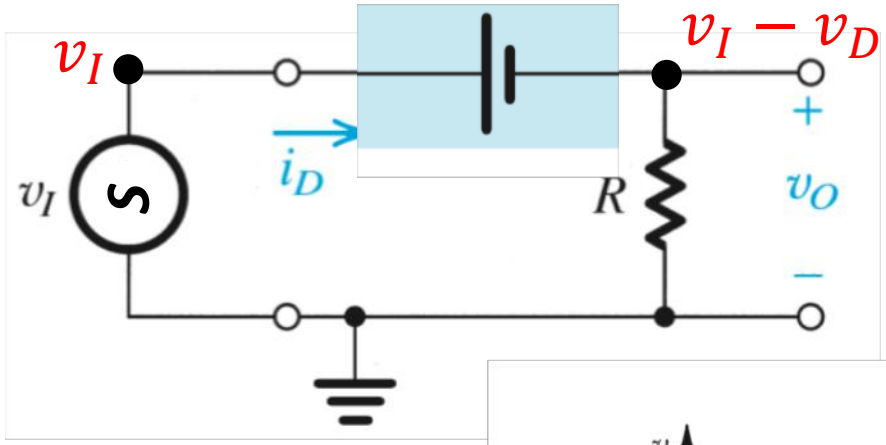
When on, $v_o = v_I - v_D$



$$v_I = V_M \sin \omega t$$
$$v_o = V_M \sin \omega t - V_D$$

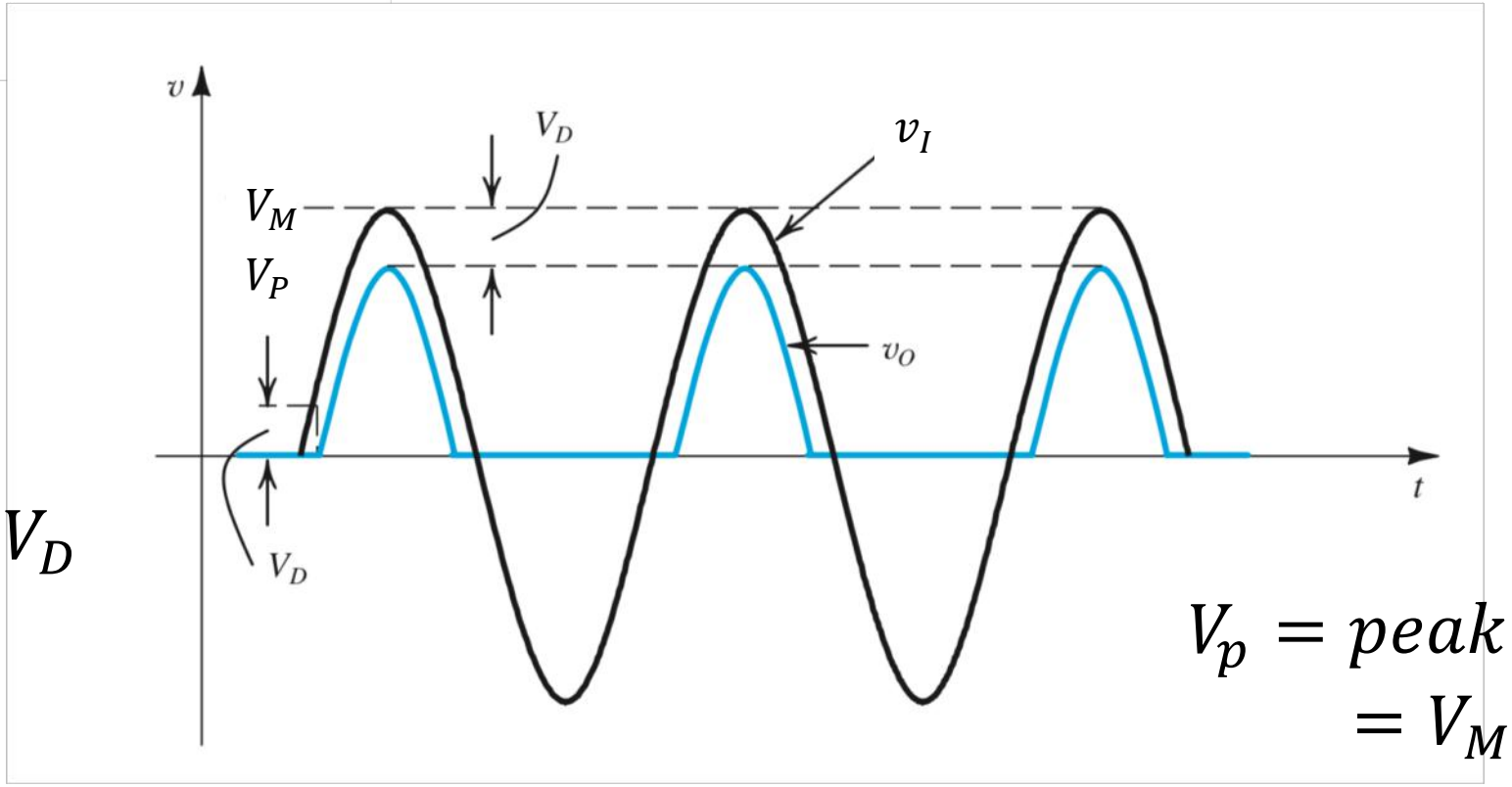
Half wave rectifier

$$I_D = \frac{v_I - v_D}{R}$$



So diode on when $I_D > 0$ hence when $v_I > v_D$

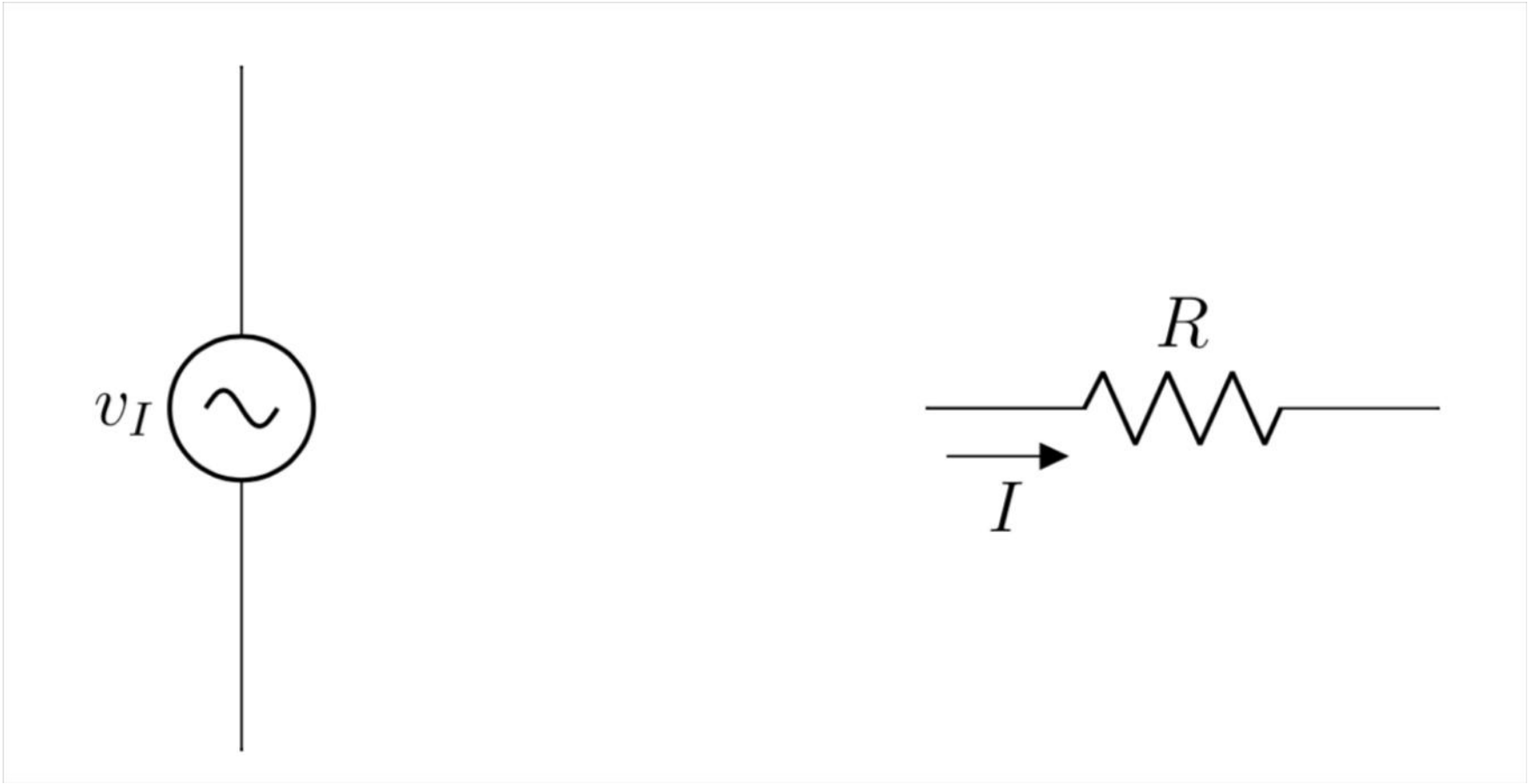
When on, $v_o = v_I - v_D$



$$v_I = V_M \sin \omega t$$
$$v_o = V_M \sin \omega t - V_D$$

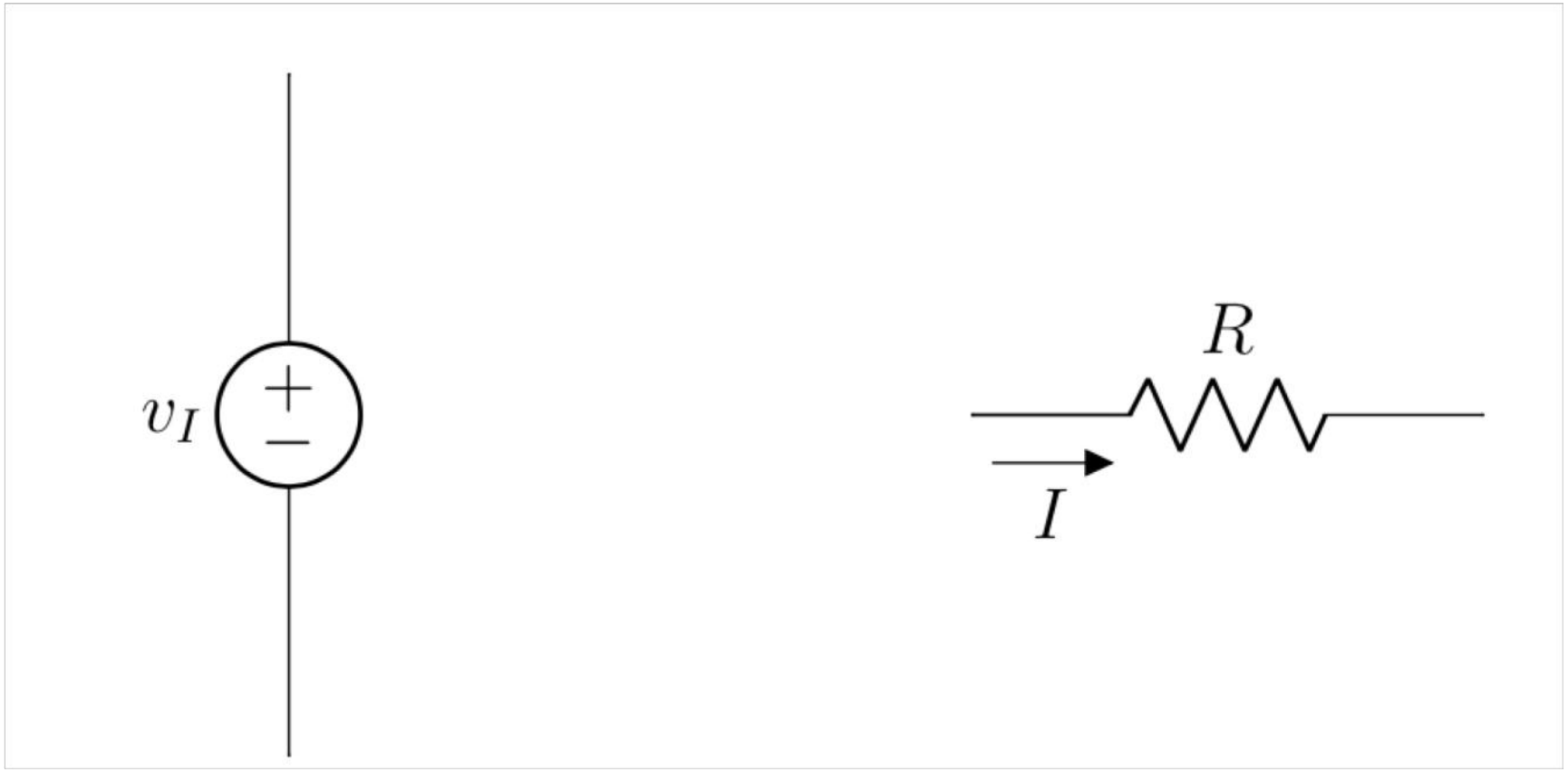
$$V_p = peak\ of\ output = V_M - V_D$$

First improvement: Full wave rectifier



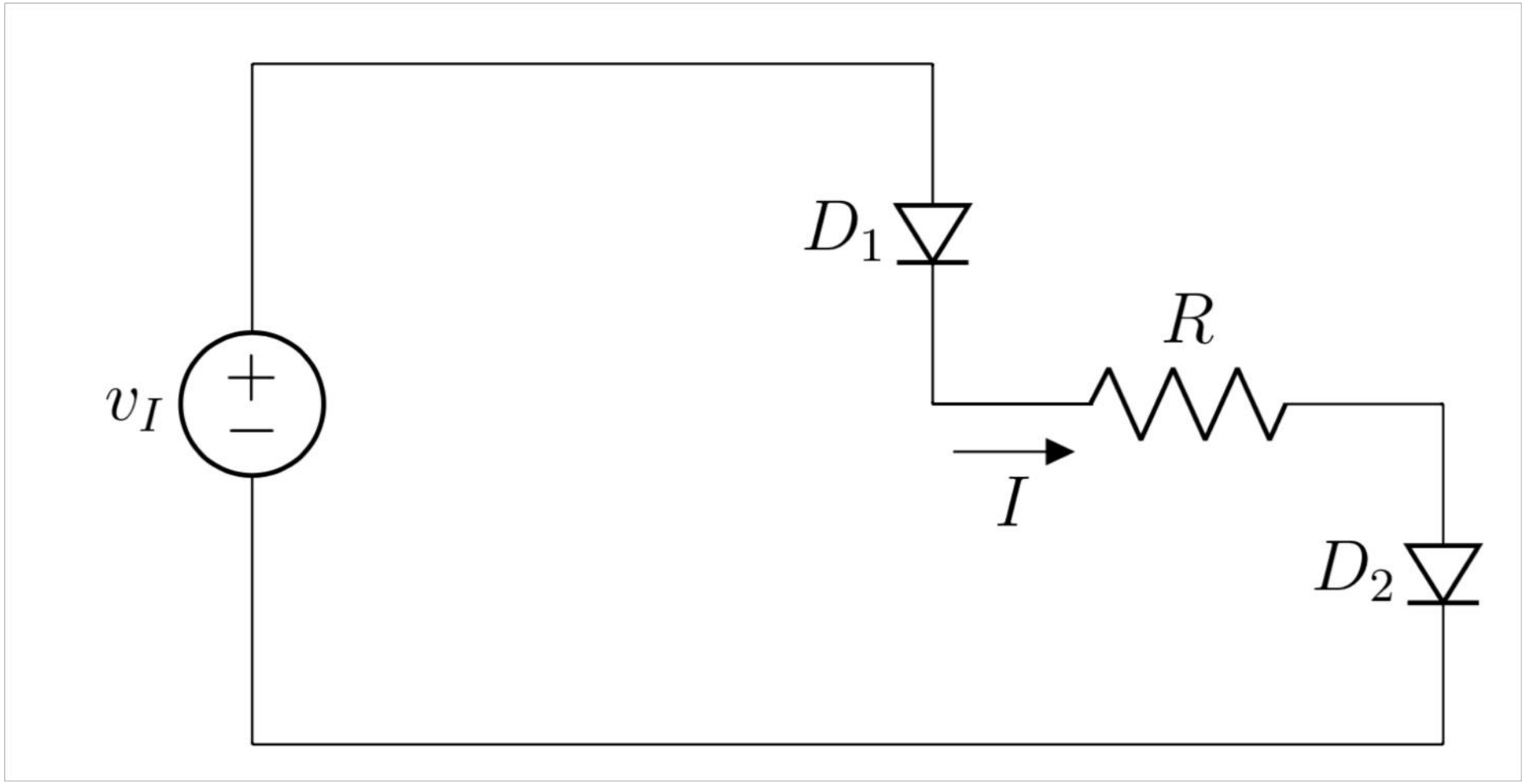
First improvement: Full wave rectifier

Positive half cycle



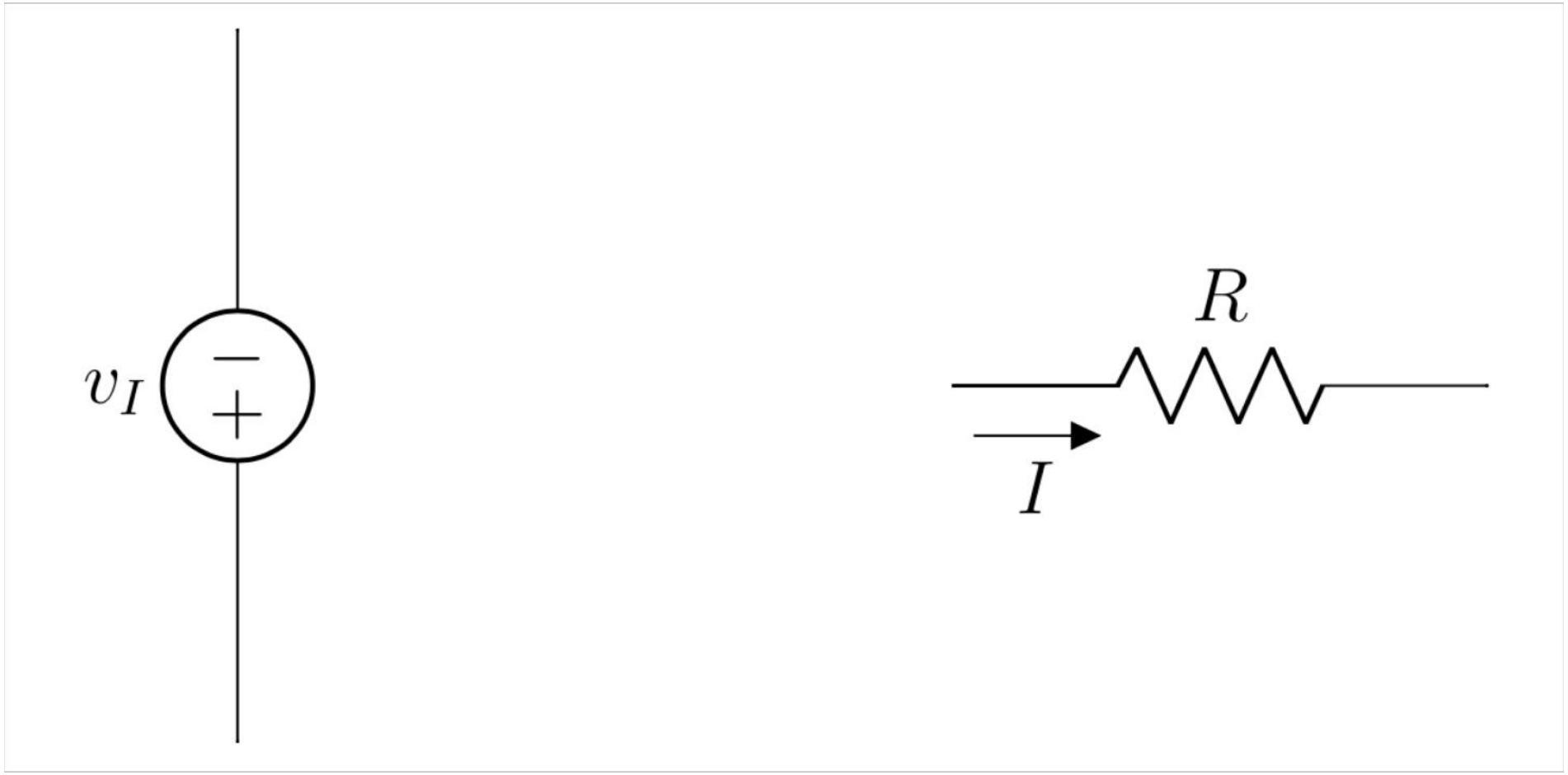
First improvement: Full wave rectifier

Positive half cycle



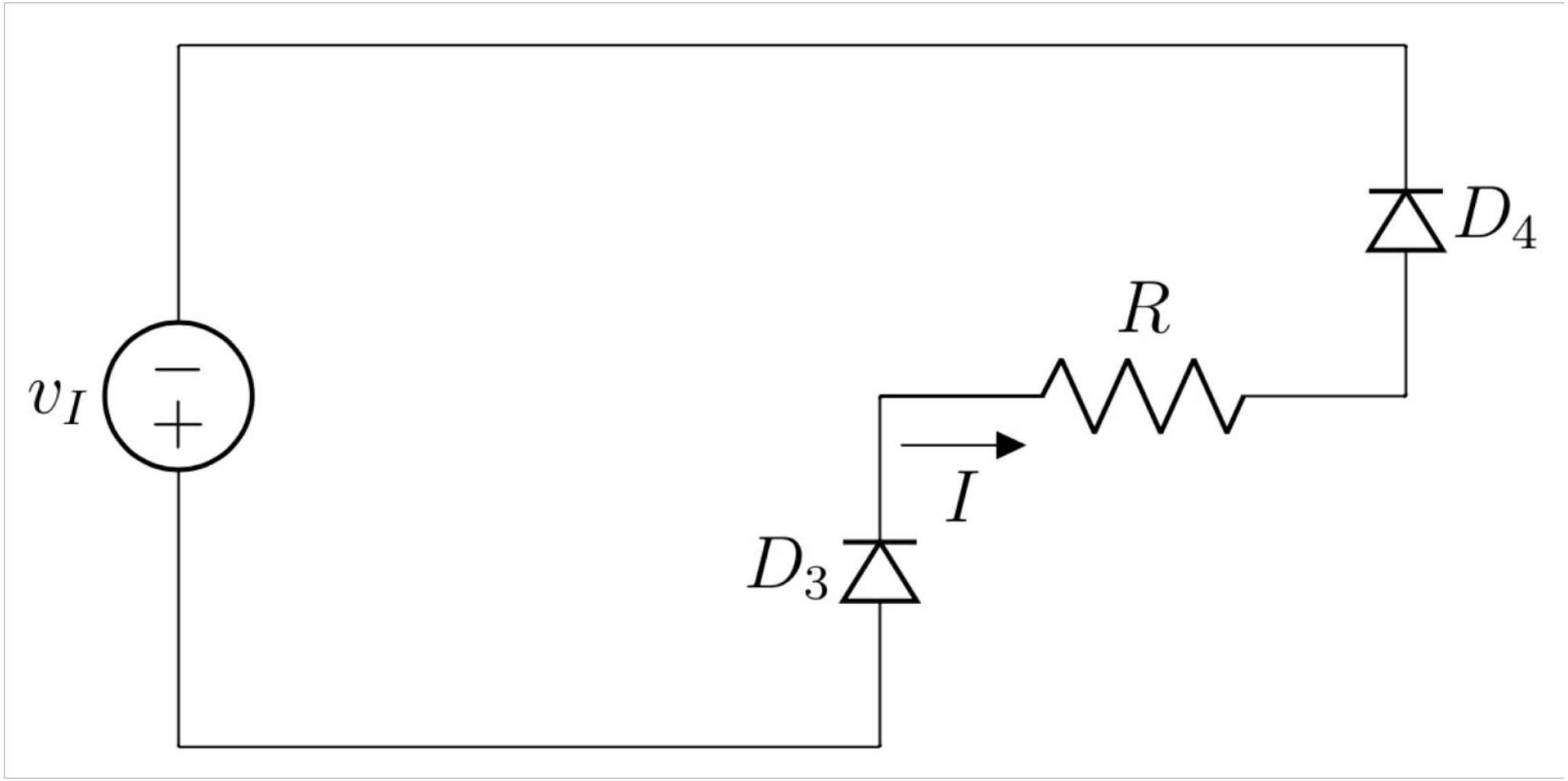
First improvement: Full wave rectifier

Negative half cycle



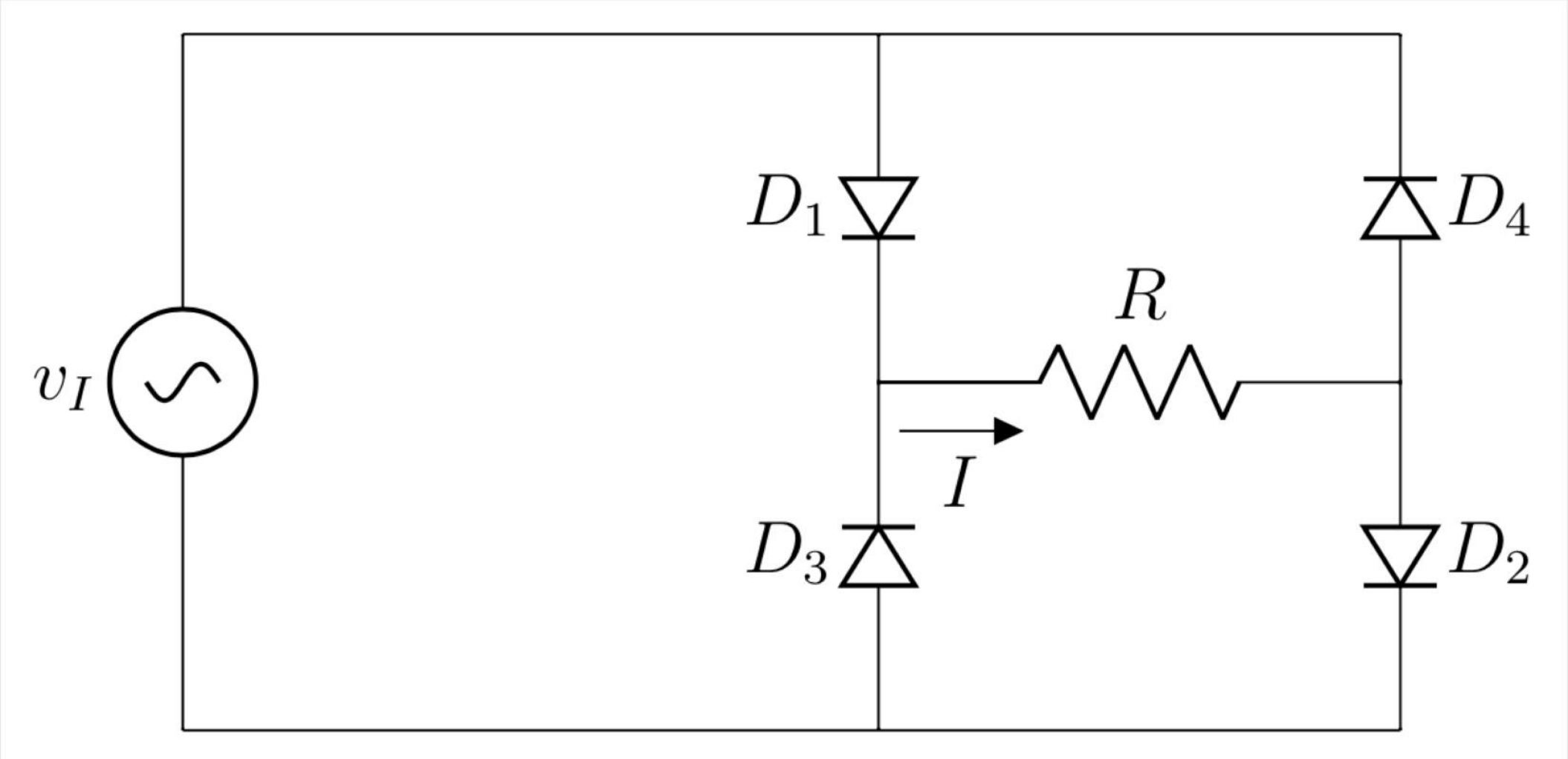
First improvement: Full wave rectifier

Negative half cycle



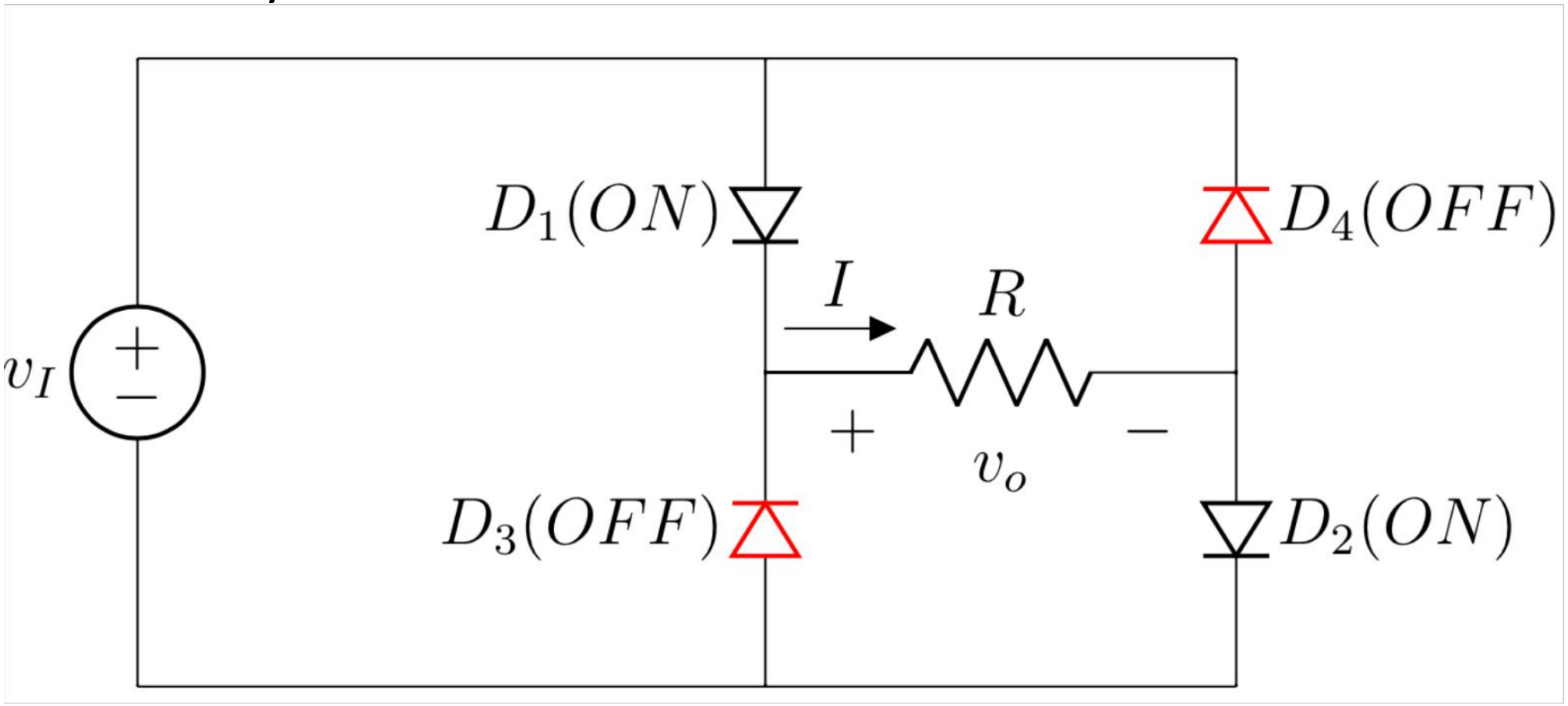
First improvement: Full wave rectifier

Combining



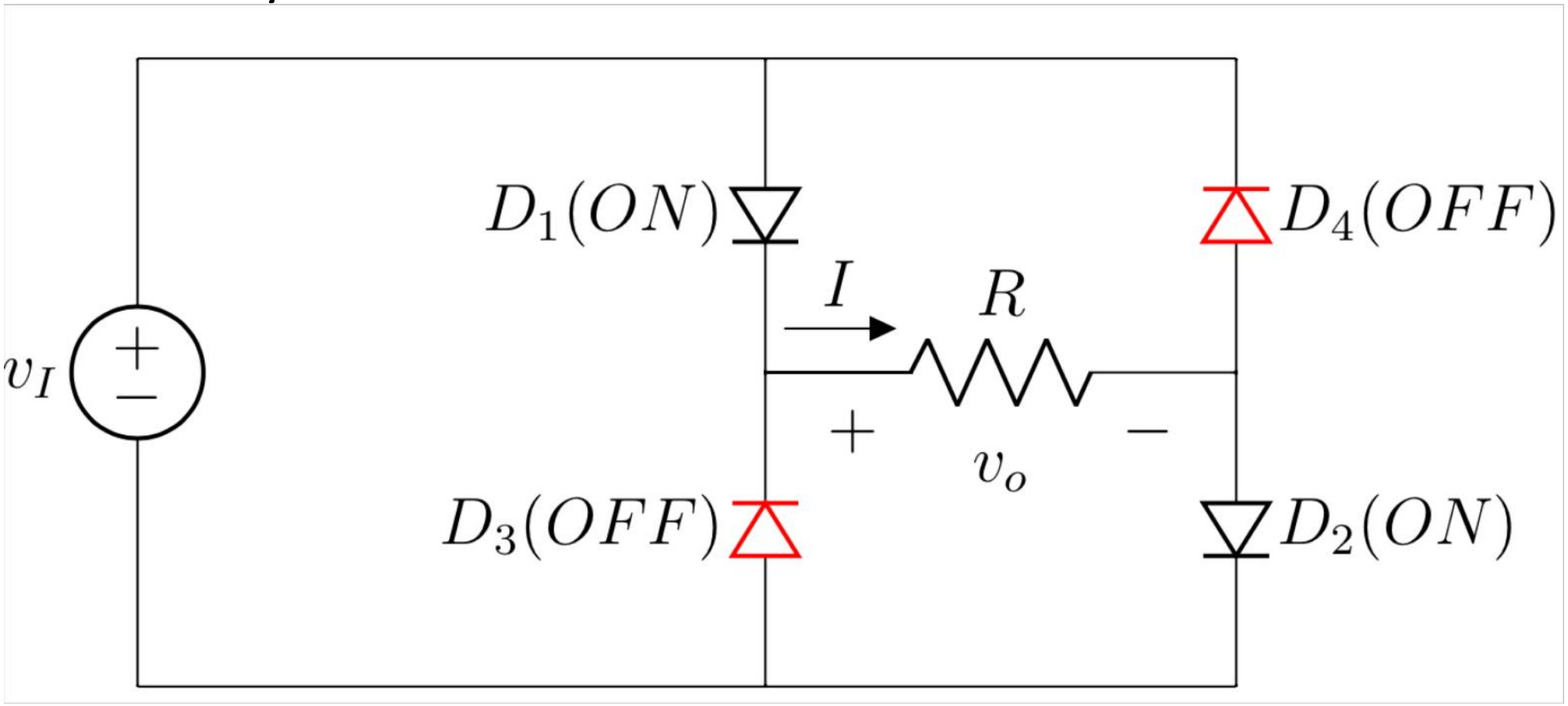
First improvement: Full wave rectifier

Positive half cycle



First improvement: Full wave rectifier

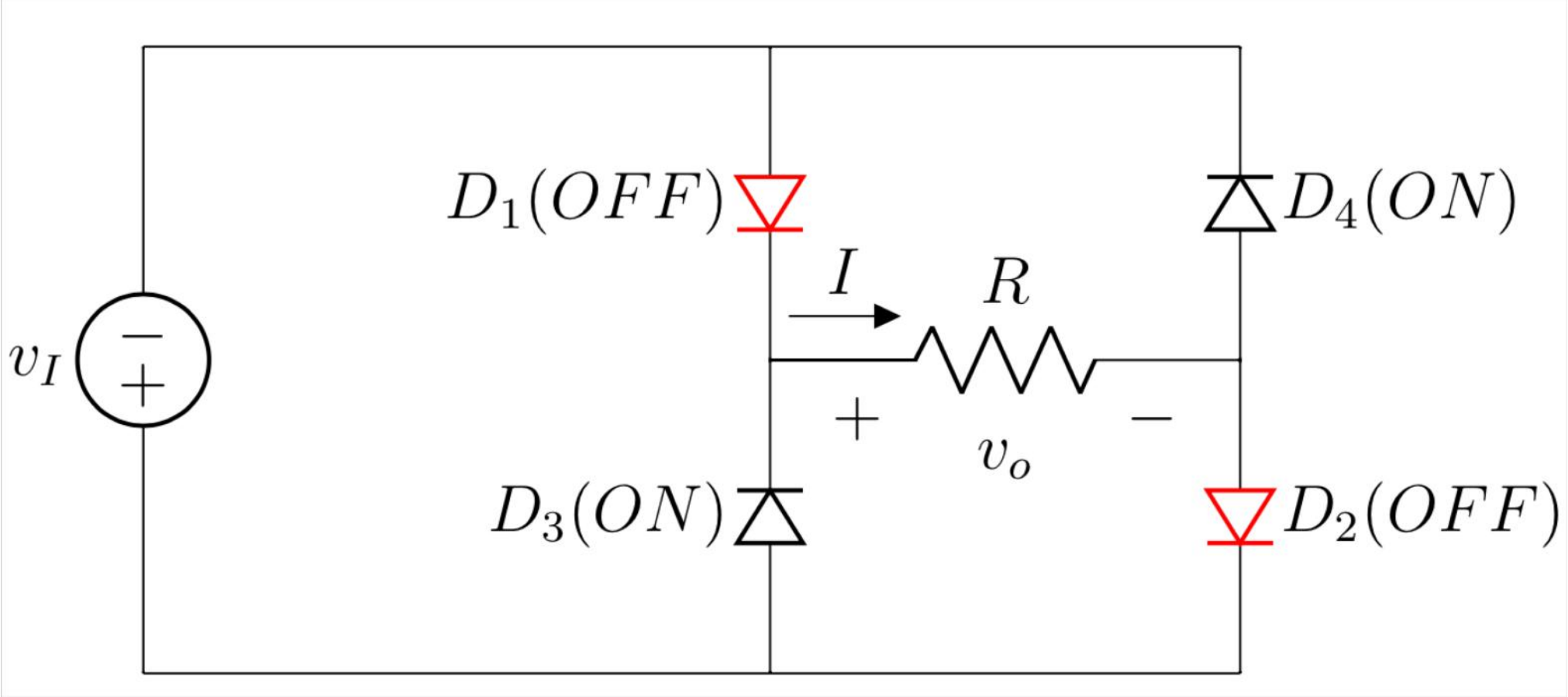
Positive half cycle



$$v_o = v_I - 2V_D$$

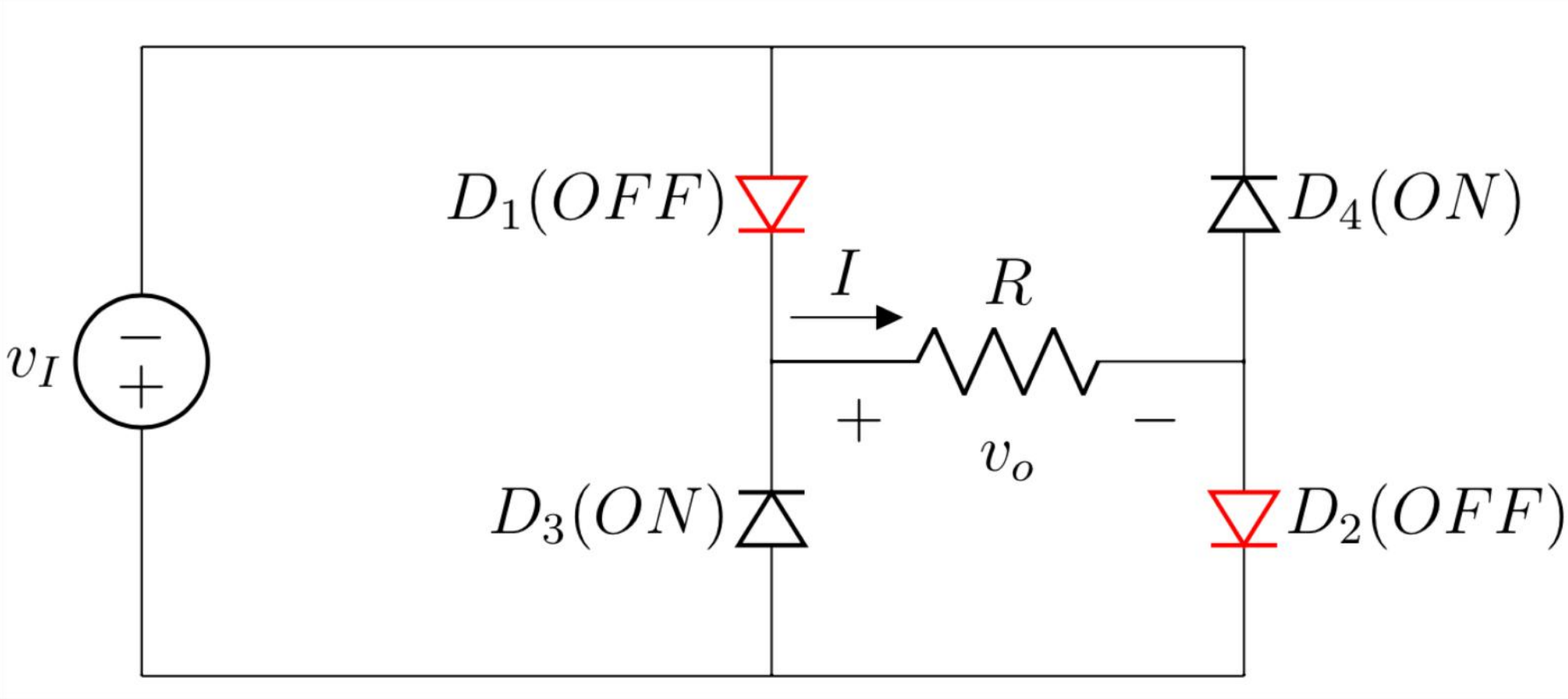
First improvement: Full wave rectifier

Negative half cycle



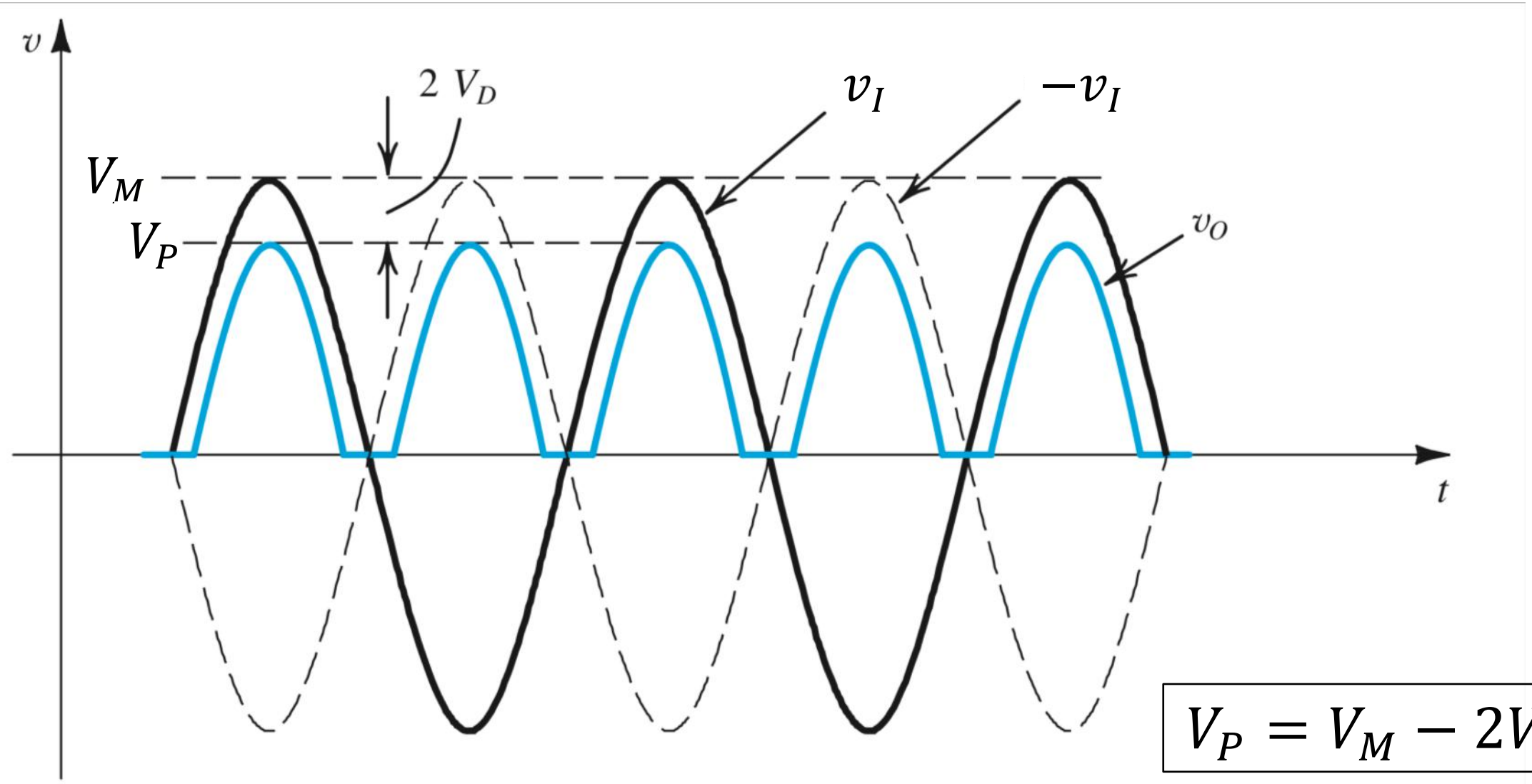
First improvement: Full wave rectifier

Negative half cycle



$$v_o = -v_I - 2V_D$$

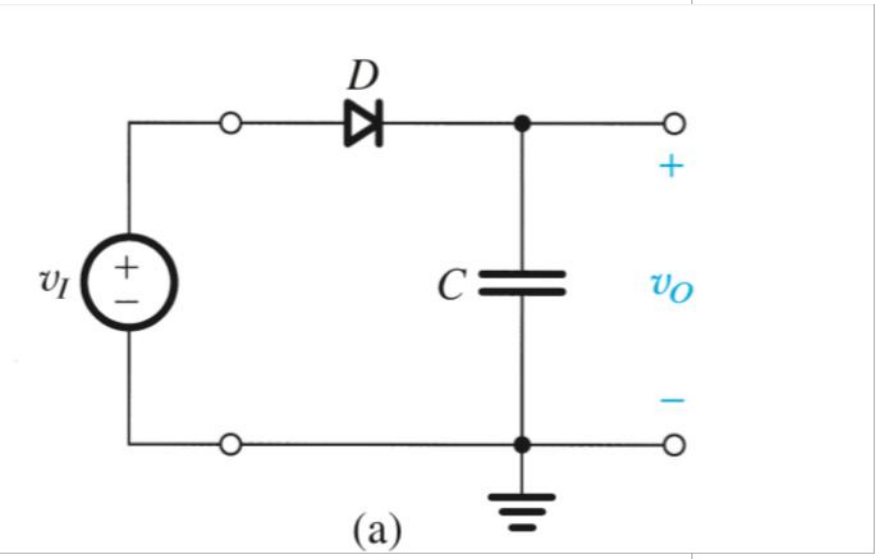
First improvement: Full wave rectifier

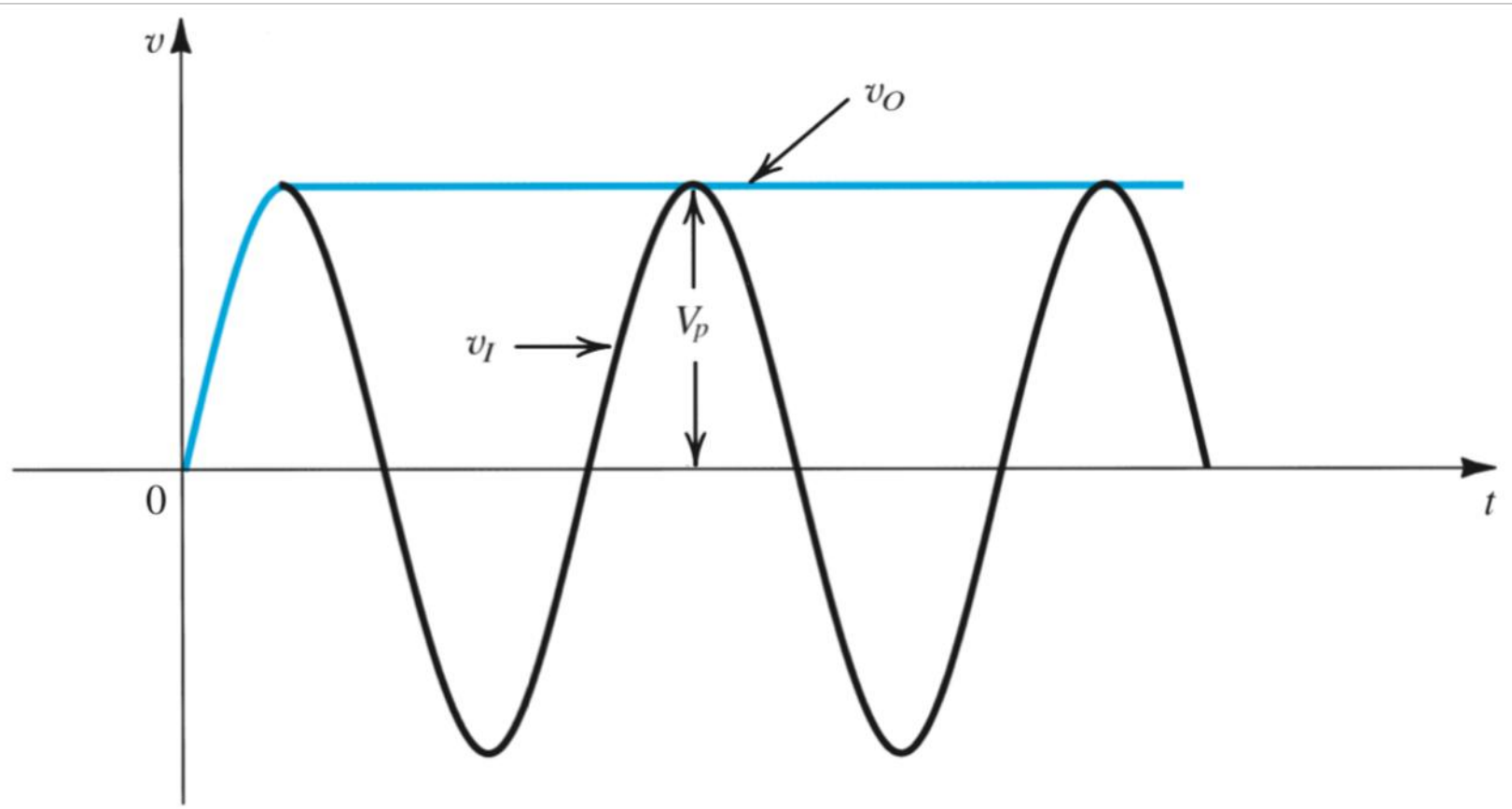


$$V_P = V_M - 2V_D$$

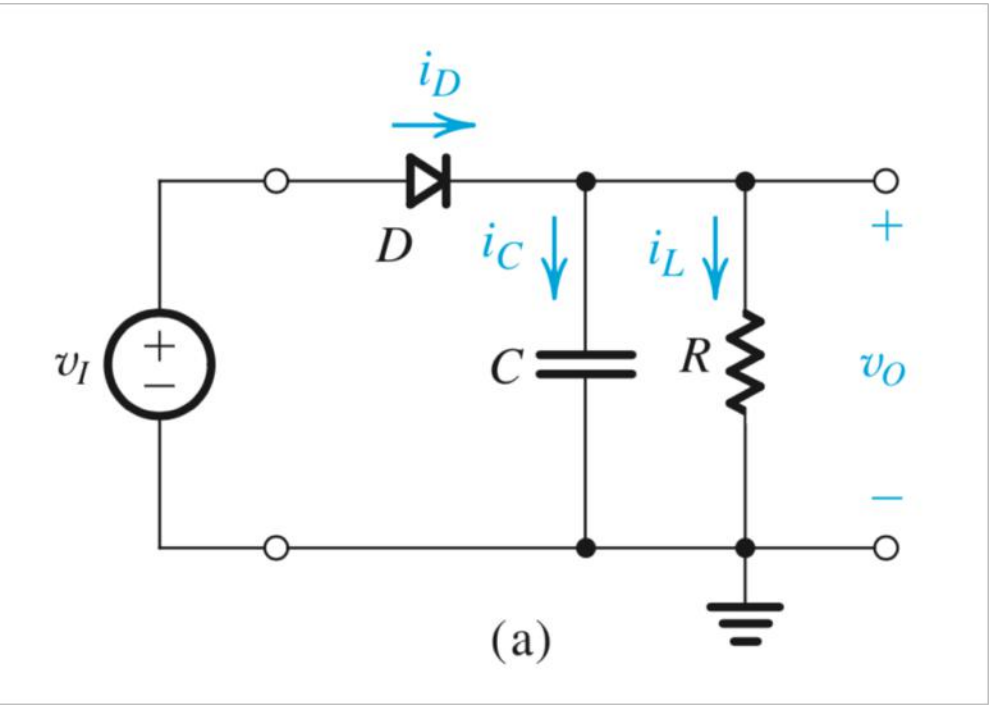
Second improvement: Capacitor smoothing

$$V_P = V_M - V_D$$





Second improvement: Capacitor smoothing



Second improvement: Capacitor smoothing