AC Circuit Examples

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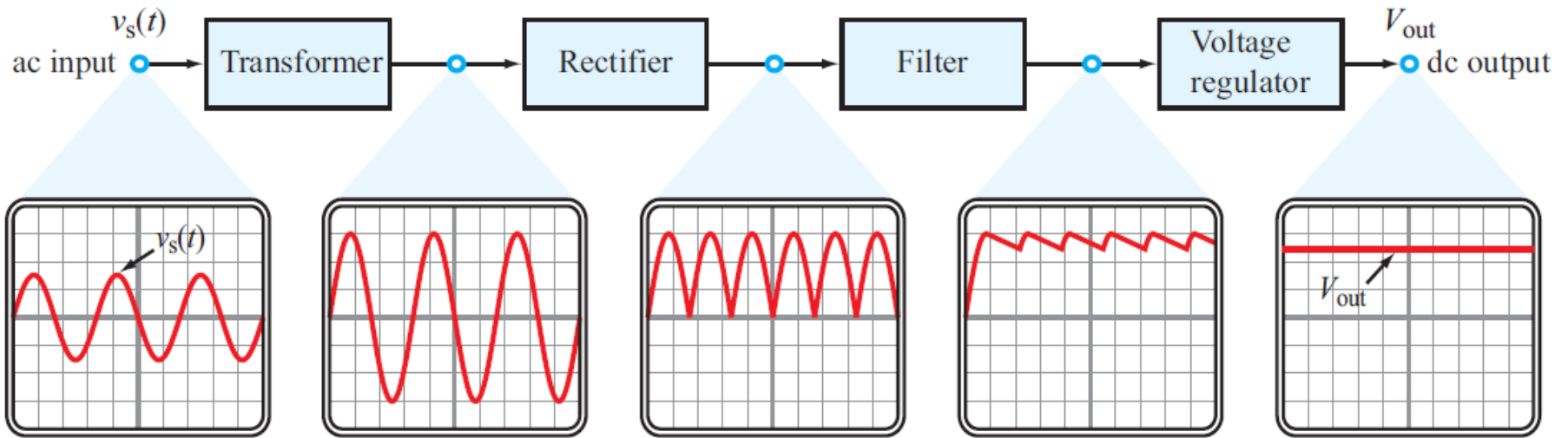
Vivek Subramanian

Phase Shift Circuits
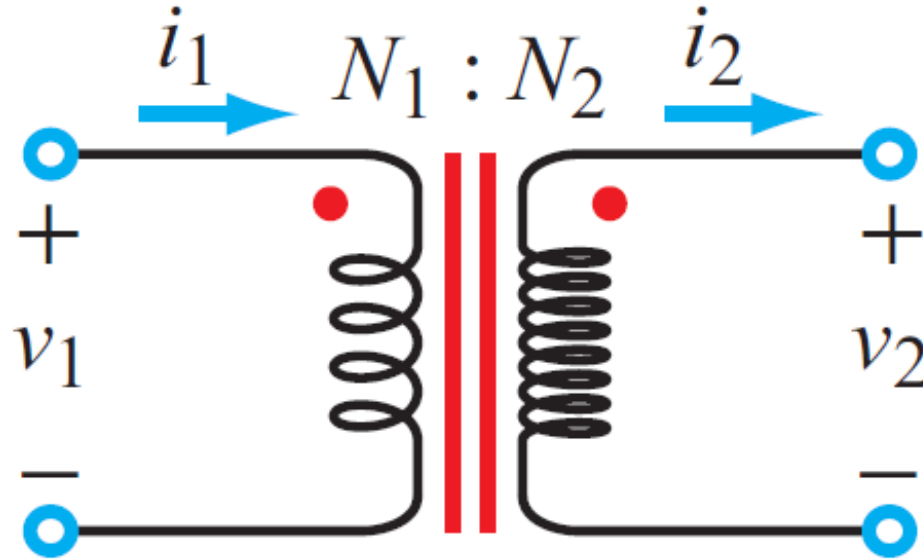

$v_a = v_{in}(t)$

a

$+$

i

R

v_{out1}

$- b$

$+$

$v_{in}(t)$

C

v_{out2}

$v_b = v_{out2}(t)$

t_0

Input

Δt

t_2

v_{out2}

Lags input by Δt_2

v_{out1} (not displayed)

Leads input by Δt_1
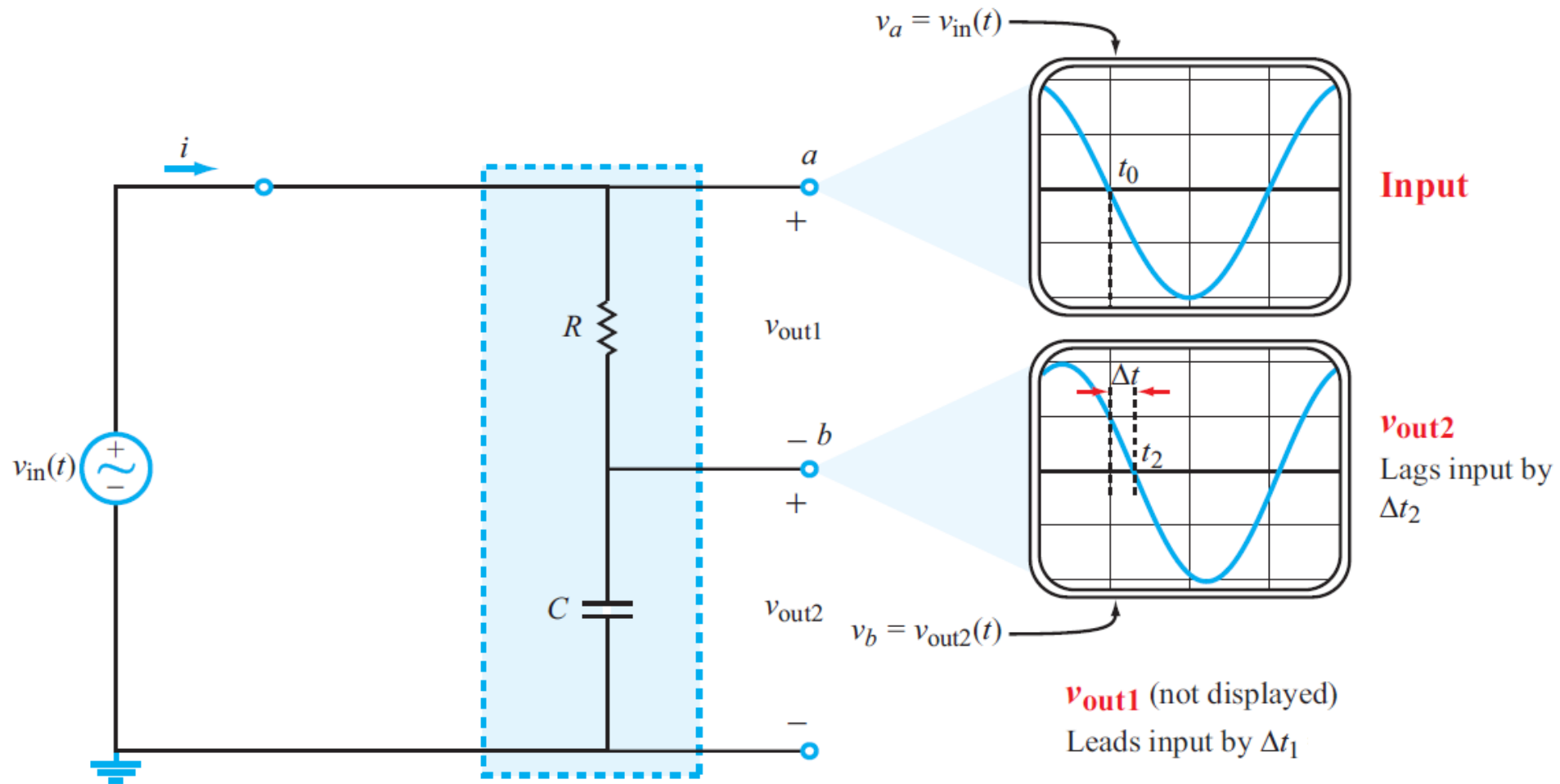
(a) Time-domain waveforms

Power Supply Circuit
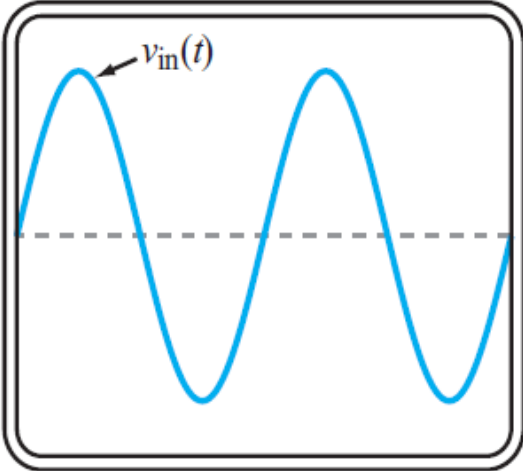
Ideal Transformer

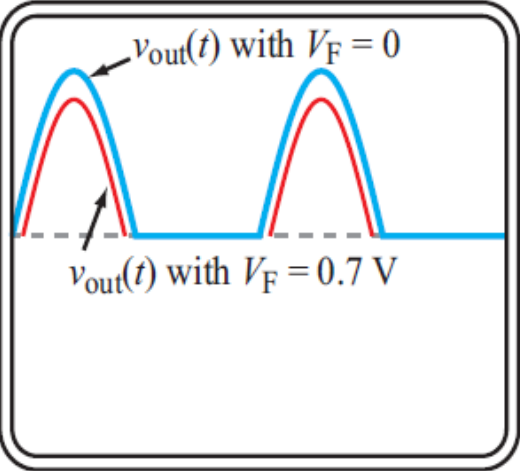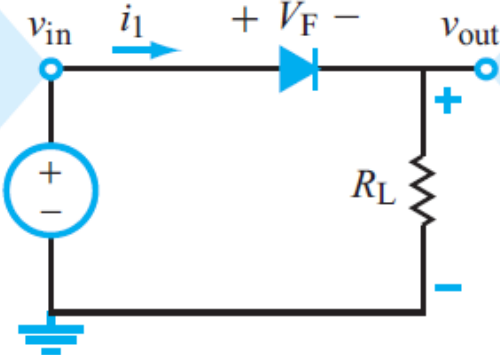i_1 $N_1 : N_2$ i_2

v_1 v_2

$$\frac{v_2}{v_1} = \frac{N_2}{N_1}$$

$$\frac{i_2}{i_1} = \frac{N_1}{N_2}$$

Half-Wave Rectifier

$v_{in}(t)$

$v_{in}(t)$

v_{in} i_1 $+ V_F -$ v_{out}
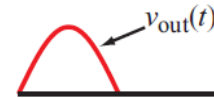
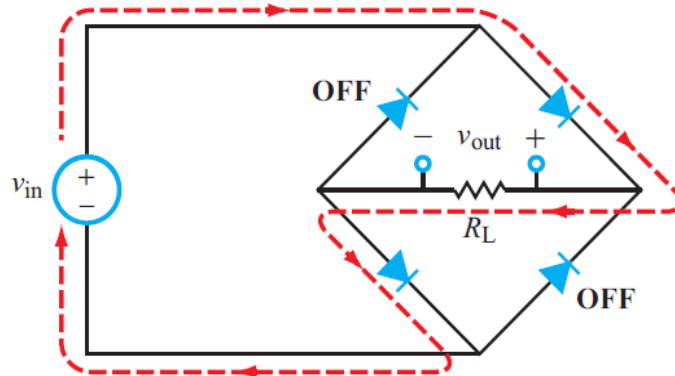R_L
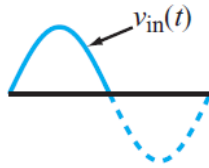
$v_{out}(t)$ with $V_F = 0$

$v_{out}(t)$ with $V_F = 0.7$ V

$v_{out}(t)$
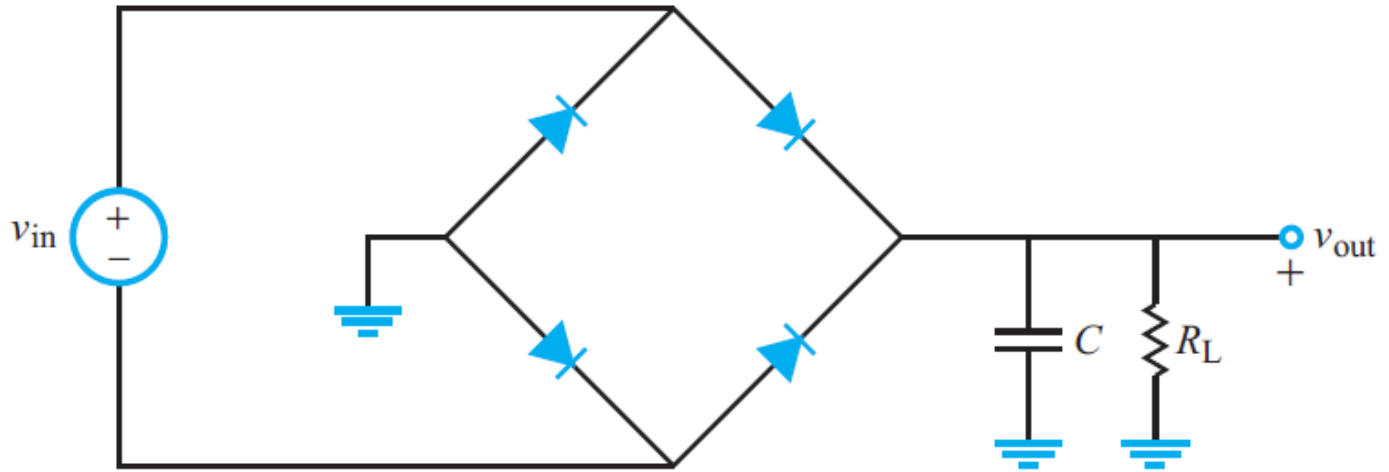
Full-Wave Rectifier

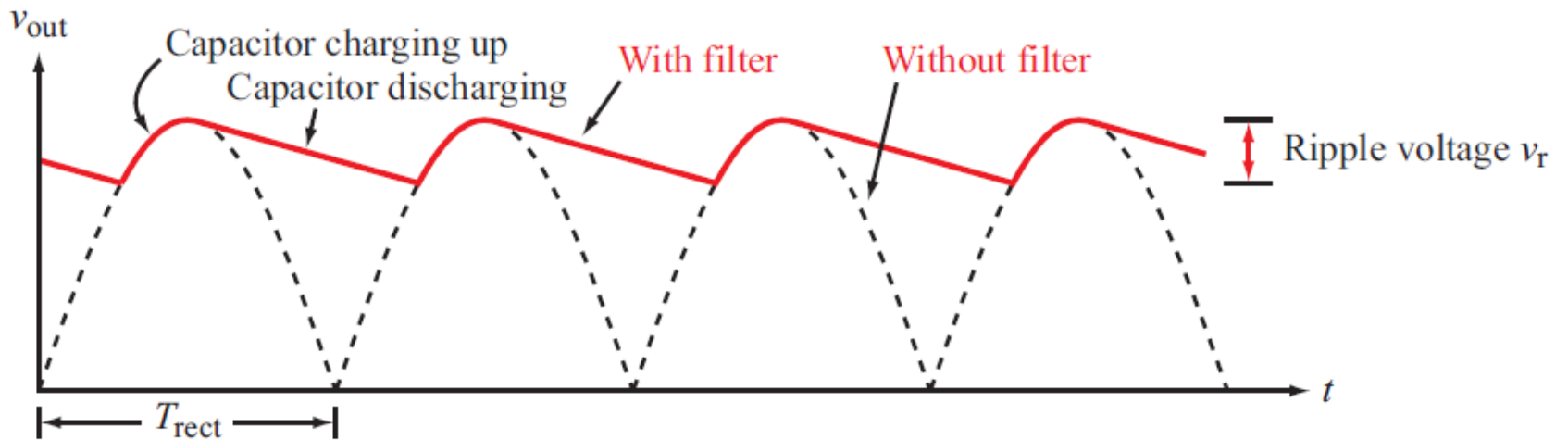Current flow during first half of cycle

(a) Positive half cycle

Current flow during second half of cycle

Smoothing RC Filter

(a) Bridge rectifier with filter

(b) Filtered output

Complete Power Supply

$$V_{s_1} = \left(\frac{N_2}{N_1}\right)V_s$$

$$v_{s_1}(t) = V_{s_1}\cos\omega t$$

$N_1 : N_2$

$(V_{s_1} - 1.4)$

v_{s_2}

v_{out}

V_z

Zener diode V_z

R_s

i_z

$v_{s_2}(t)$

C

R_L

$v_{\text{out}}(t)$

Transformer

Rectifier

RC filter and voltage regulator