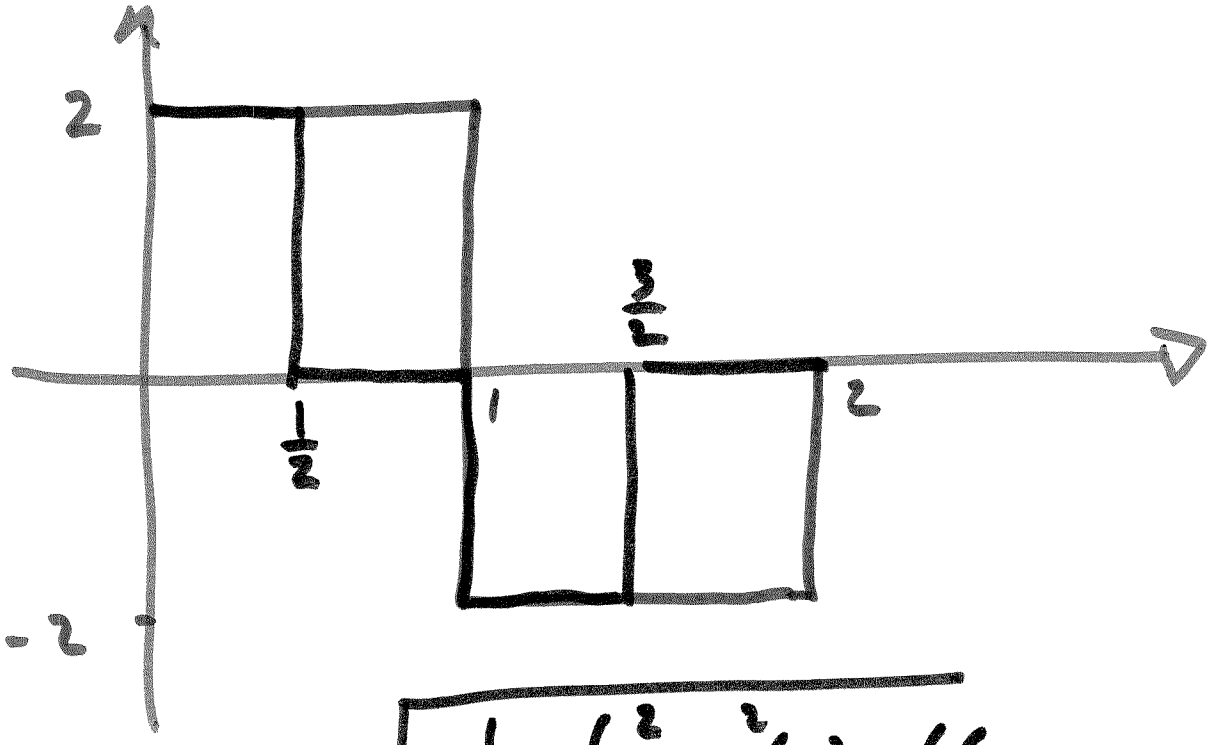
ECE 320 & ECE 329

ENERGY SYSTEMS I

BACKGROUND STUDY IN ENERGY SYSTEMS

SESSION no. 4



$$\sqrt{\frac{1}{2}\int_0^2 v^2(t)\,dt}$$

$$\sqrt{\frac{1}{2}\left[\int_0^{\frac{1}{2}} 2^2\,dt + \int_1^{\frac{3}{2}} (-2)^2\,dt\right]} = \sqrt{\frac{1}{2}(2+2)}$$

$$= \sqrt{2}$$

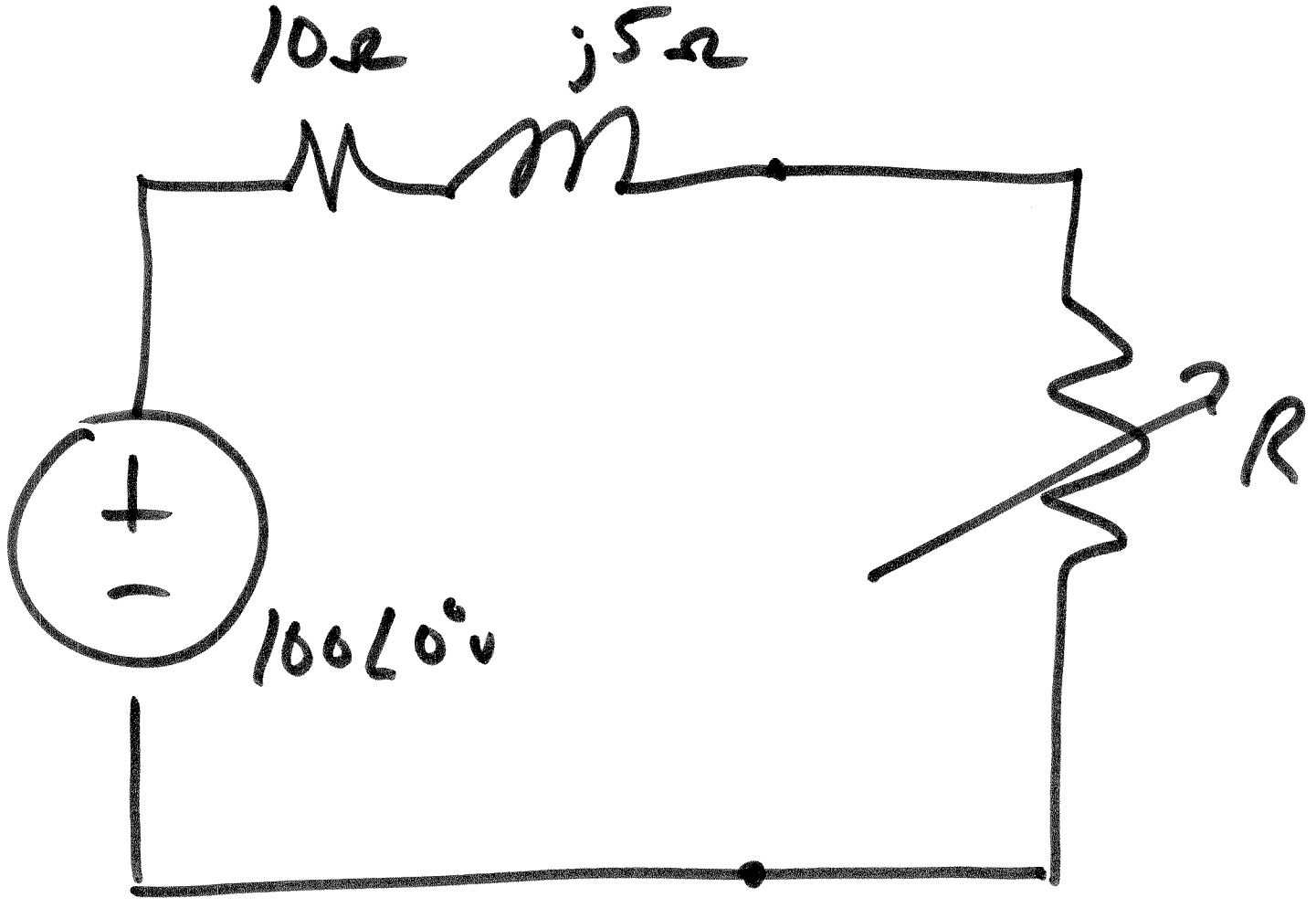
$$P = \frac{(10\,V)(2\,A)}{2}(0.6)$$

$$P = 6\ W$$

$$P = \frac{(100)(2\pi)(1.0)}{2}$$

$$P = 10\ W$$

$$V = WNBA$$



FIND R FOR MAX POWER TRANSFER.

Example Double Frequency Power Term. For a voltage of 10 cos(ωt)Volts and a current of 2cos(ωt-θ)Amps, find the power as a function of time. Vary the power factor over its range to see if there is any effect on the power output.

$pf := 0.6$ $\theta := \text{acos}(pf)$

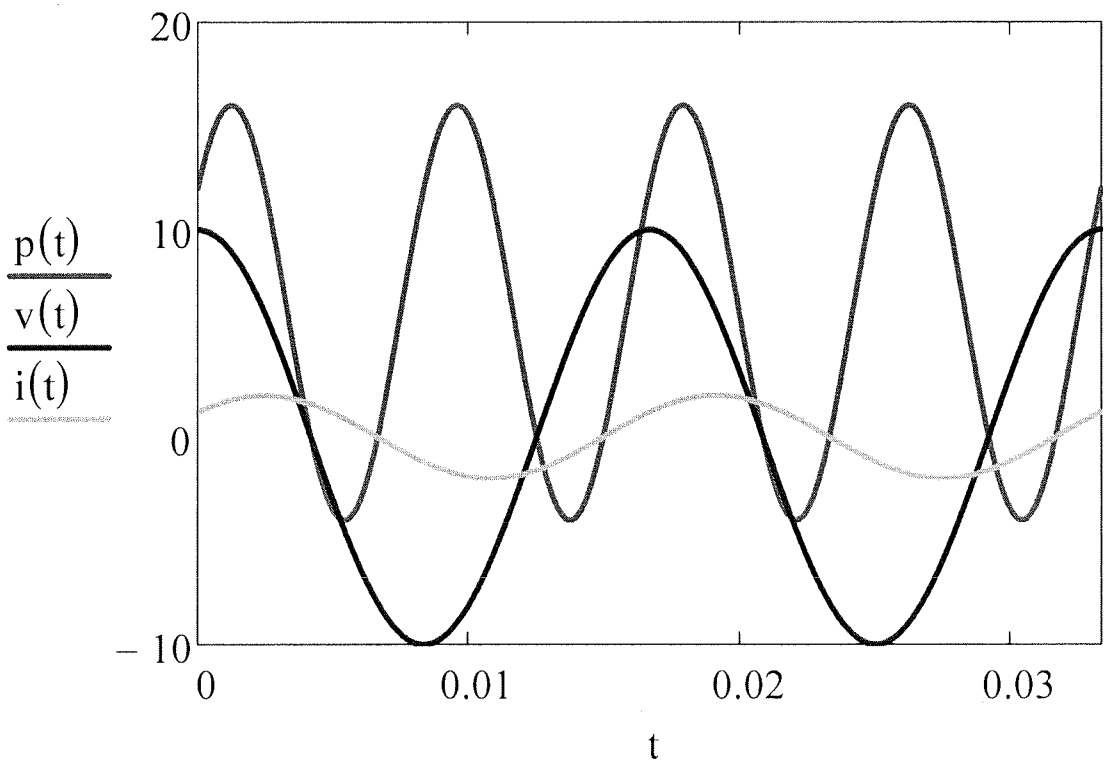
$\omega := 2 \cdot \pi \cdot 60 \cdot \frac{\text{rad}}{\text{sec}}$

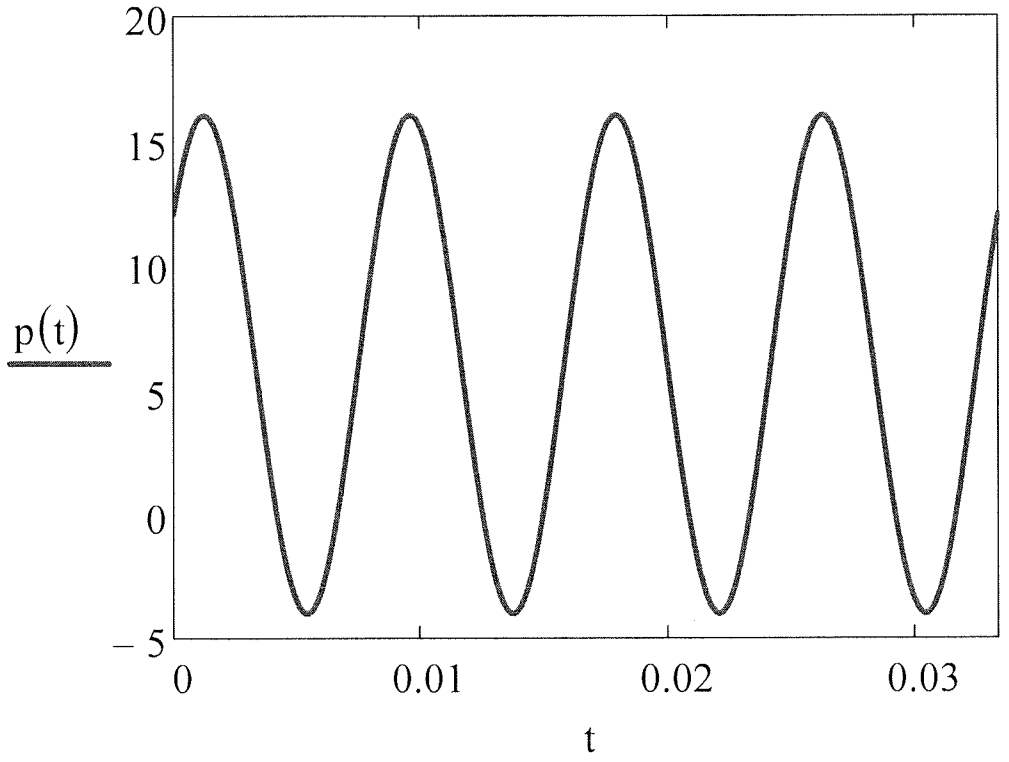
$v(t) := 10 \cdot \cos(\omega \cdot t) \cdot V$

$i(t) := 2 \cdot \cos(\omega \cdot t - \theta) \cdot A$

$\omega = 376.991 \frac{\text{rad}}{\text{sec}}$

$p(t) := v(t) \cdot i(t)$




20
15
10
p(t)
5
0
– 5
0
0.01
0.02
0.03
t

Example Double Frequency Power Term. For a voltage of 10 cos(ωt)Volts and a current of 2cos(ωt-θ)Amps, find the power as a function of time. Vary the power factor over its range to see if there is any effect on the power output.

$pf := 1.0$ $\theta := \text{acos}(pf)$

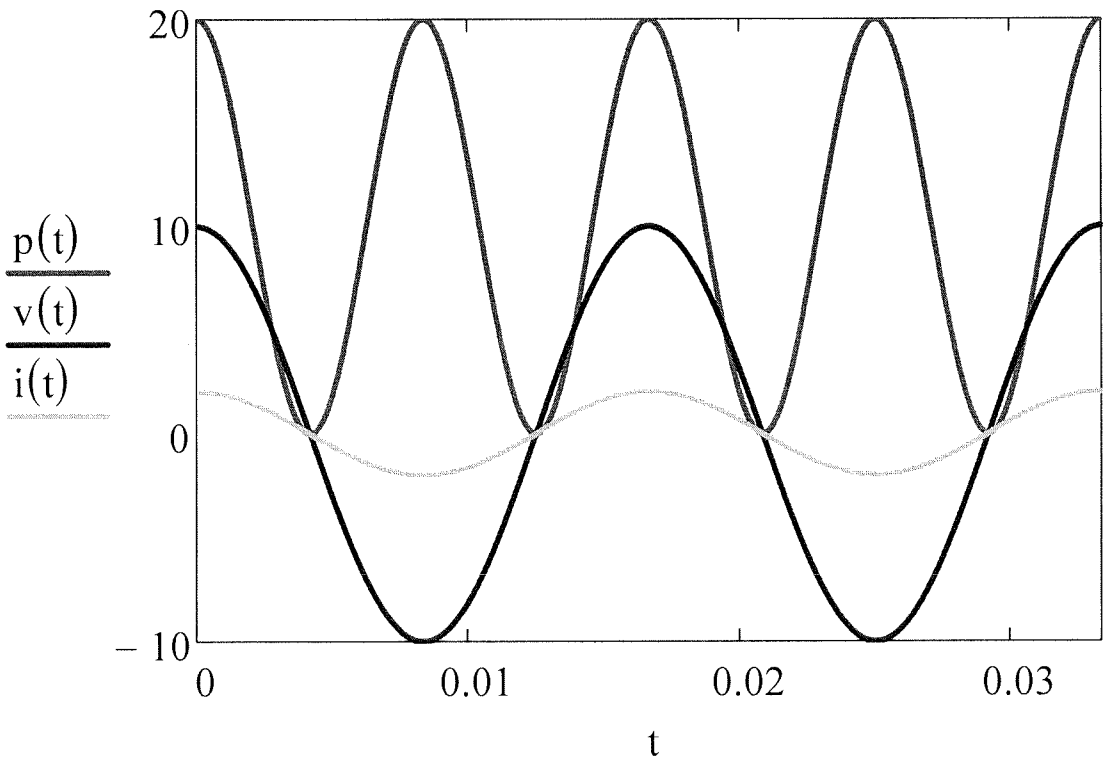
$\omega := 2 \cdot \pi \cdot 60 \cdot \frac{\text{rad}}{\text{sec}}$

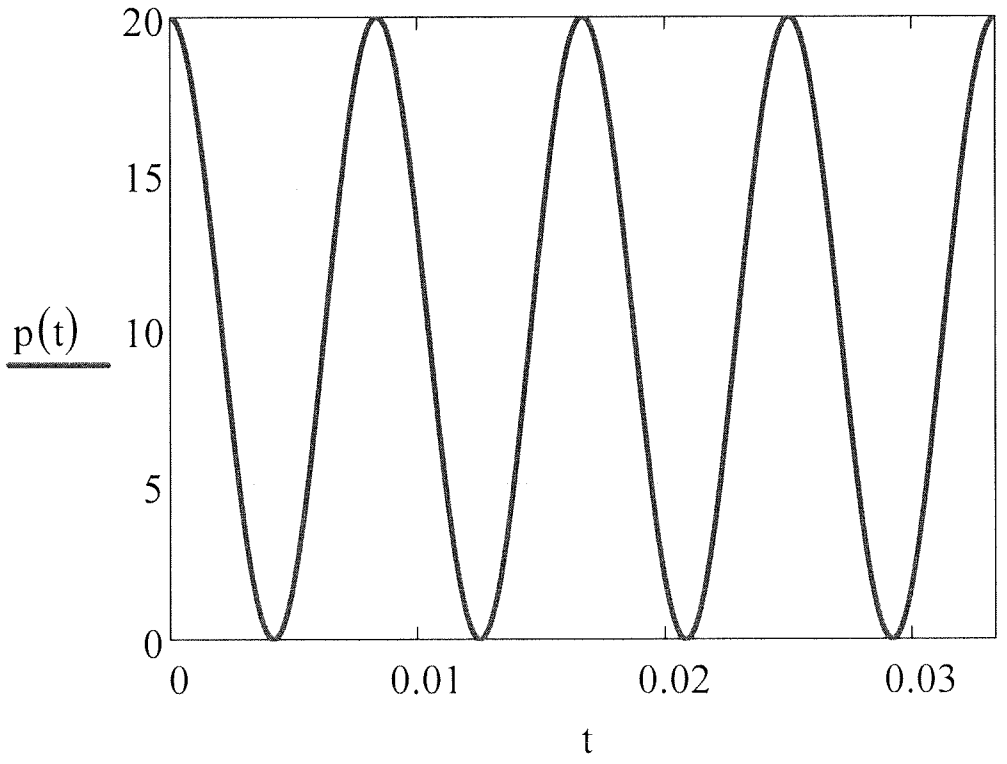
$v(t) := 10 \cdot \cos(\omega \cdot t) \cdot V$

$i(t) := 2 \cdot \cos(\omega \cdot t - \theta) \cdot A$

$\omega = 376.991 \frac{\text{rad}}{\text{sec}}$

$p(t) := v(t) \cdot i(t)$




20
15
p(t)
10
5
0
0
0.01
0.02
0.03
t

Example Double Frequency Power Term. For a voltage of 10 cos(ωt)Volts and a current of 2cos(ωt-θ)Amps, find the power as a function of time. Vary the power factor over its range to see if there is any effect on the power output.

$pf := 0$ $\theta := \text{acos}(pf)$

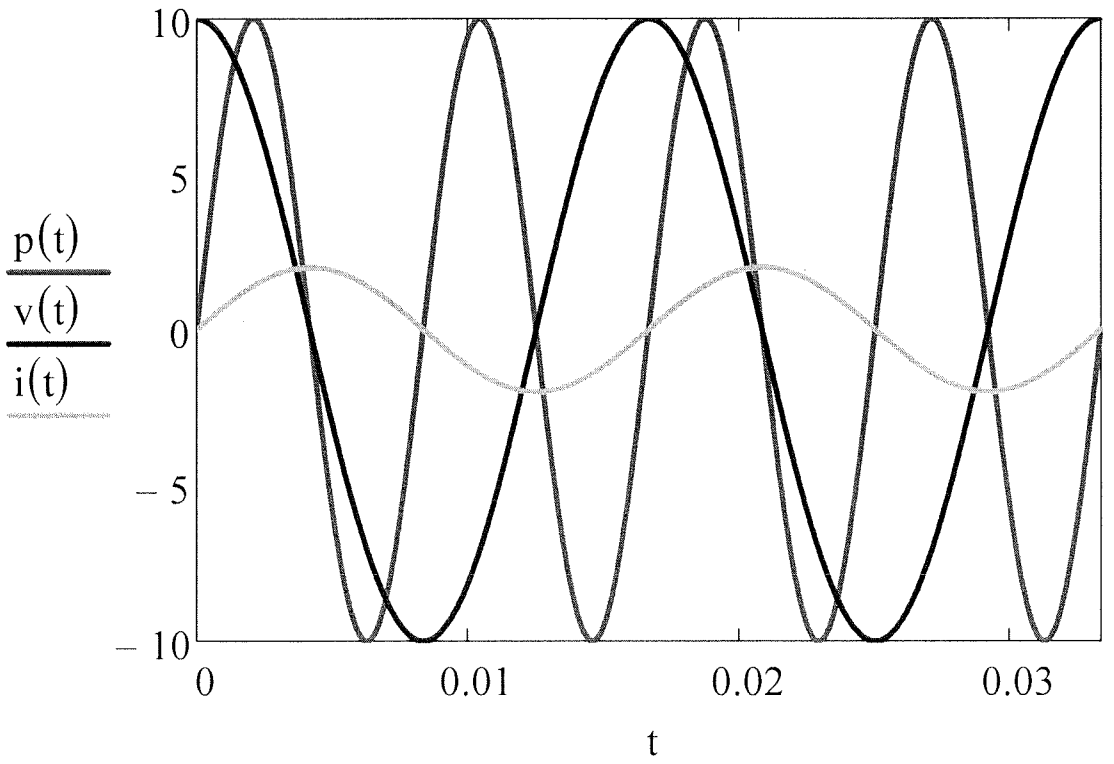
$\omega := 2 \cdot \pi \cdot 60 \cdot \frac{\text{rad}}{\text{sec}}$

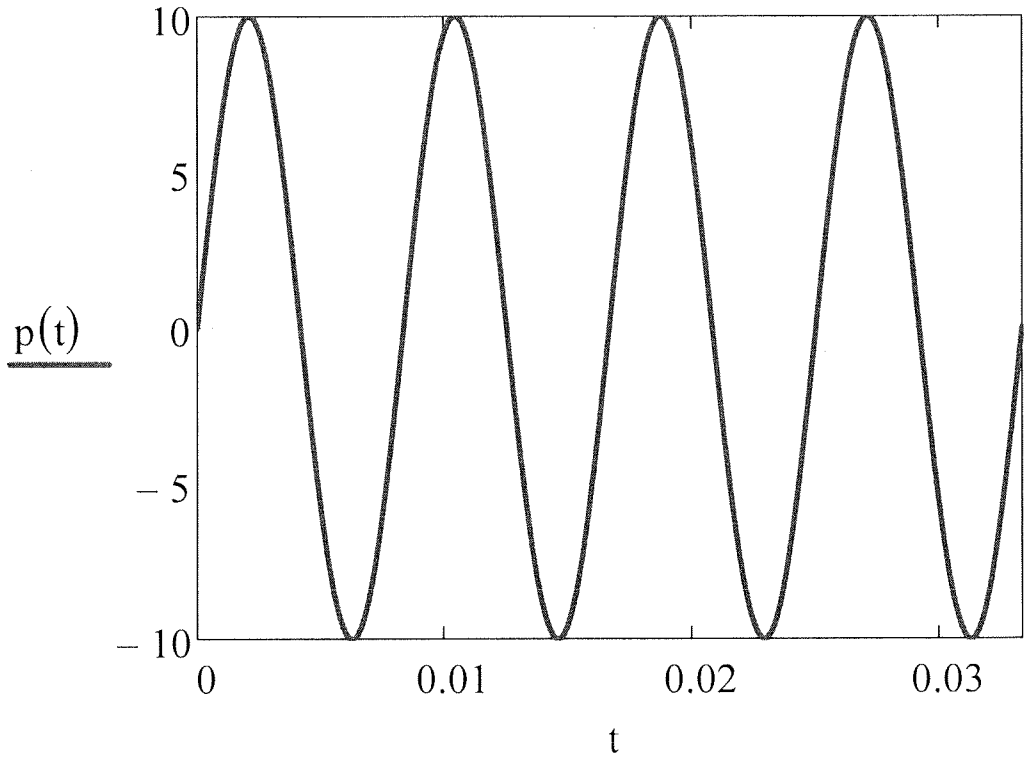
$v(t) := 10 \cdot \cos(\omega \cdot t) \cdot V$

$i(t) := 2 \cdot \cos(\omega \cdot t - \theta) \cdot A$

$\omega = 376.991 \frac{\text{rad}}{\text{sec}}$

$p(t) := v(t) \cdot i(t)$




p(t)
10
5
0
− 5
− 10
0
0.01
0.02
0.03
t

Example Double Frequency Power Term. For a voltage of 10 cos(ωt)Volts and a current of 2cos(ωt-θ)Amps, find the power as a function of time. Vary the power factor over its range to see if there is any effect on the power output.

$pf := 0.6$ $\theta := -\text{acos}(pf)$

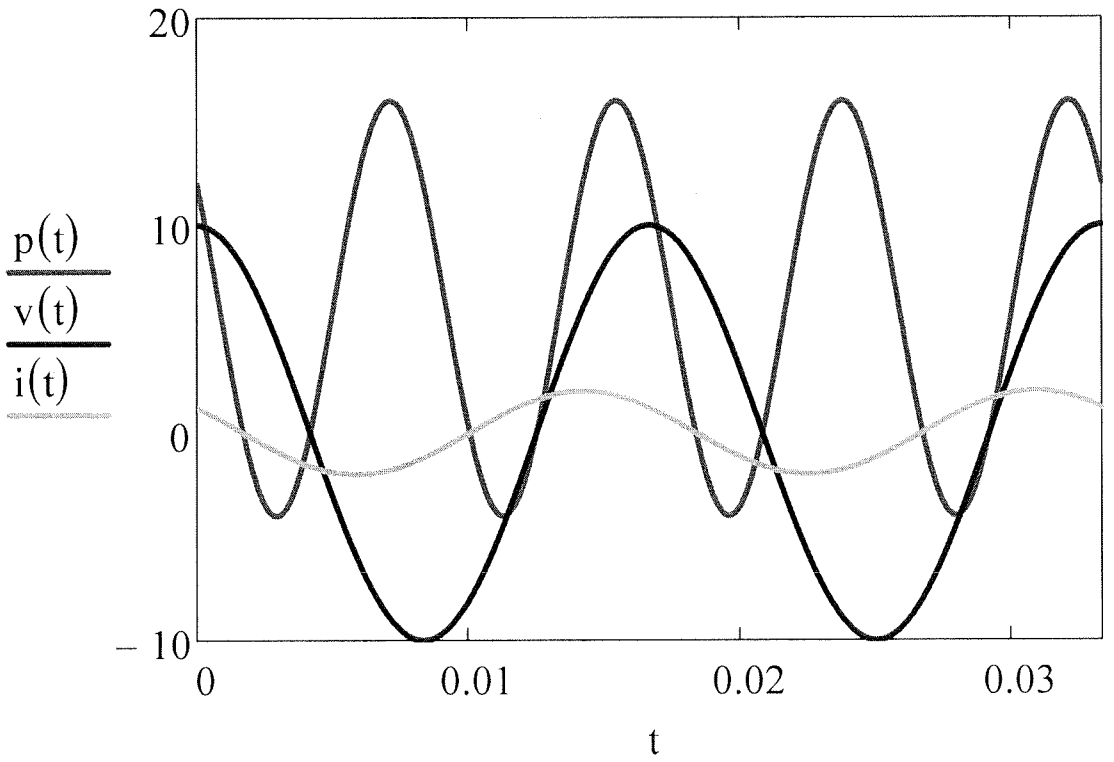
$\omega := 2 \cdot \pi \cdot 60 \cdot \frac{\text{rad}}{\text{sec}}$

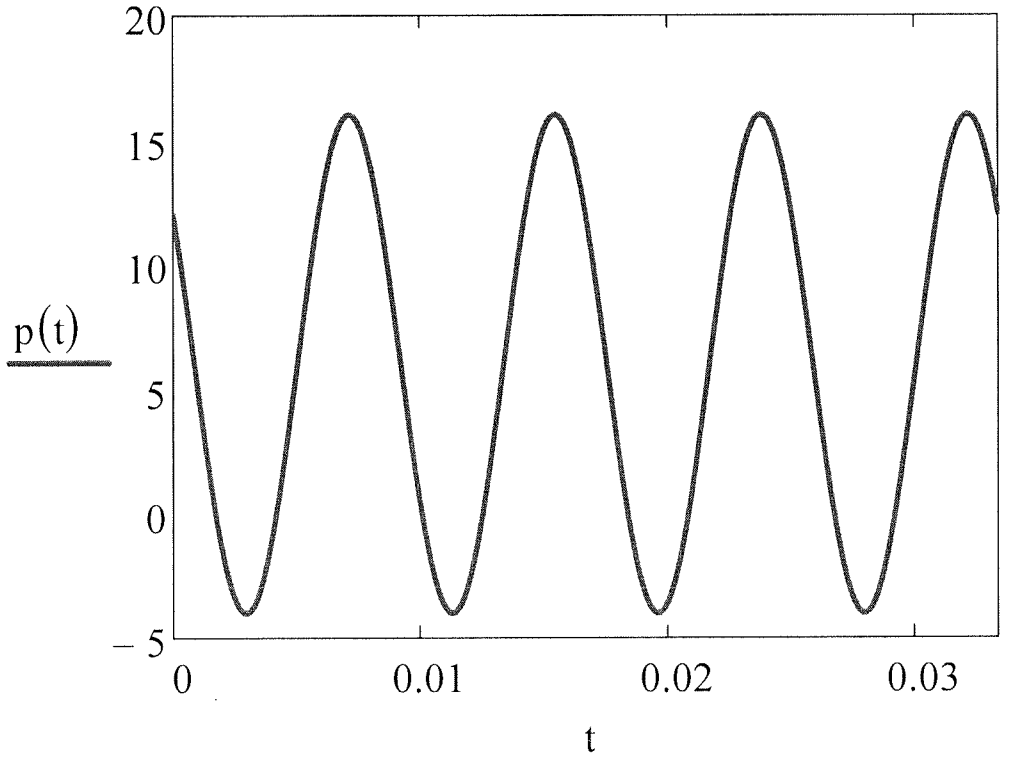
$v(t) := 10 \cdot \cos(\omega \cdot t) \cdot V$

$i(t) := 2 \cdot \cos(\omega \cdot t - \theta) \cdot A$

$\omega = 376.991 \frac{\text{rad}}{\text{sec}}$

$p(t) := v(t) \cdot i(t)$




20
15
10
5
0
− 5
p(t)
0
0.01
0.02
0.03
t

ECE 320

Energy Systems I

Lesson 4

AC Power Examples