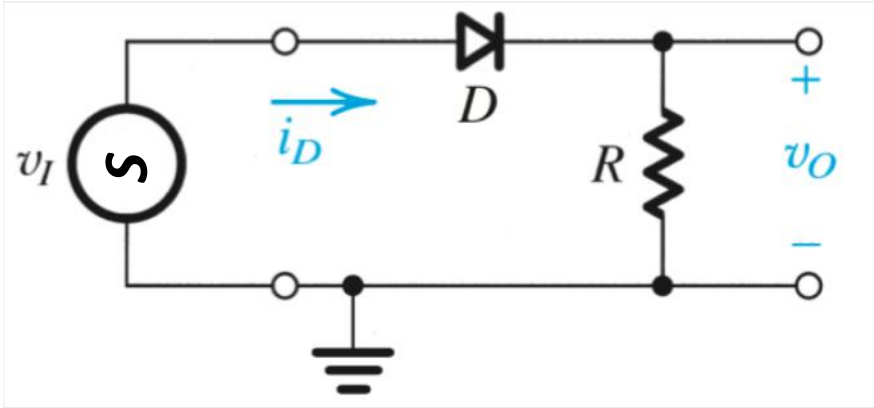


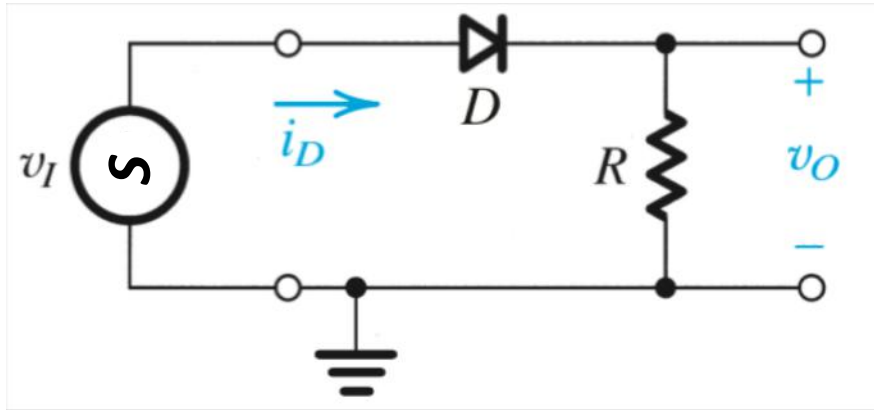
Rectifiers Revisited 1

Improvements

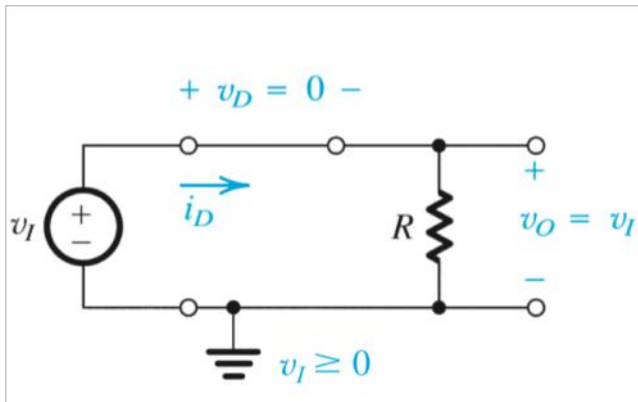
Half wave rectifier



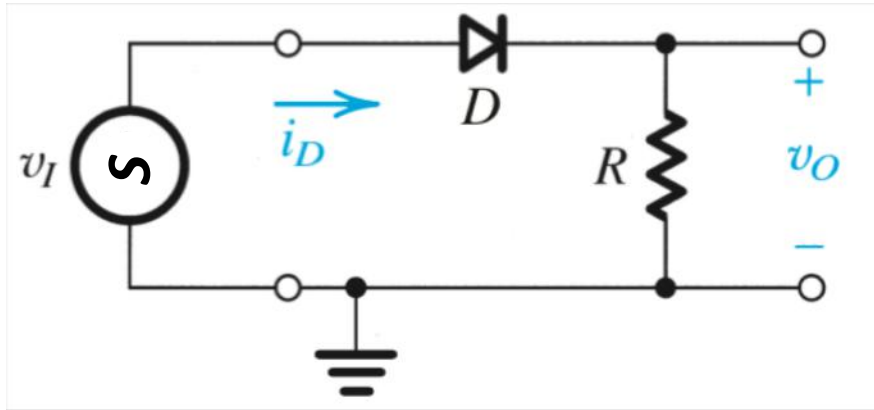
Half wave rectifier



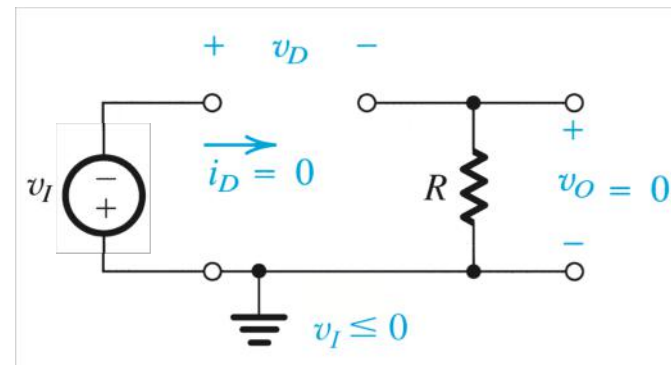
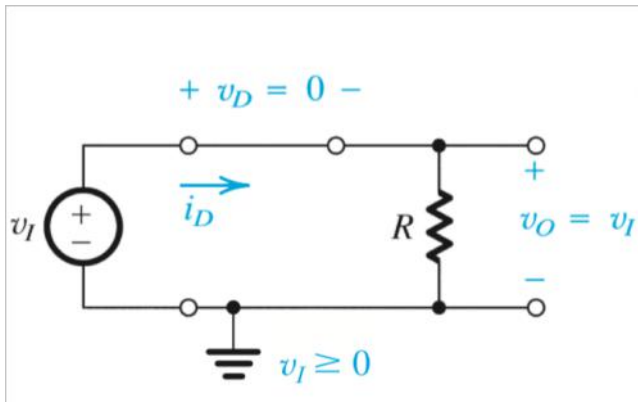
Assuming ideal diode



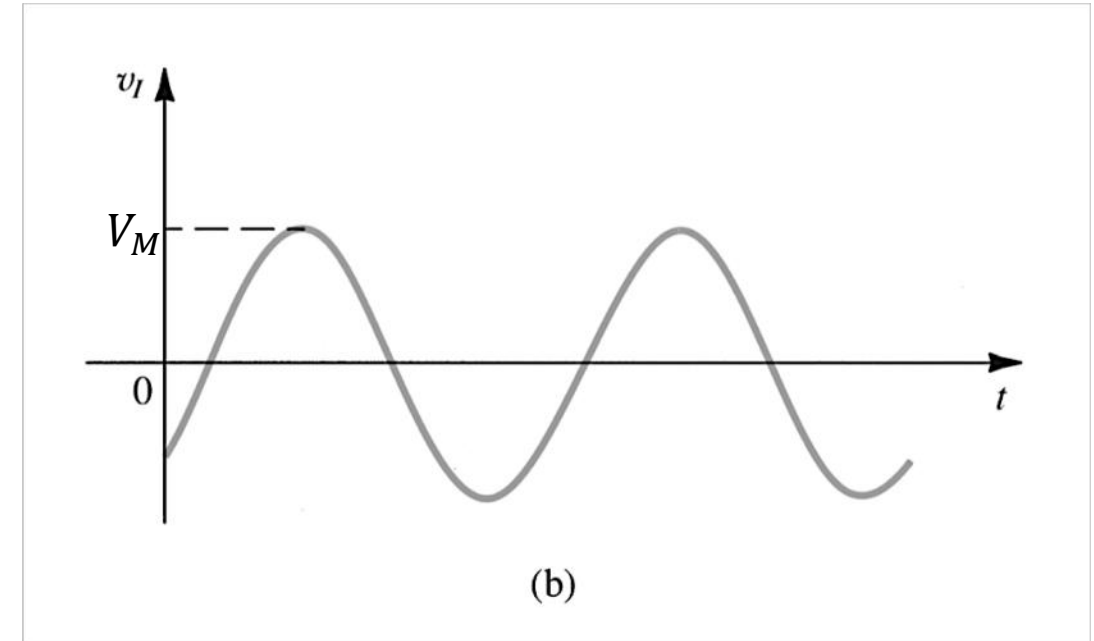
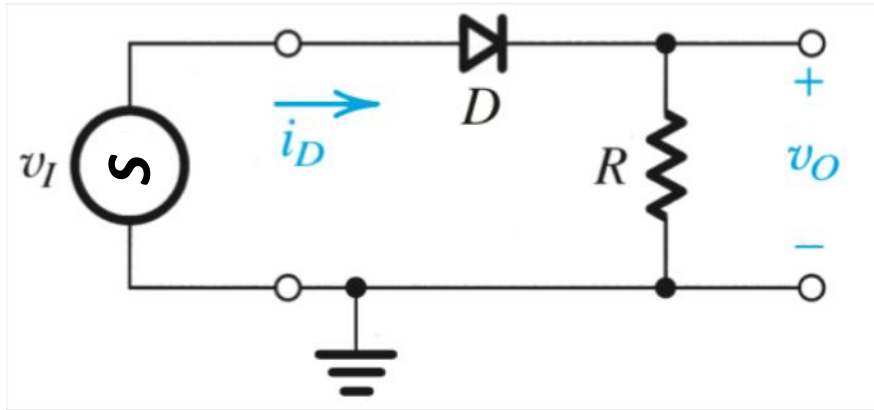
Half wave rectifier



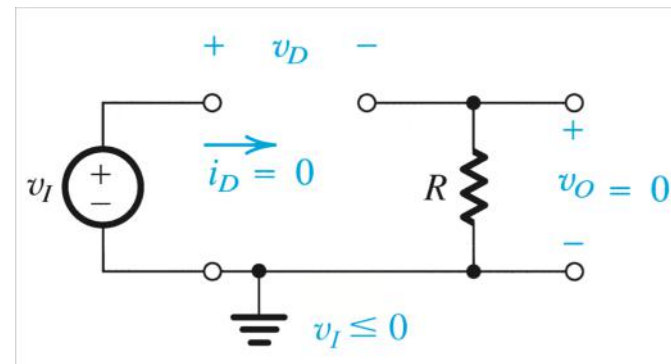
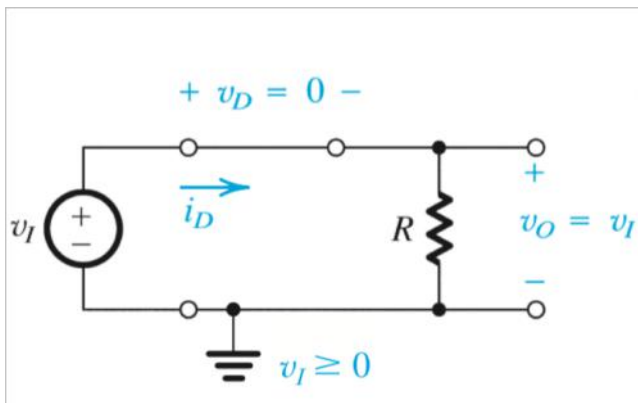
Assuming ideal diode



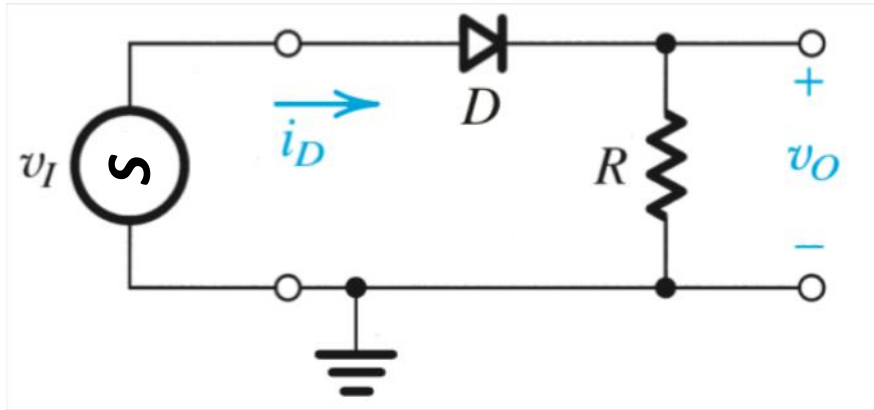
Half wave rectifier



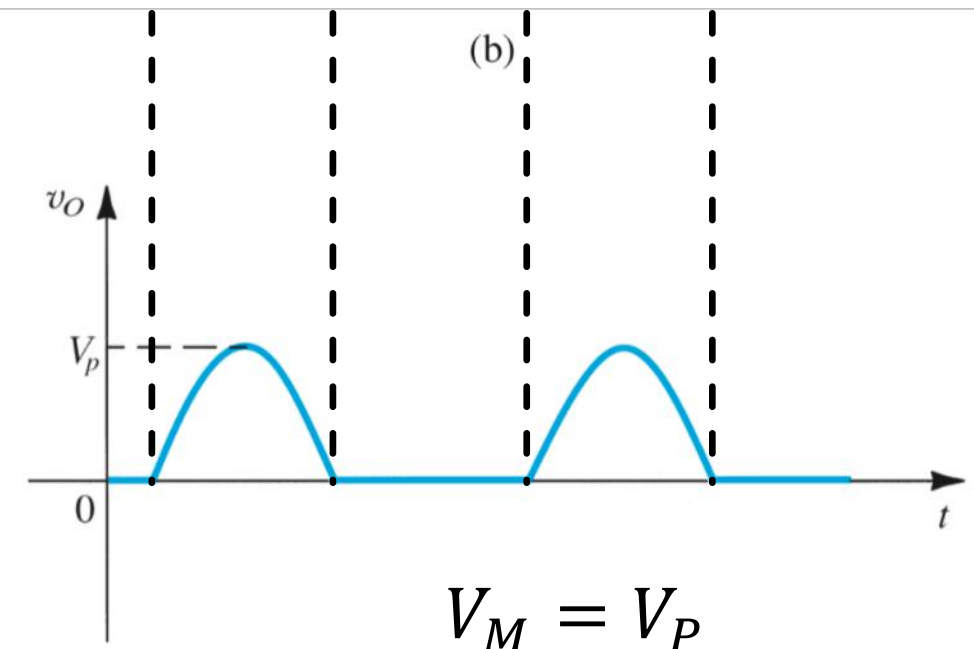
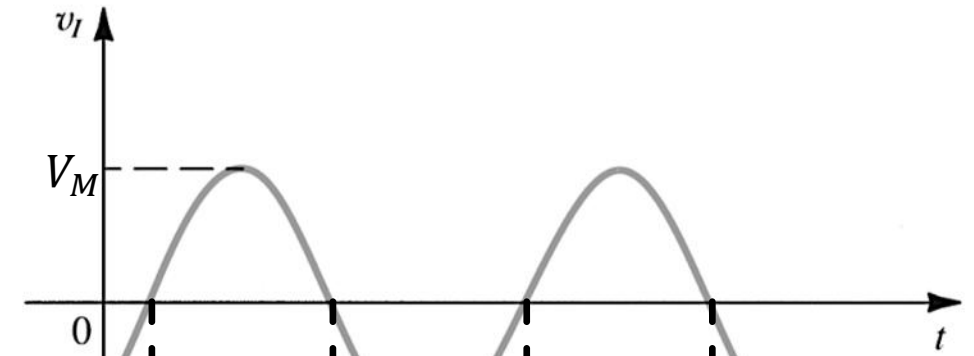
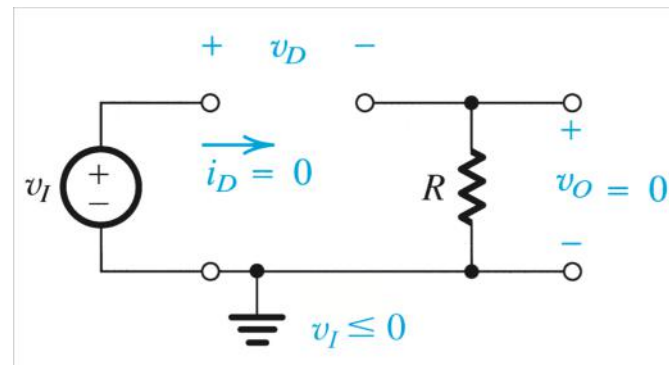
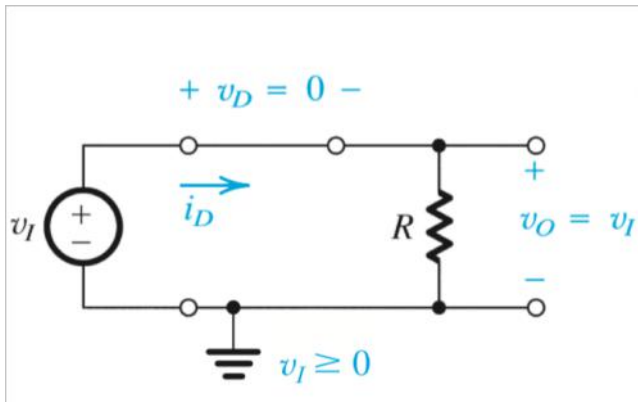
Assuming ideal diode



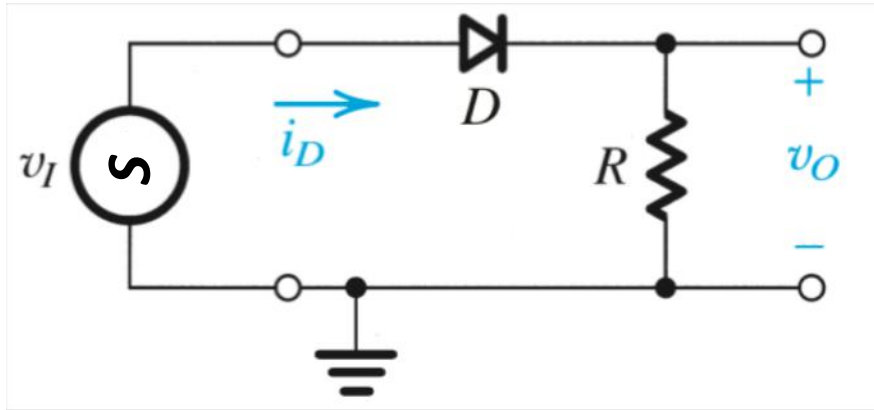
Half wave rectifier



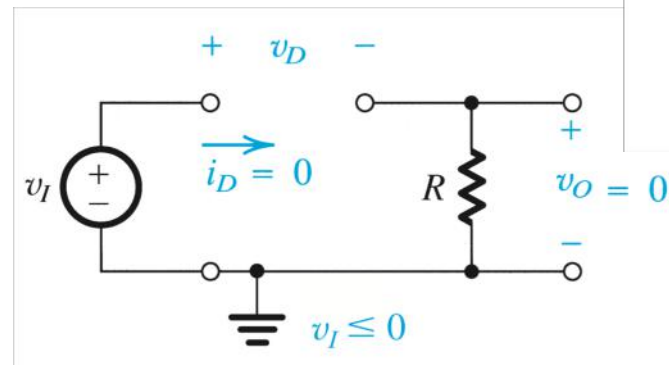
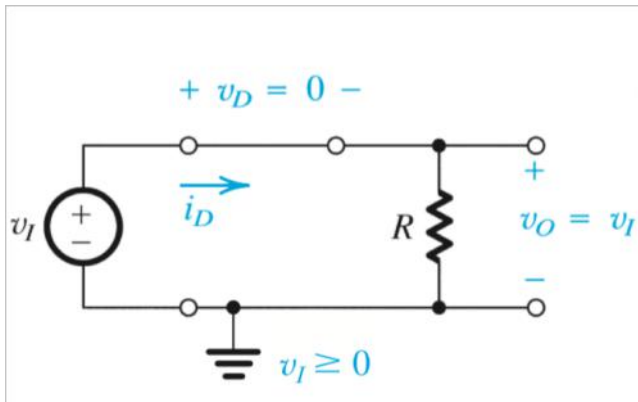
Assuming ideal diode



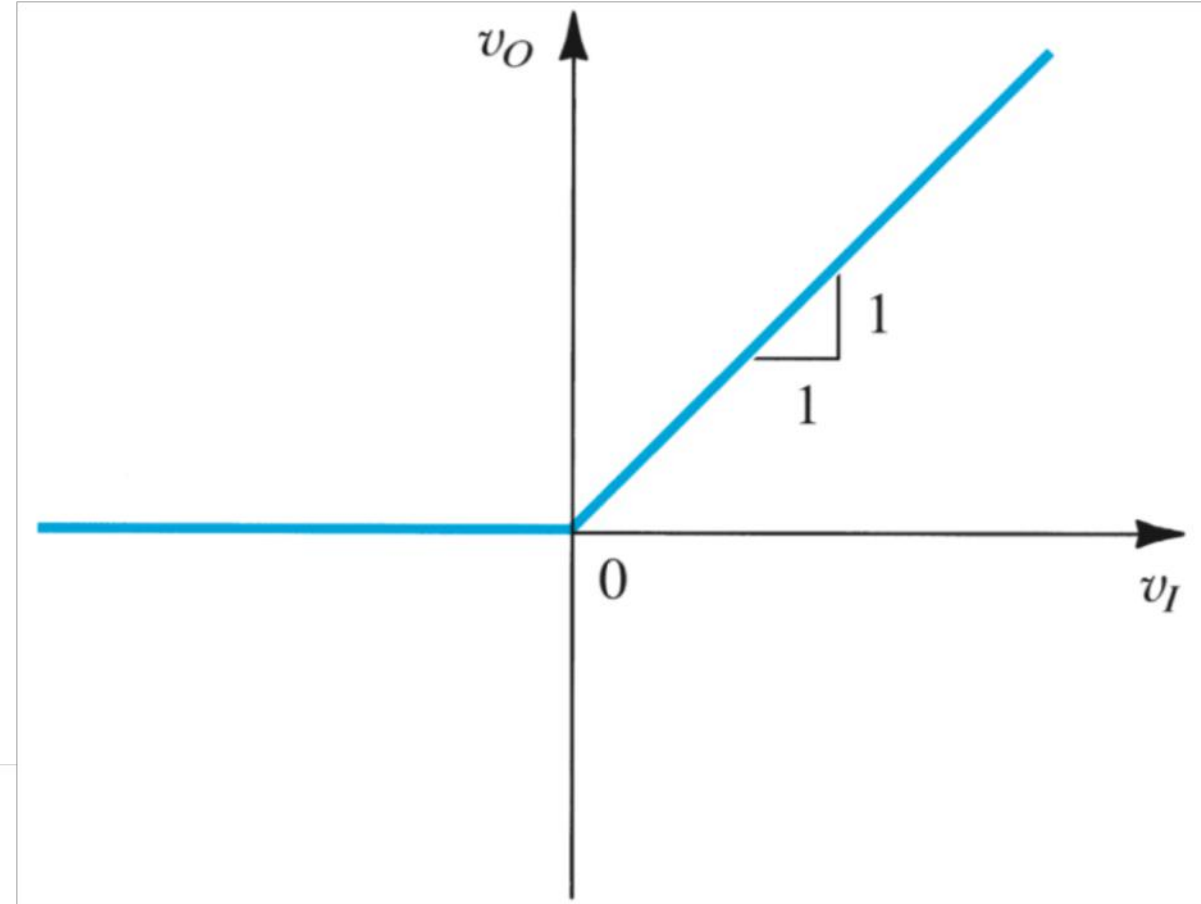
Half wave rectifier



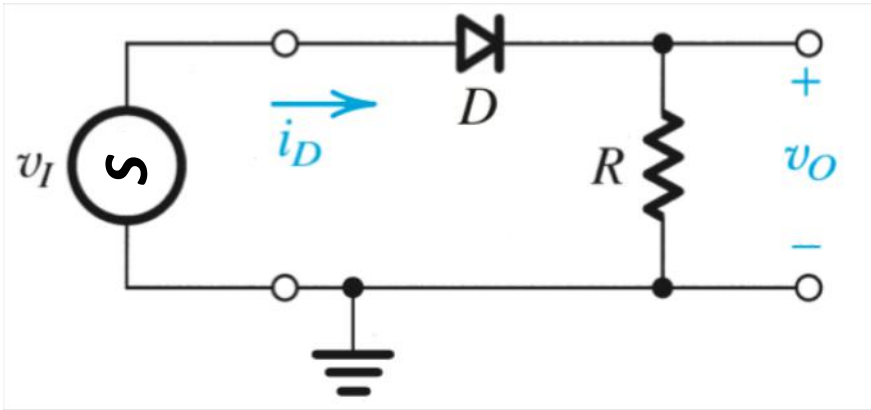
Assuming ideal diode



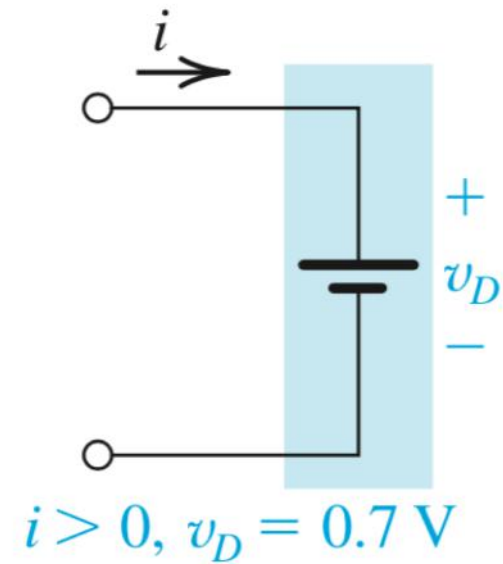
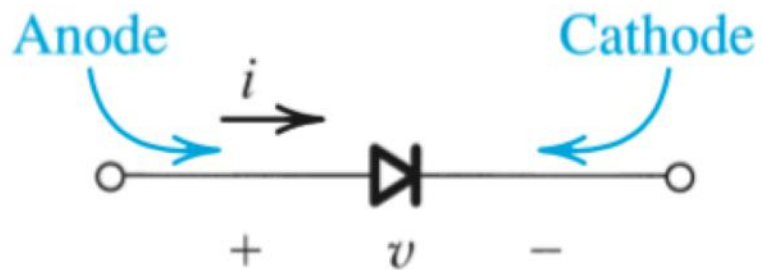
Transfer Characteristics



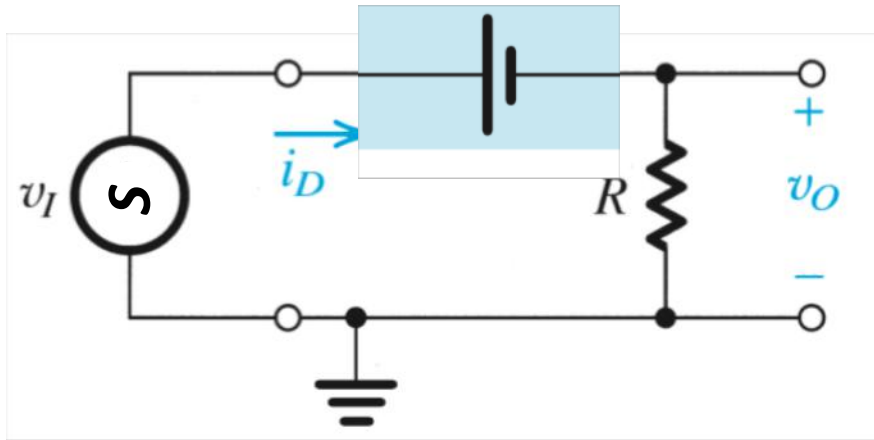
Half wave rectifier



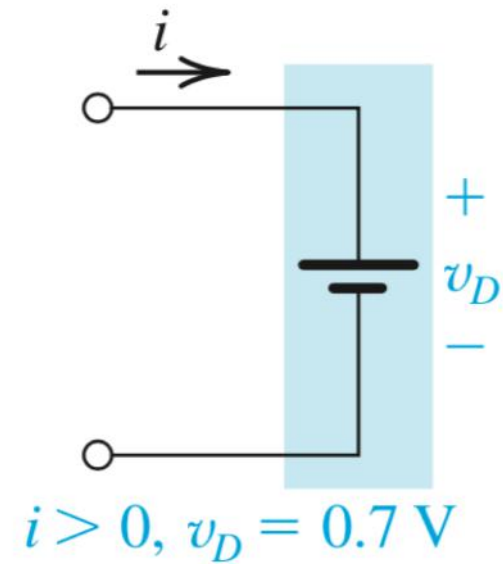
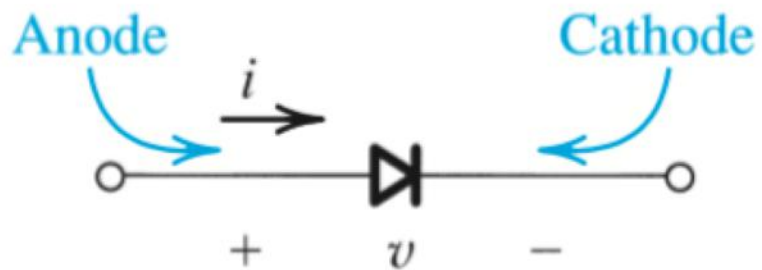
Real diode



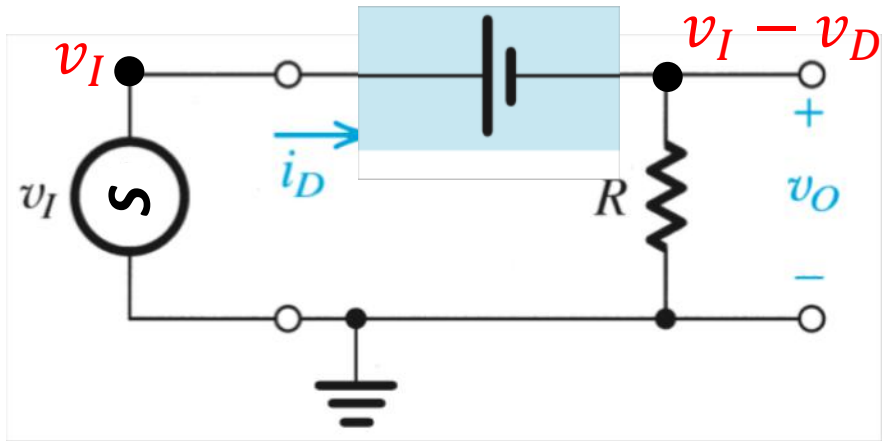
Half wave rectifier



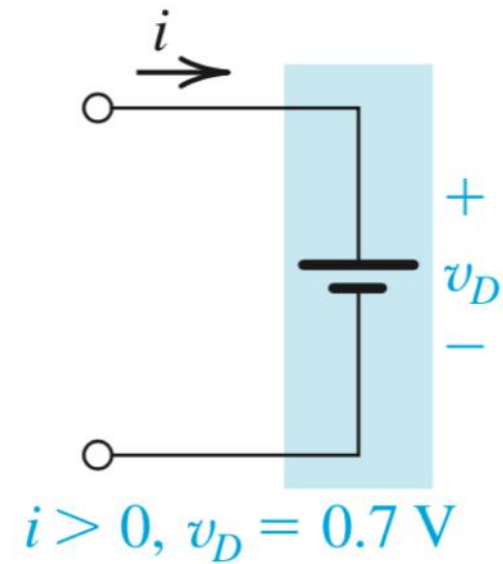
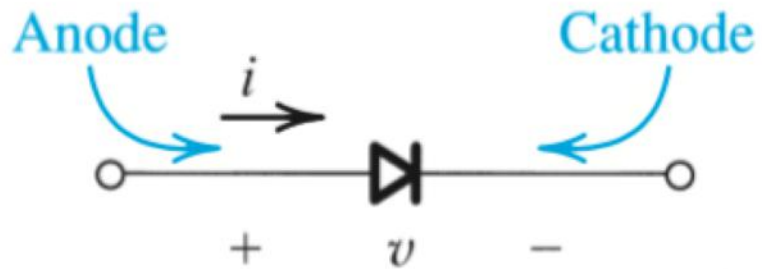
Real diode



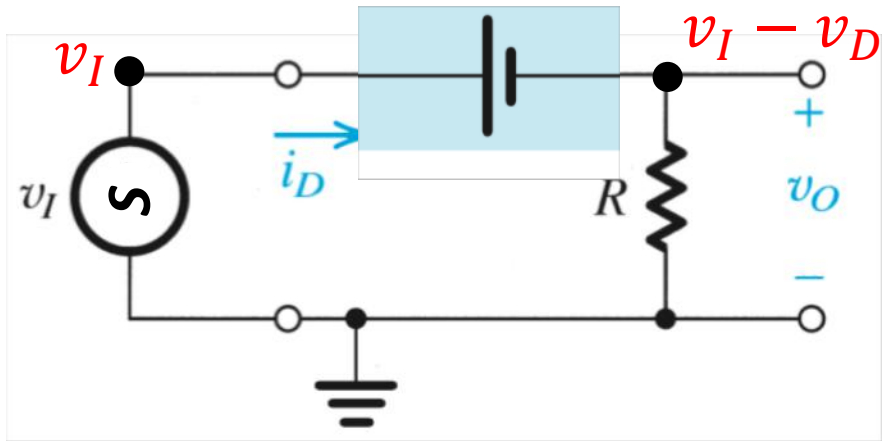
Half wave rectifier



Real diode

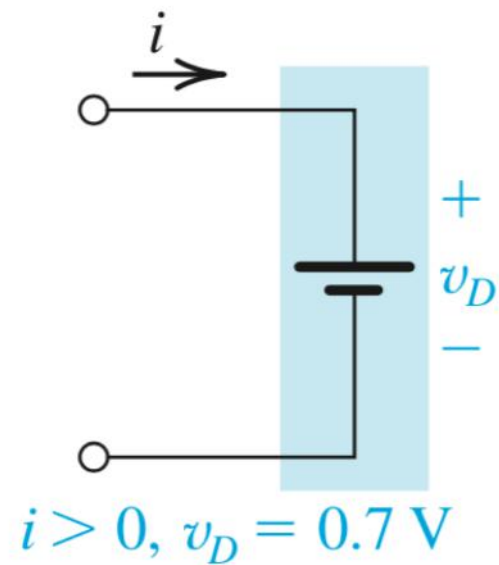
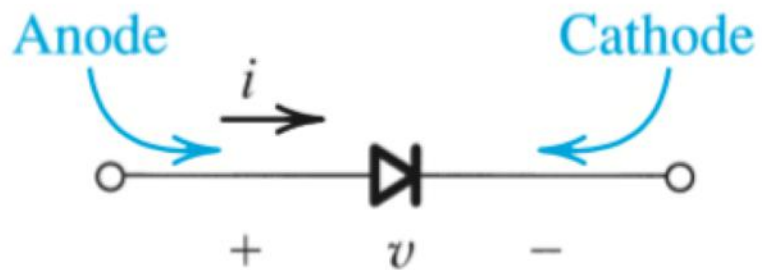


Half wave rectifier

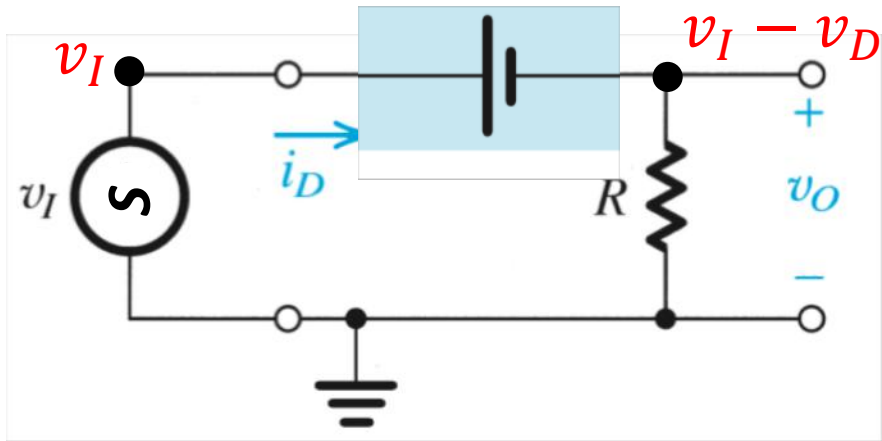


$$I_R = \frac{v_I - V_D}{R}$$

Real diode



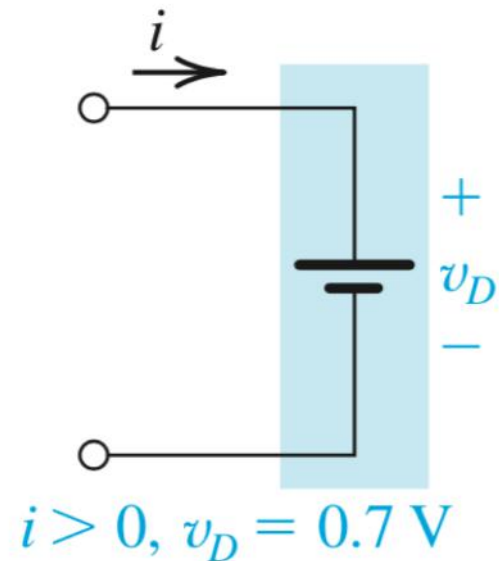
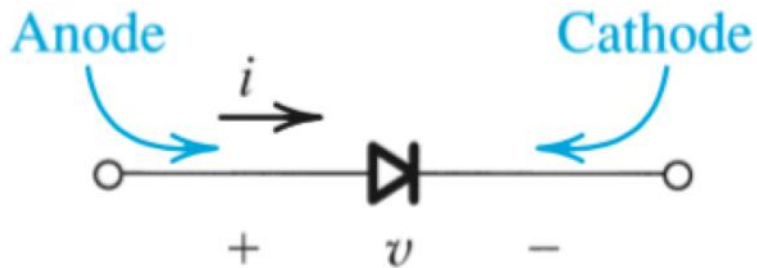
Half wave rectifier



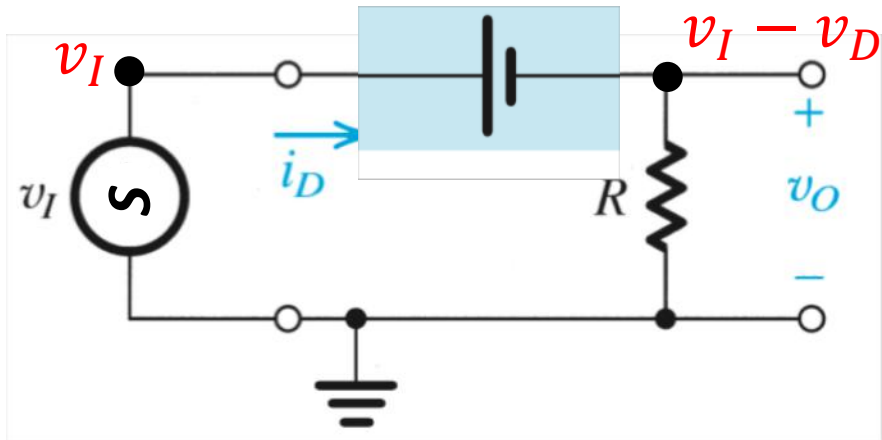
$$I_D = \frac{v_I - v_D}{R}$$

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

Real diode



Half wave rectifier

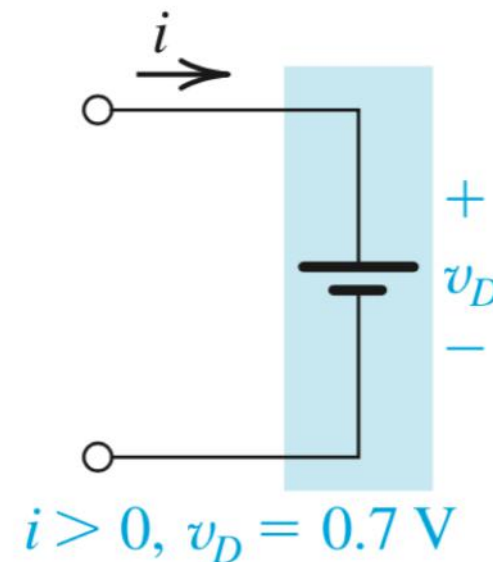
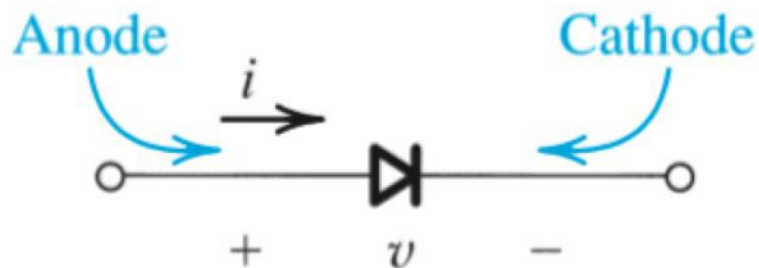


$$I_D = \frac{v_I - v_D}{R}$$

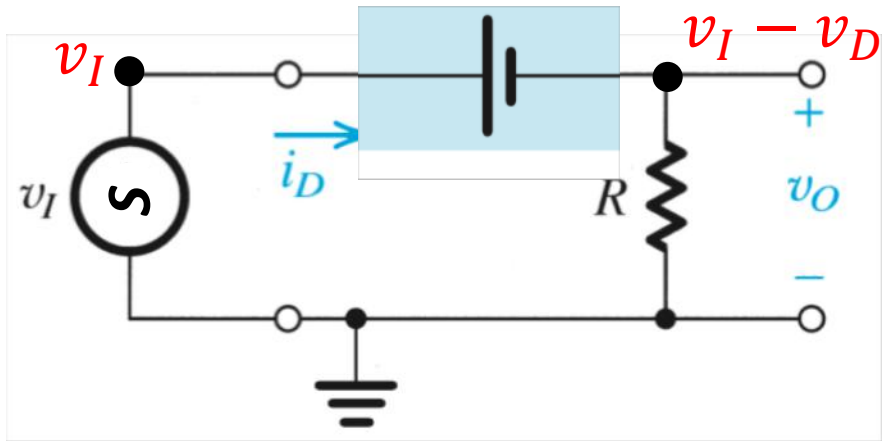
So diode on when $I_D > 0$ hence when $v_I > v_D$

When on, $v_O = v_I - v_D$

Real diode



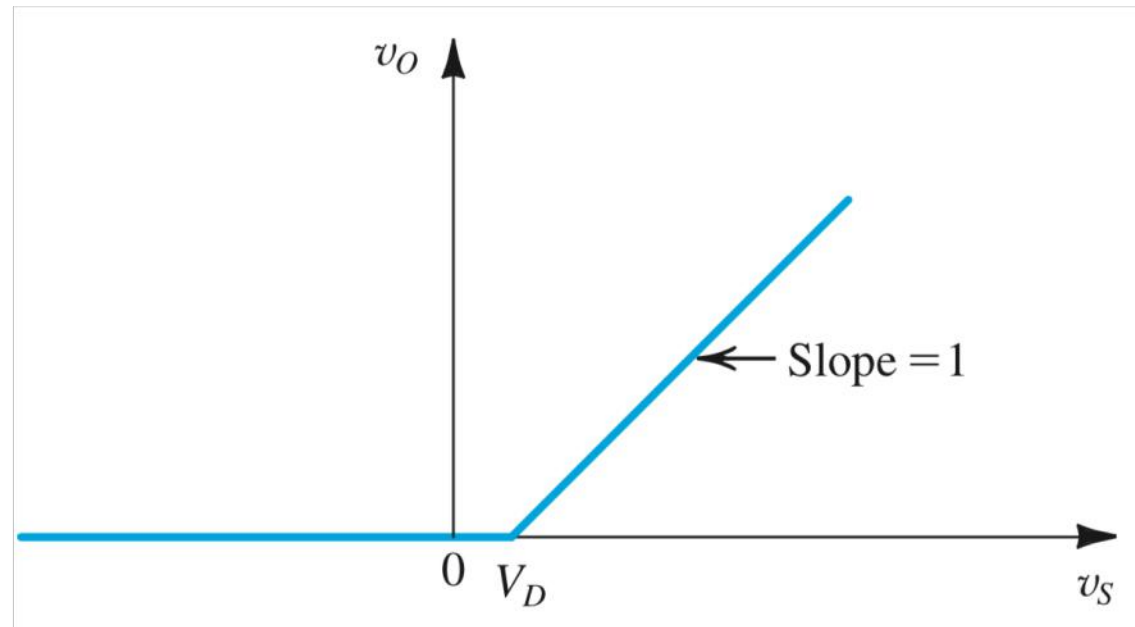
Half wave rectifier



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

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

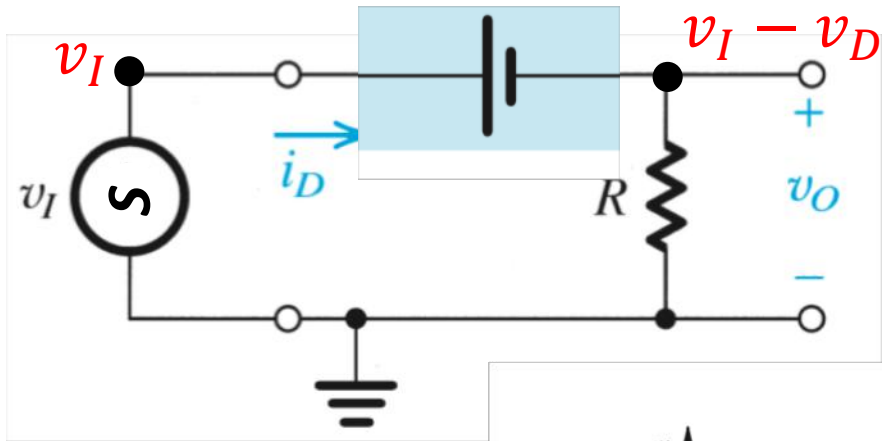
When on, $v_O = v_I - v_D$



$$y = x - v_D$$

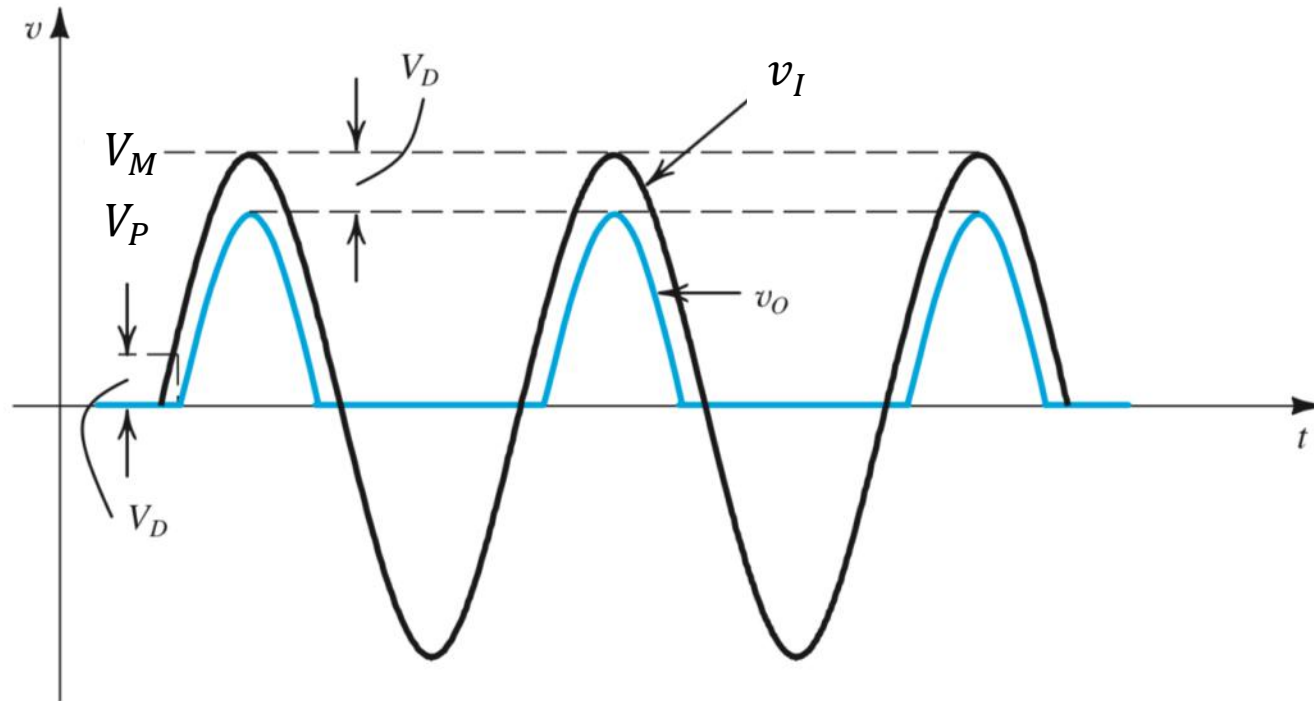
Half wave rectifier

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



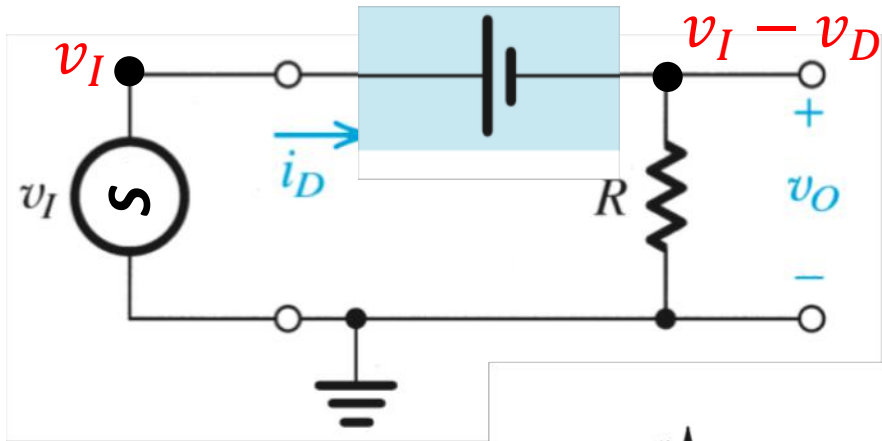
So diode on when $I_D > 0$ hence when $v_I > v_D$
When on, $v_O = v_I - v_D$

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



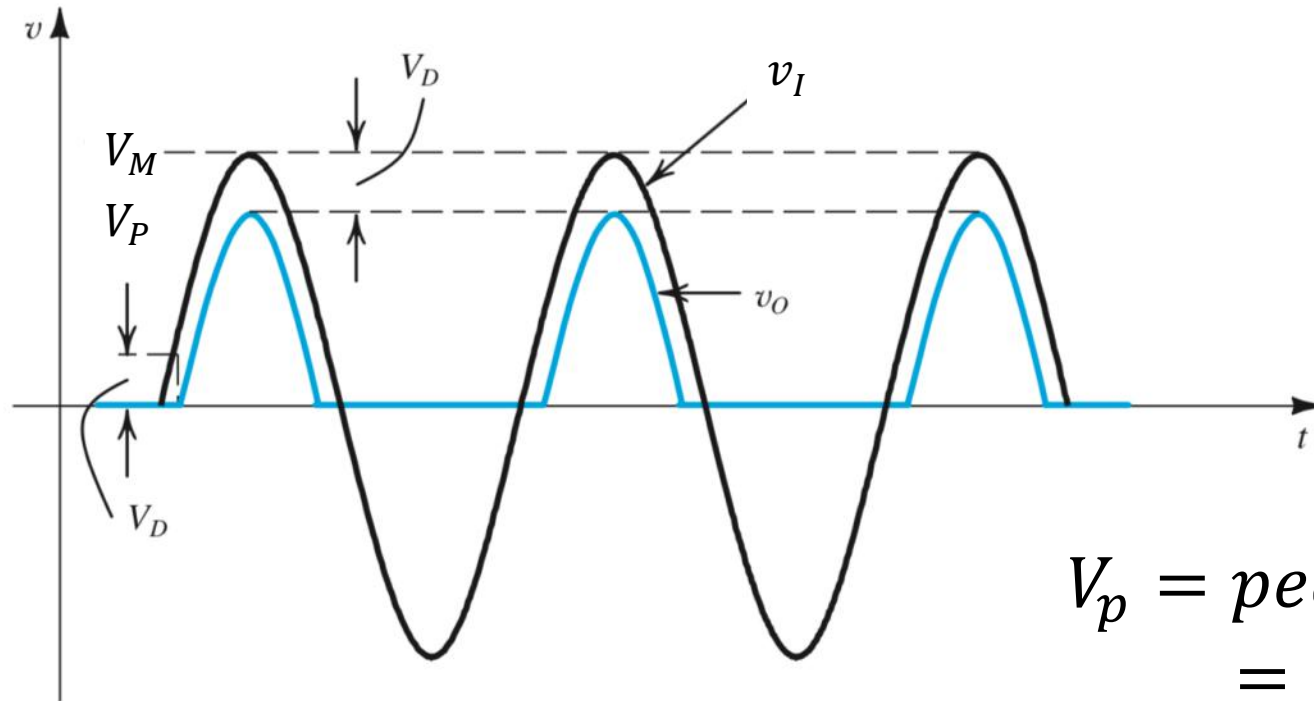
Half wave rectifier

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



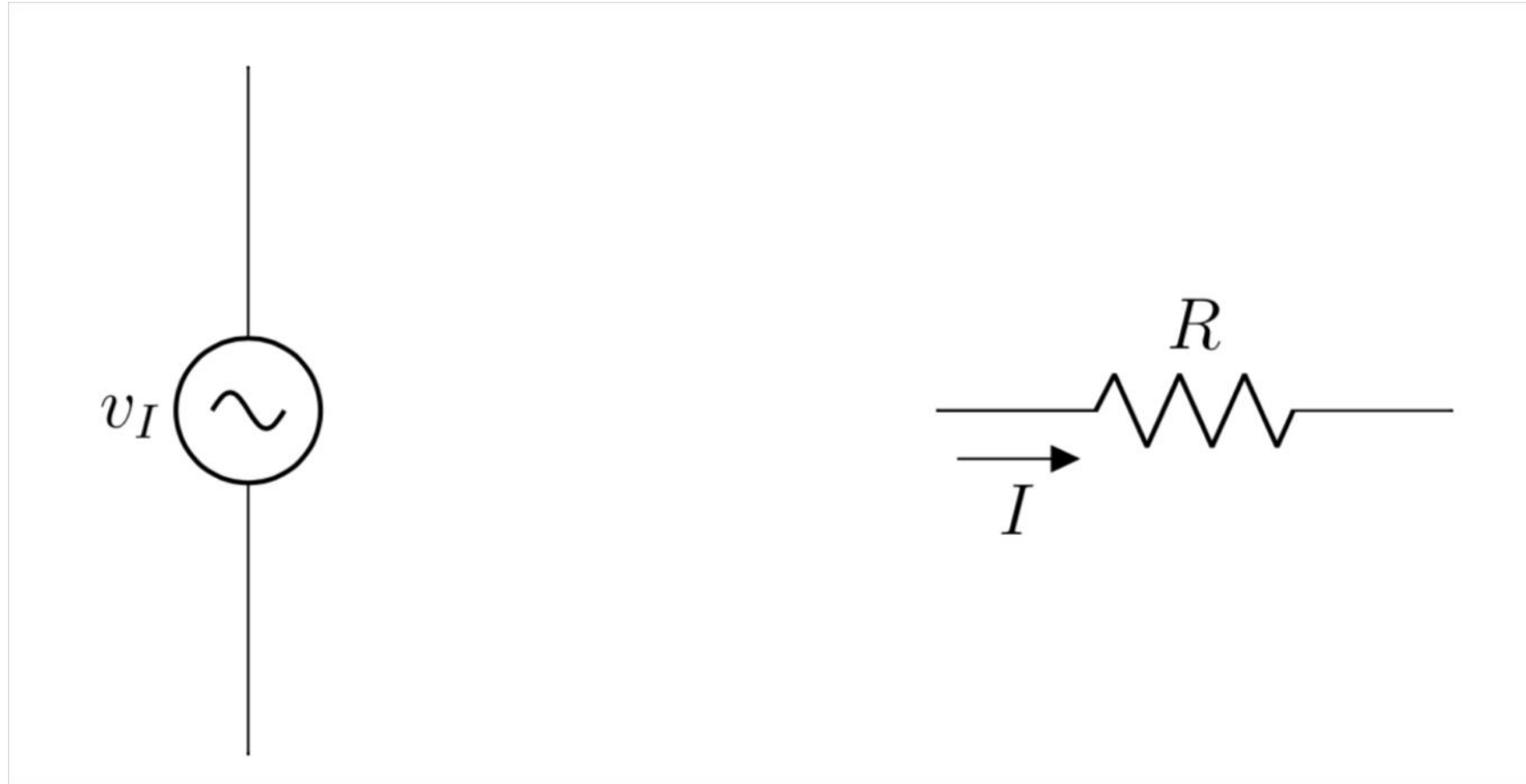
So diode on when $I_D > 0$ hence when $v_I > v_D$
When on, $v_O = v_I - v_D$

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



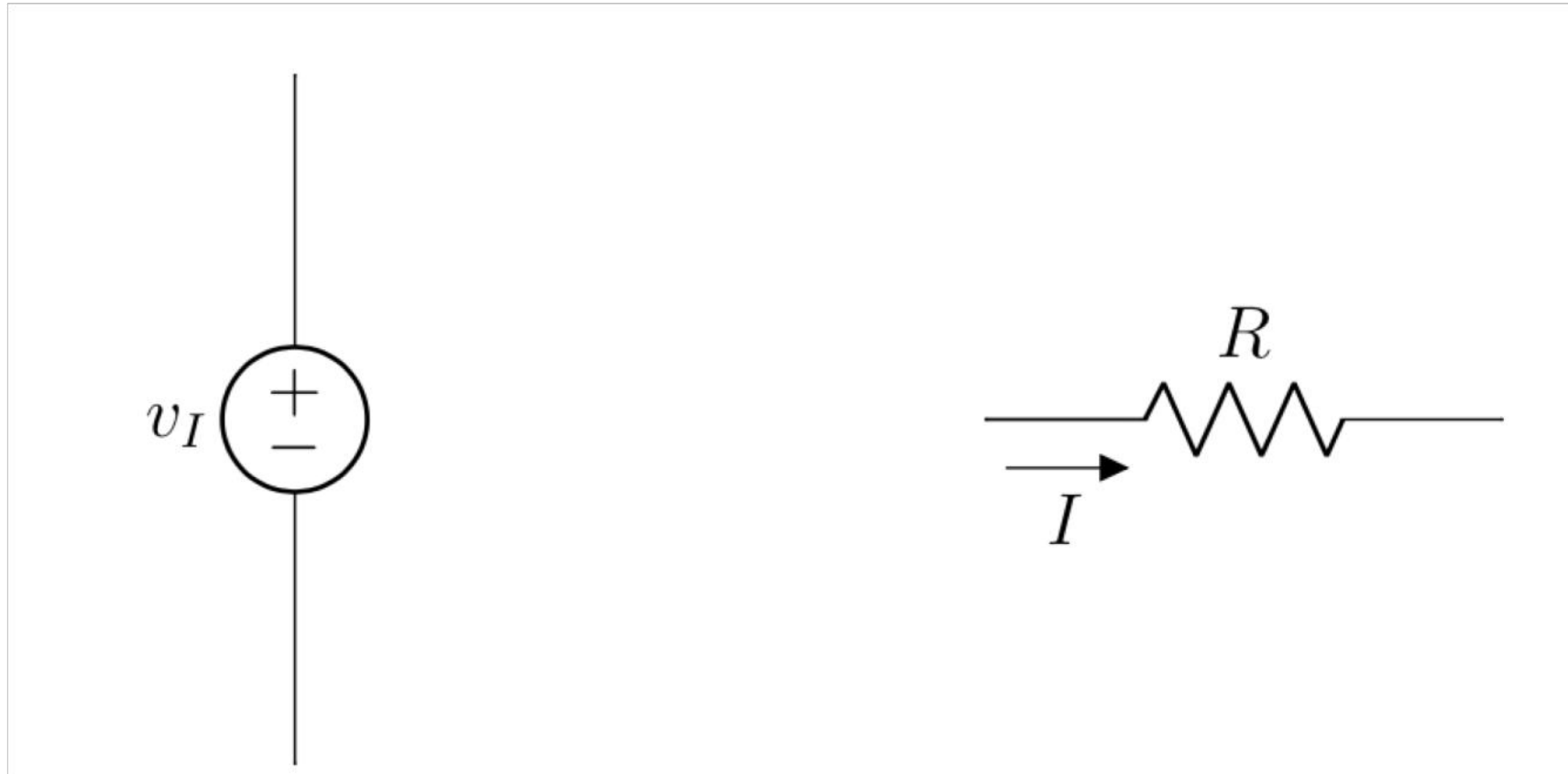
$$V_p = \text{peak of output} \\ = V_M - V_D$$

First improvement: Full wave rectifier



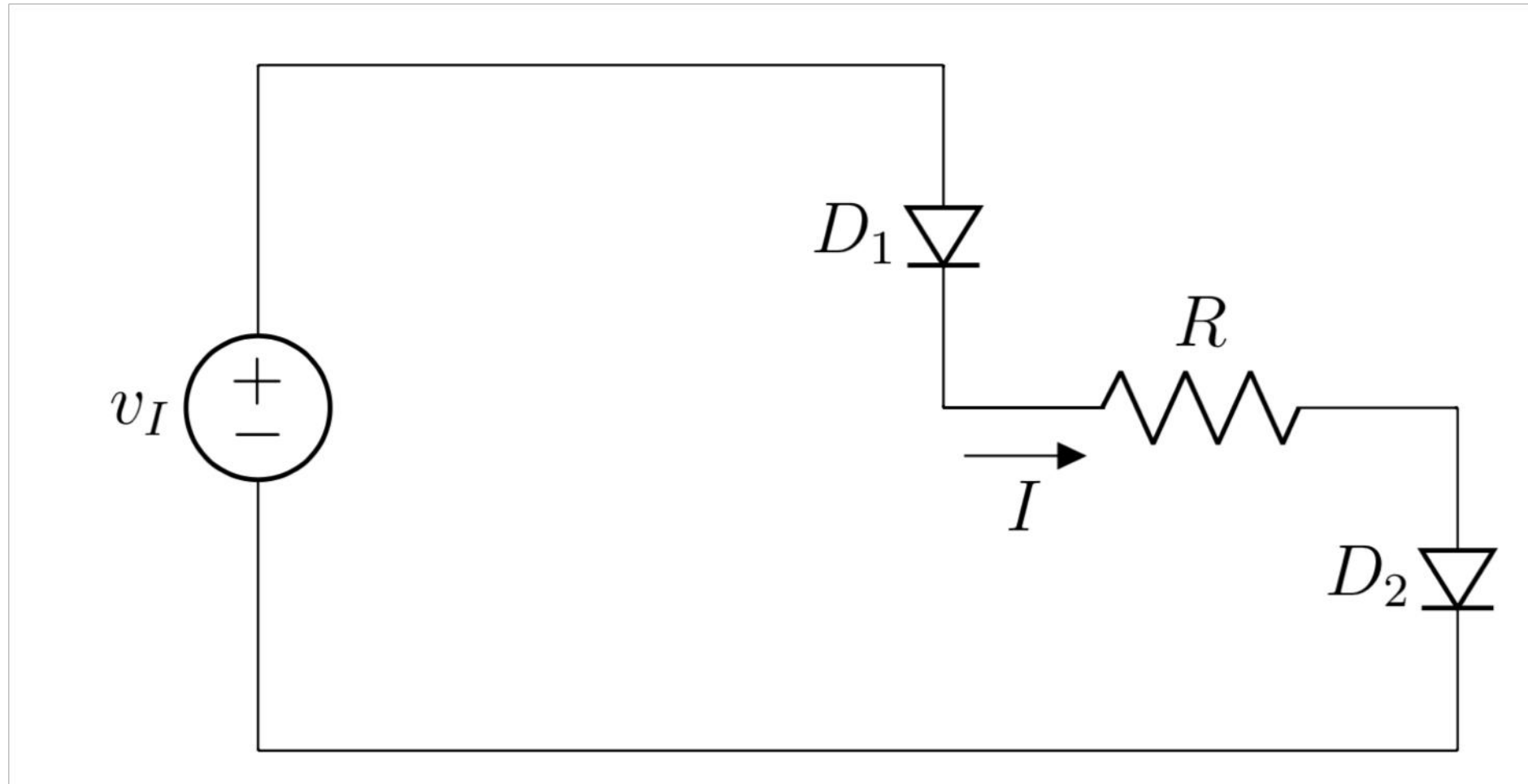
First improvement: Full wave rectifier

Positive half cycle



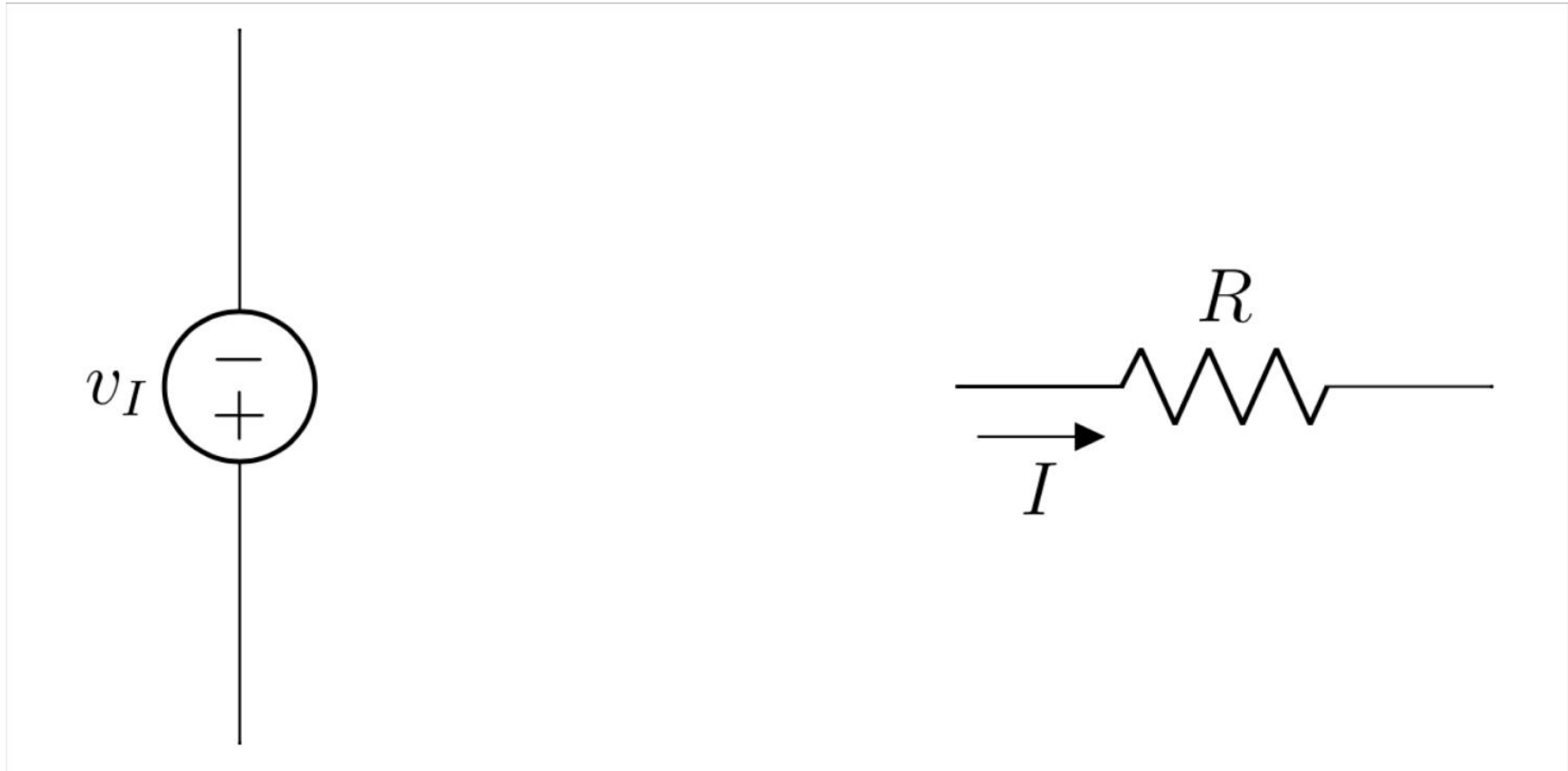
First improvement: Full wave rectifier

Positive half cycle



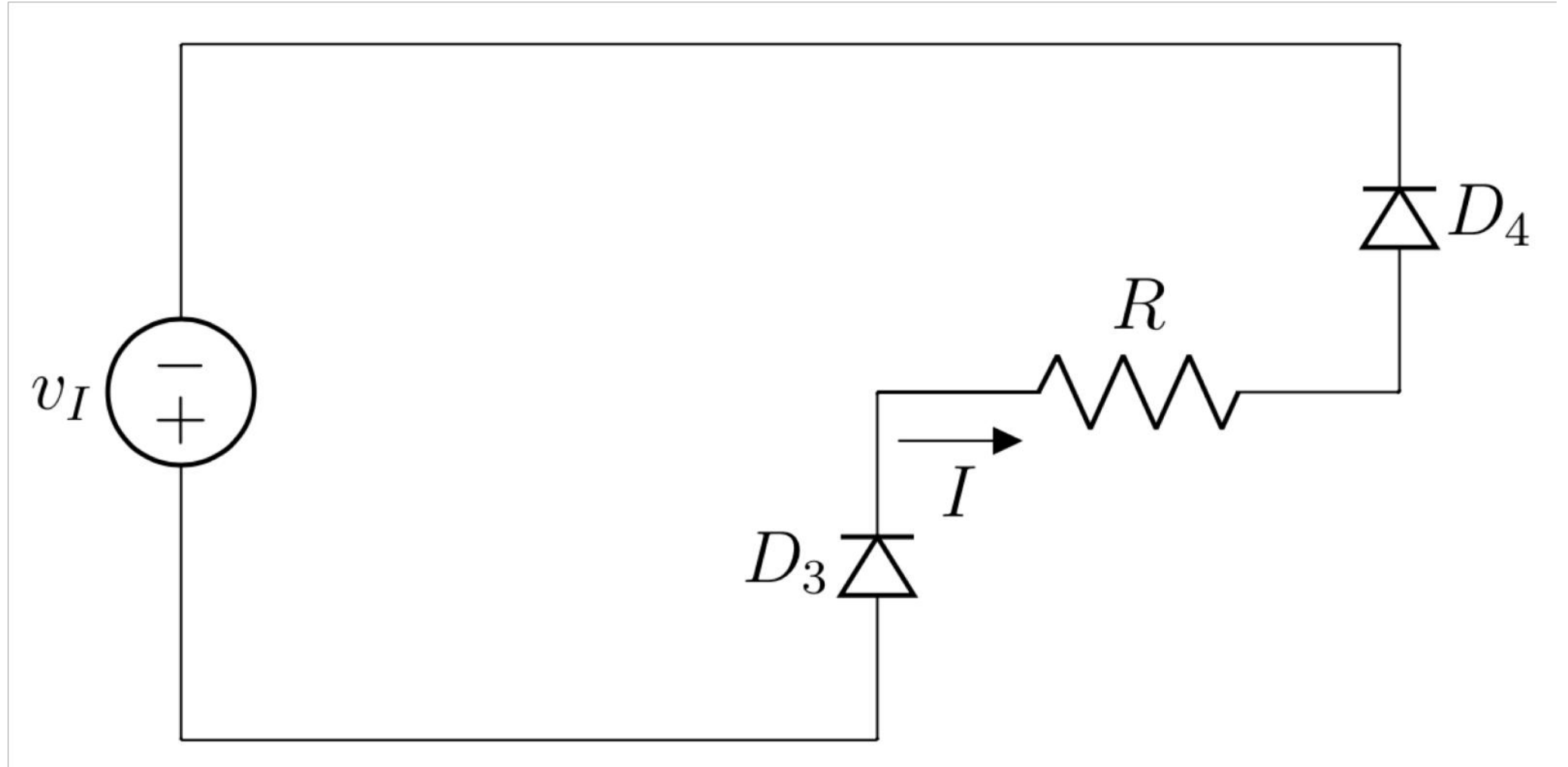
First improvement: Full wave rectifier

Negative half cycle



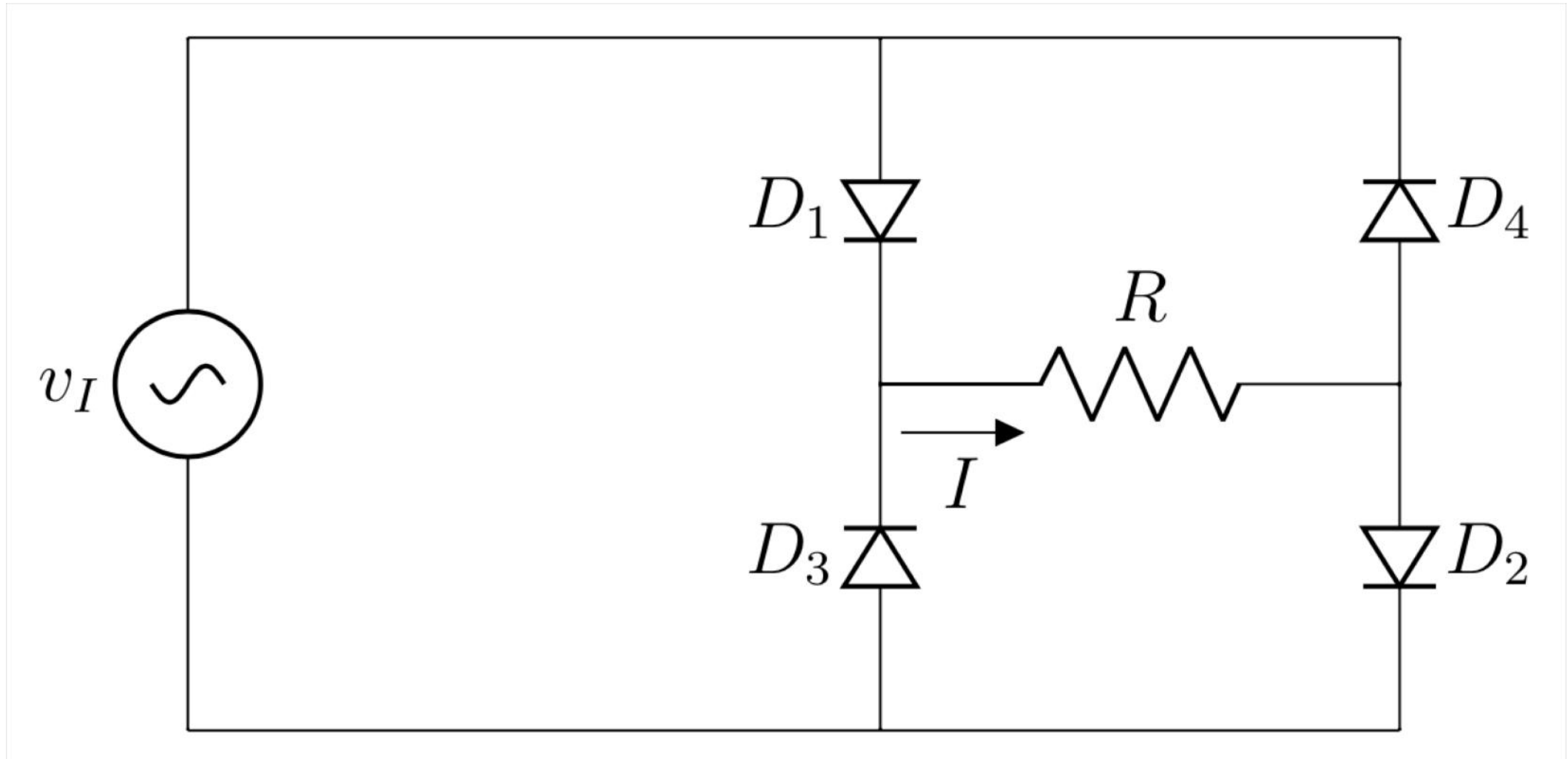
First improvement: Full wave rectifier

Negative half cycle



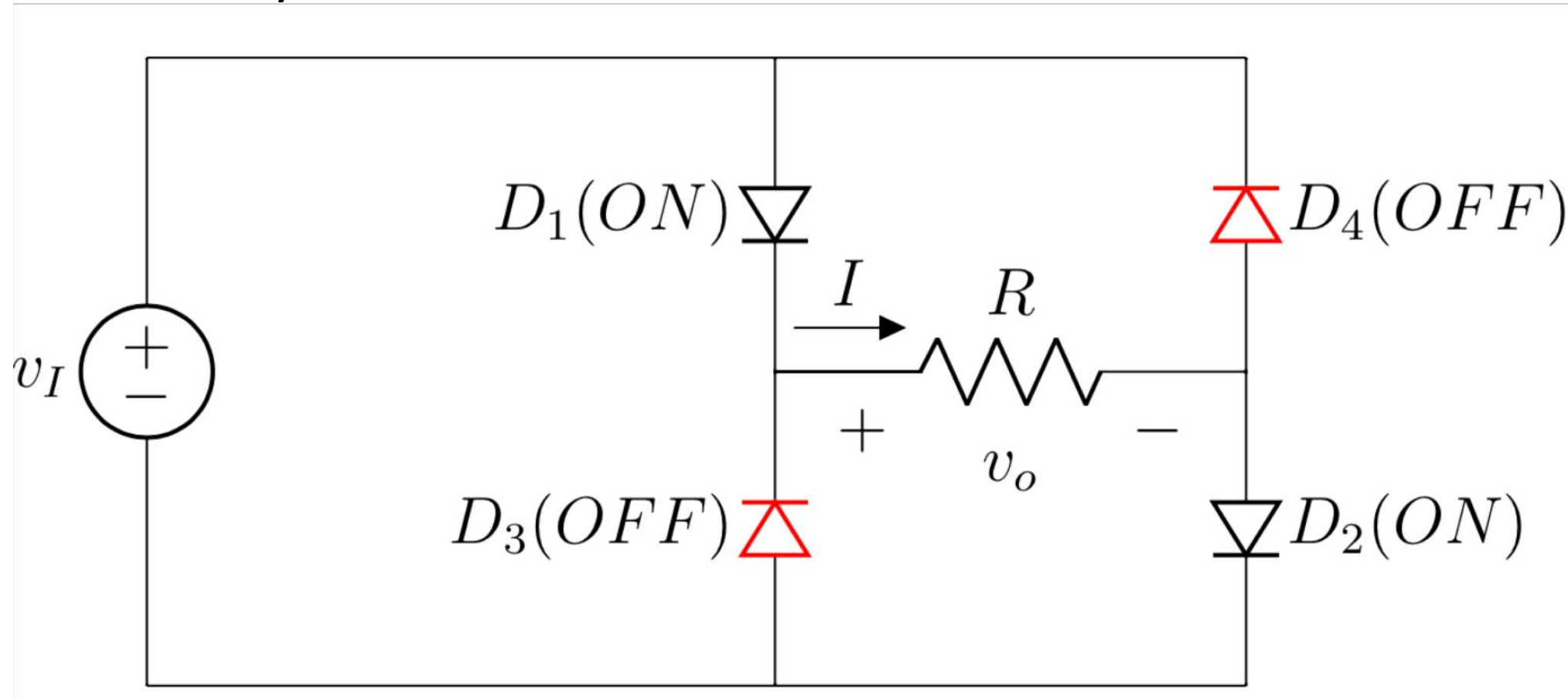
First improvement: Full wave rectifier

Combining



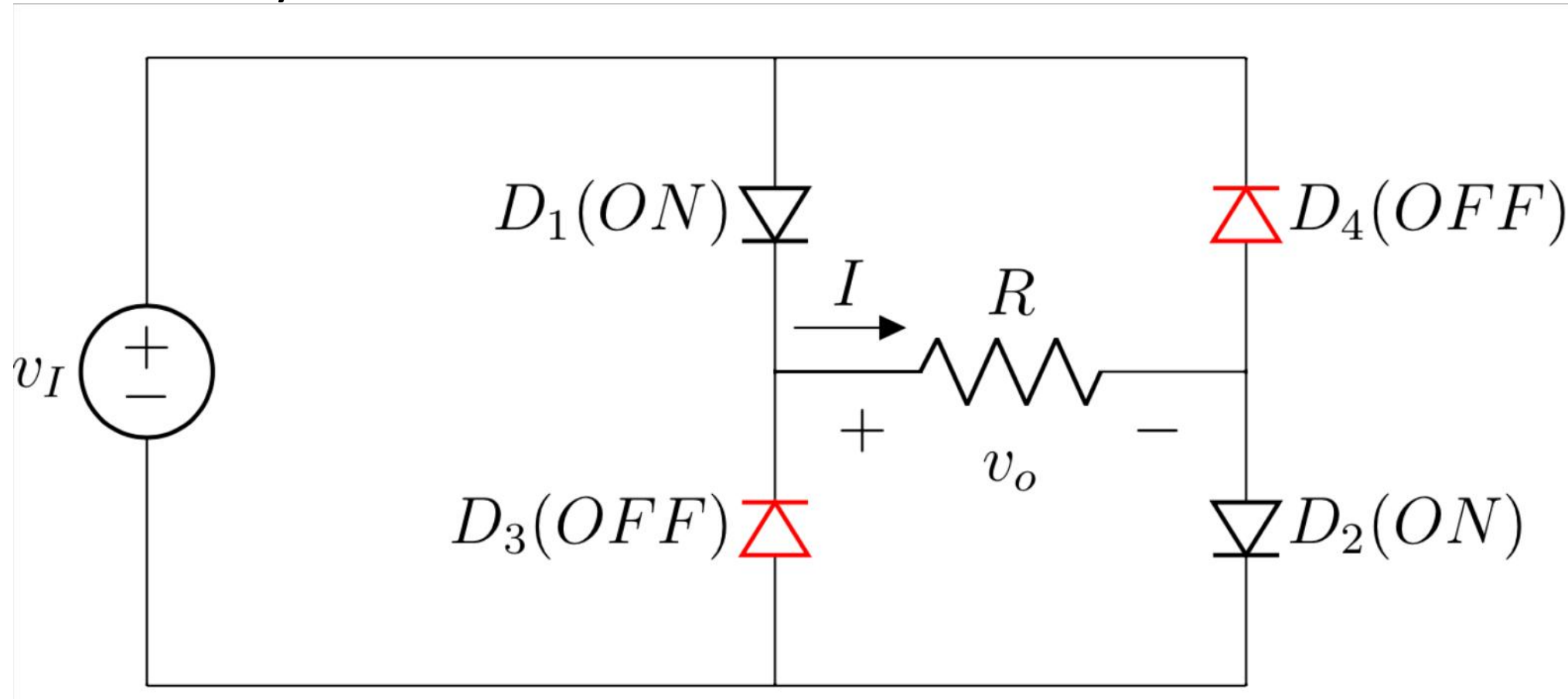
First improvement: Full wave rectifier

Positive half cycle



First improvement: Full wave rectifier

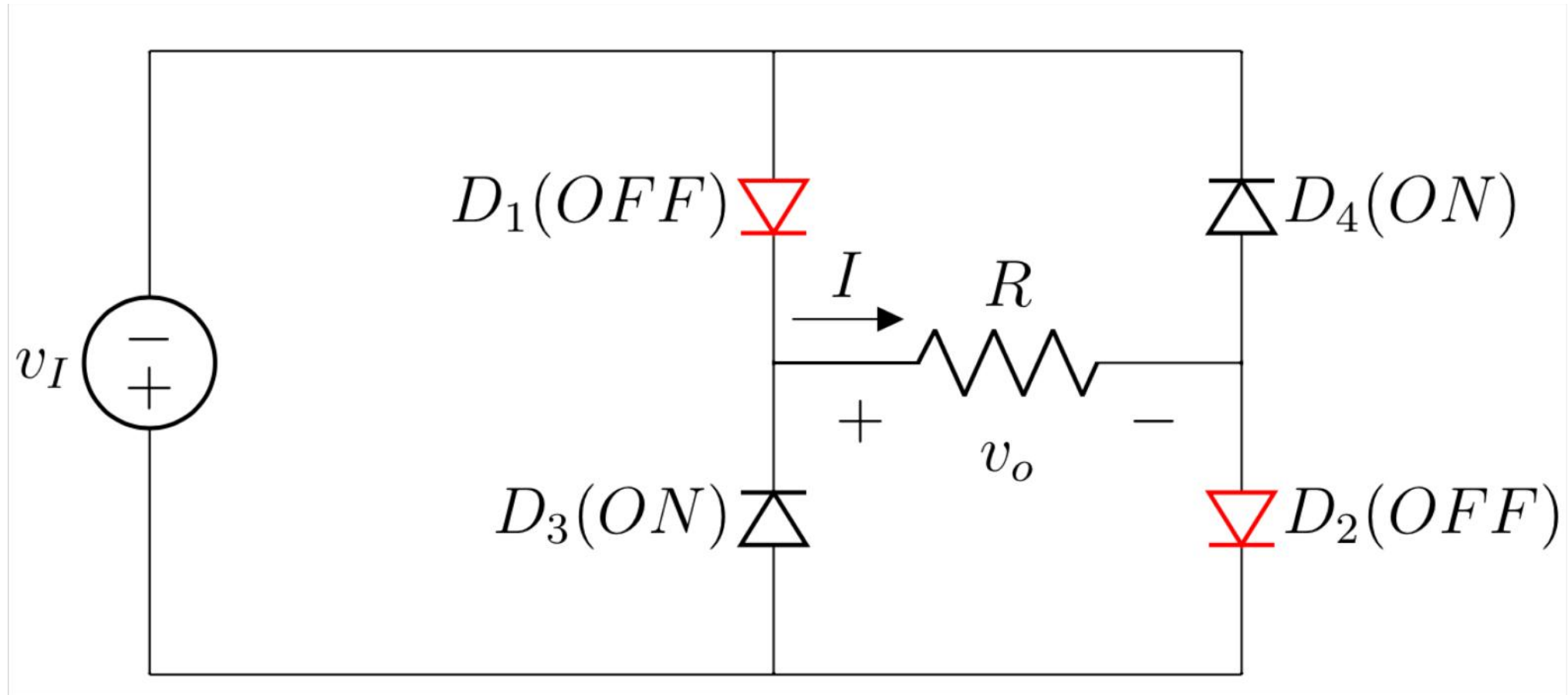
Positive half cycle



$$v_o = v_I - 2V_D$$

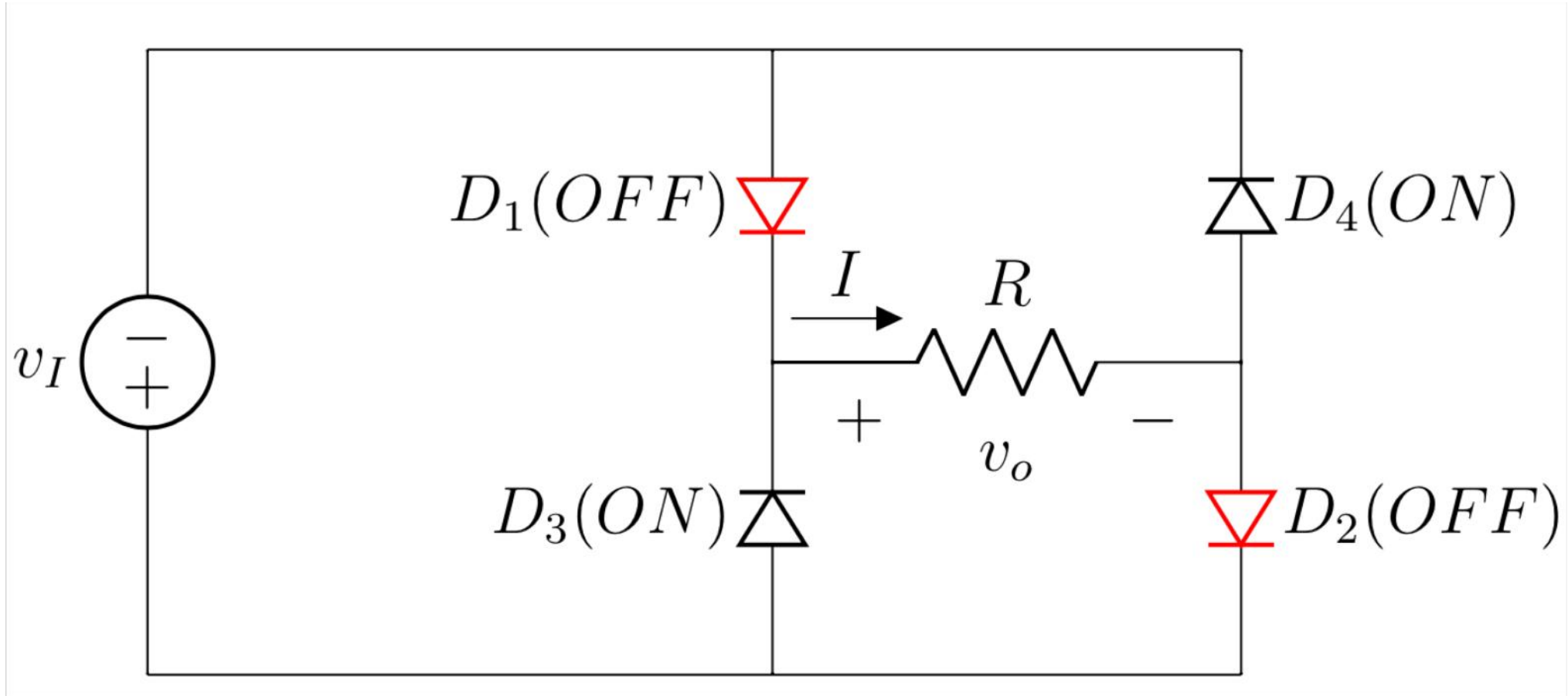
First improvement: Full wave rectifier

Negative half cycle



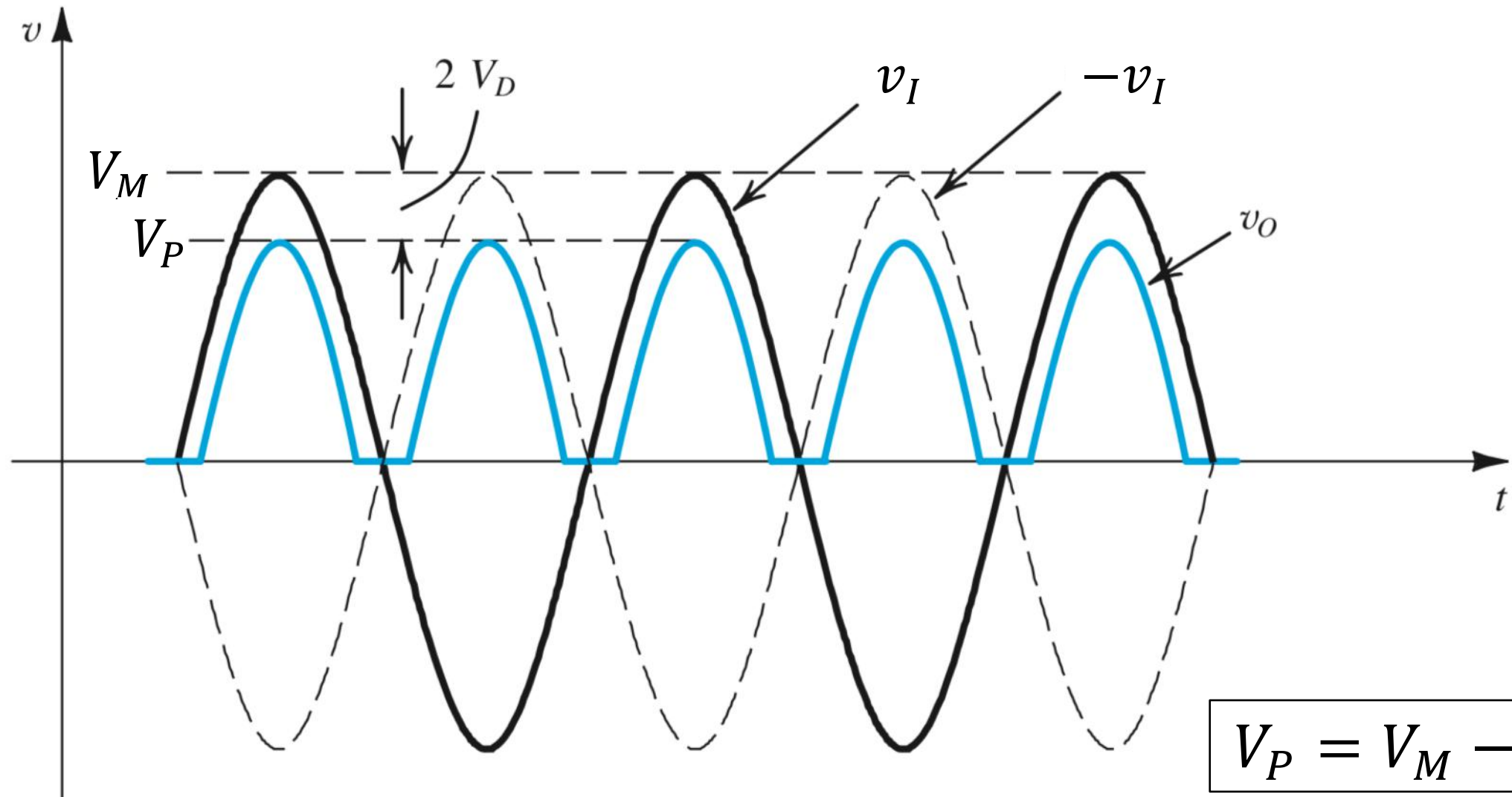
First improvement: Full wave rectifier

Negative half cycle



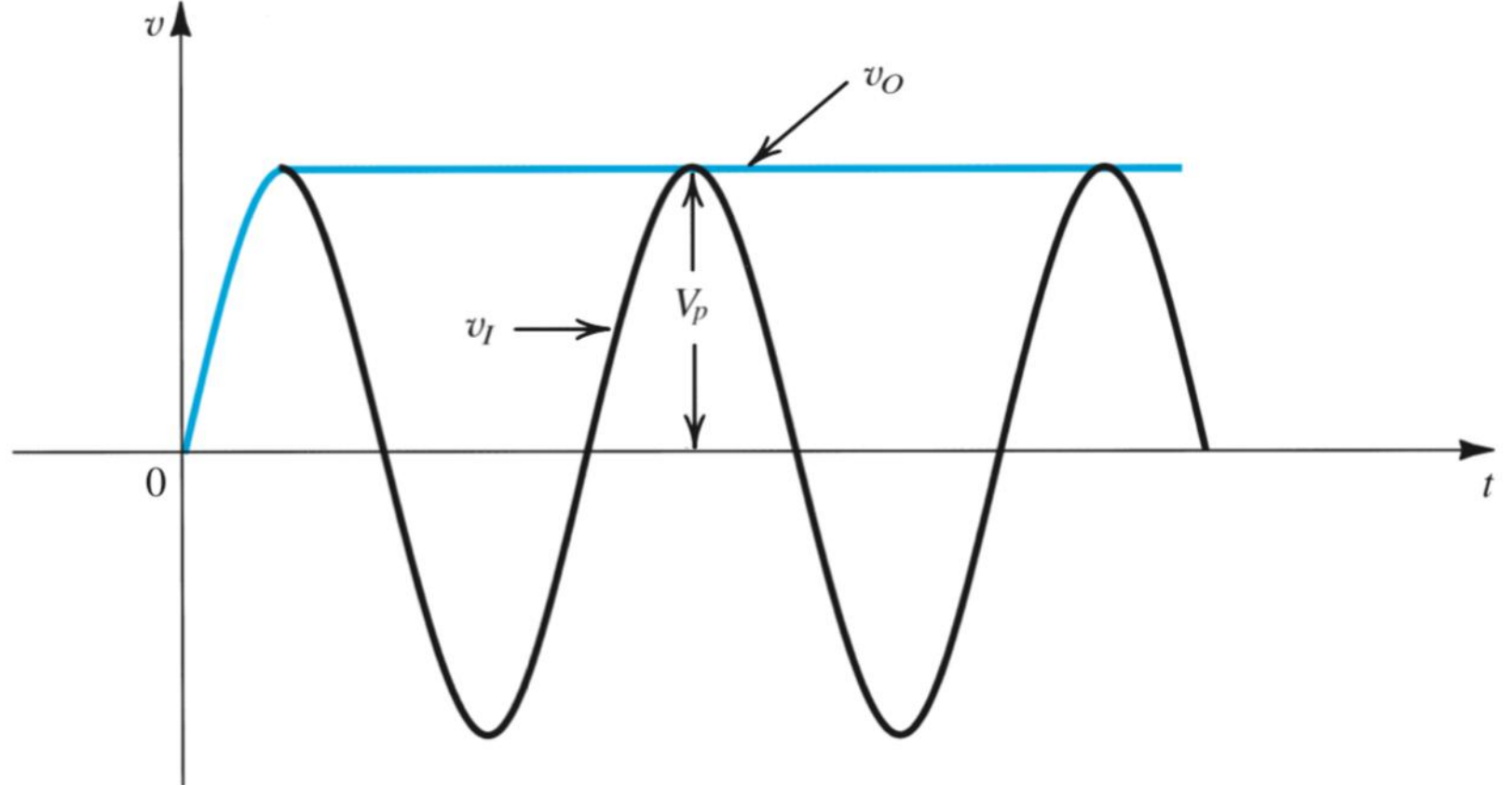
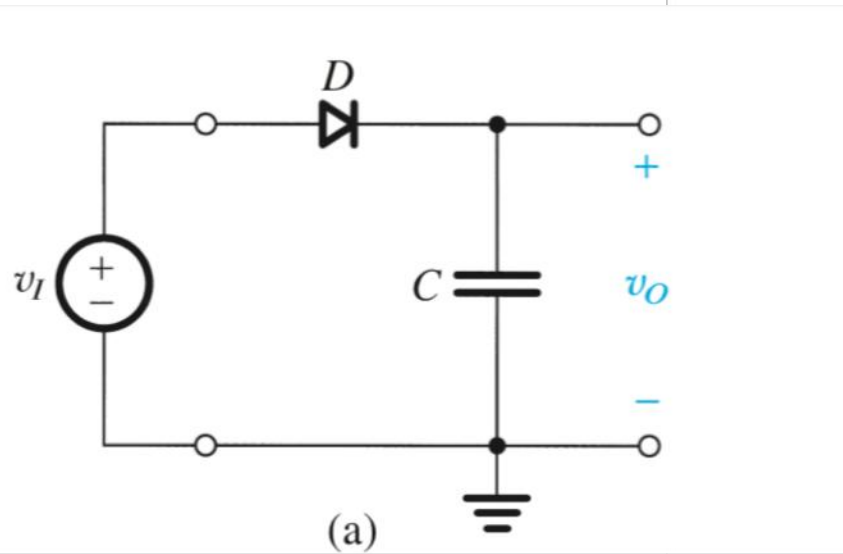
$$v_o = -v_I - 2V_D$$

First improvement: Full wave rectifier

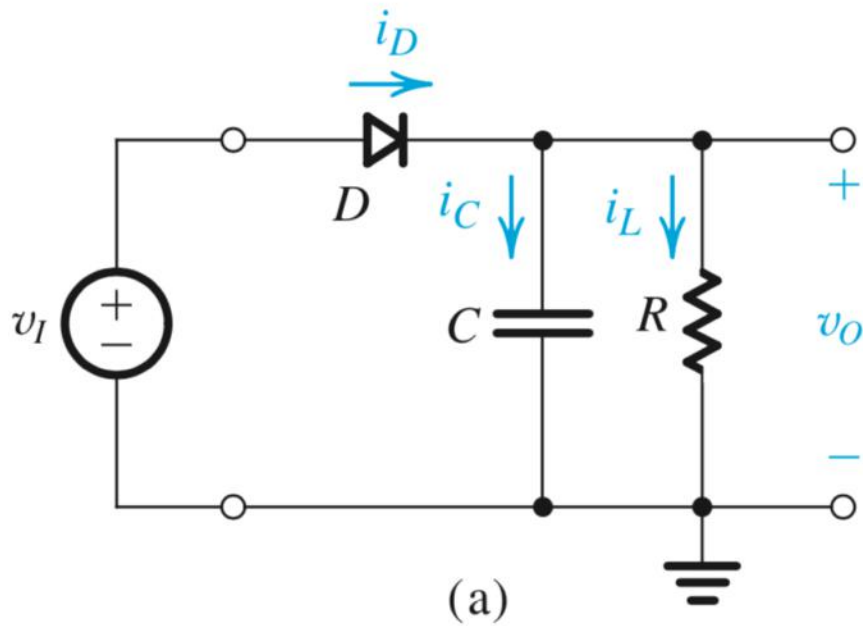


Second improvement: Capacitor smoothing

$$V_P = V_M - V_D$$



Second improvement: Capacitor smoothing



Second improvement: Capacitor smoothing

