

Analog Assignment

Karyampudi Meghana Sai
EE23BTECH11031

In Exercises 7.3 and 7.4, what is the net power absorbed by each circuit over a complete cycle. Explain your answer.

Solution: (a) In Exercise 7.3 :

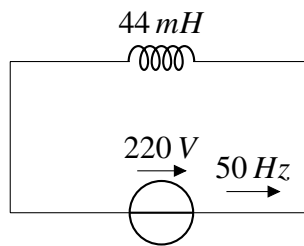


Fig. 1. Inductive Circuit

Symbol	Value	Description
L	$44mH$	Inductance
V_{rms}	$220V$	Voltage
f	$50Hz$	Frequency
ω	$2\pi f = 100\pi$	Angular Frequency
ϕ	?	Phase difference between current and voltage
I_{rms}	$15.92A$	rms value of current

TABLE I
INPUT PARAMETERS

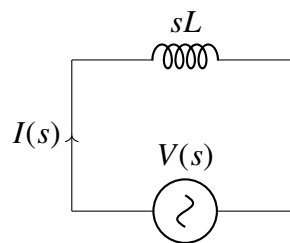


Fig. 2. s domain Circuit

$$V(s) = I(s) (sL) \quad (1)$$

$$I(s) = \frac{V(s)}{(sL)} \quad (2)$$

$$H(s) = \frac{V(s)}{I(s)} \quad (3)$$

$$H(s) = sL \quad (4)$$

Substituting s with $j\omega$:

$$H(j\omega) = j\omega L \quad (5)$$

Average power absorbed by the inductor in the circuit is given by:

$$P = VI\cos(\phi) \quad (6)$$

For an inductor the phase angle is:

$$\phi = -\frac{\pi}{2} \quad (7)$$

$$\cos(\phi) = 0 \quad (8)$$

$$P_L = 0 \quad (9)$$

(b) In Exercise 7.4 :

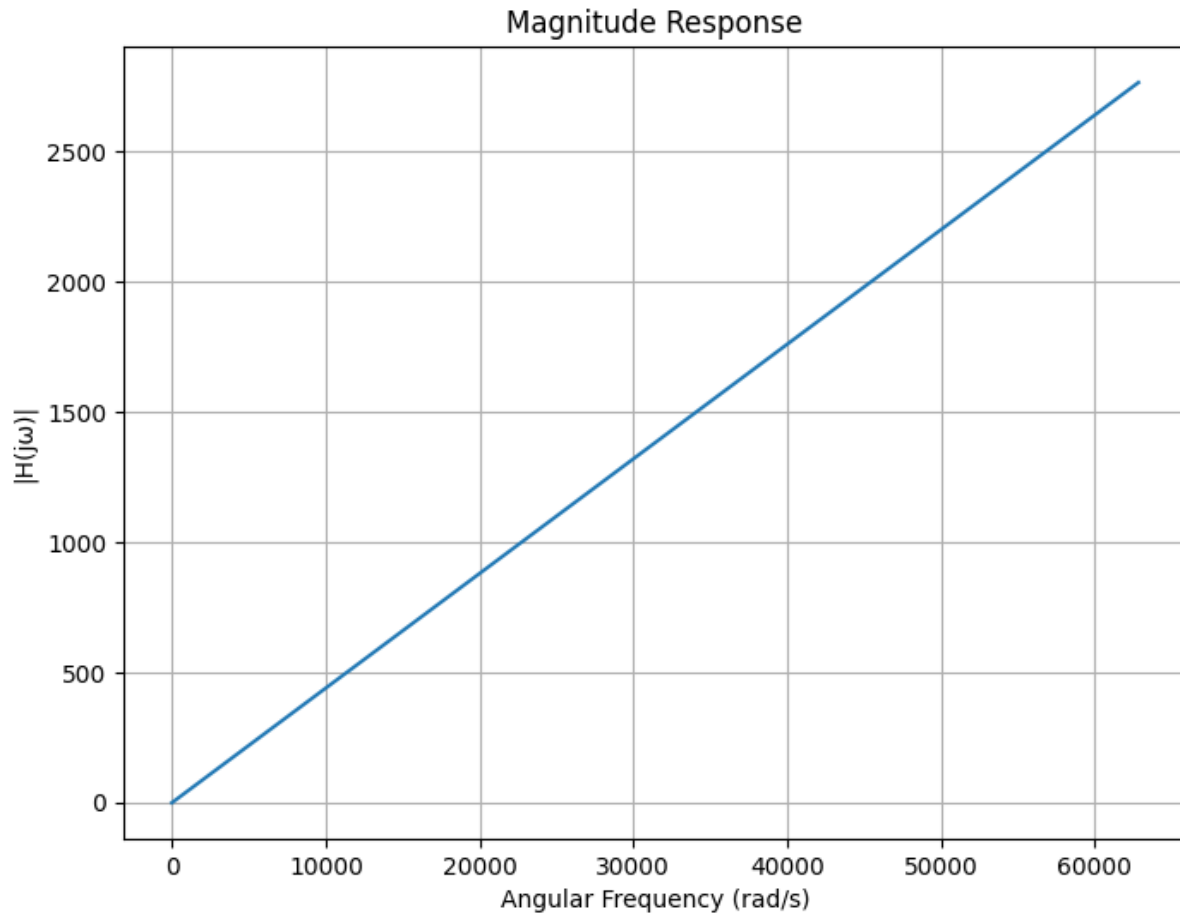


Fig. 3. Plot of equation(5)

$$V(s) = I(s) \left(\frac{1}{sC} \right) \quad (10)$$

$$I(s) = \frac{V(s)}{\left(\frac{1}{sC} \right)} \quad (11)$$

$$H(s) = \frac{V(s)}{I(s)} \quad (12)$$

$$H(s) = \frac{1}{sC} \quad (13)$$

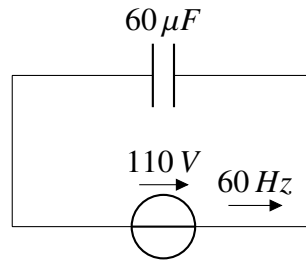


Fig. 4. Capacitive Circuit

Symbol	Value	Description
C	$60 \mu F$	Capacitance
V_{rms}	$110 V$	Voltage
f	$60 Hz$	Frequency
ω	$2\pi f = 120\pi$	Angular Frequency
ϕ	$?$	Phase difference between current and voltage
I_{rms}	$2.49 A$	rms value of current

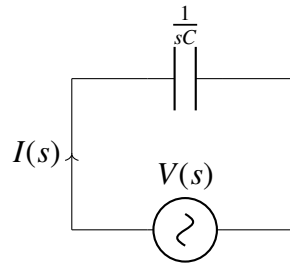
TABLE II
INPUT PARAMETERS

Fig. 5. s domain Circuit

Substituting s with $j\omega$:

$$H(j\omega) = \frac{1}{j\omega C} \quad (14)$$

Average power absorbed by the capacitor in the circuit is given by:

$$P = VI \cos(\phi) \quad (15)$$

For an capacitor the phase angle is:

$$\phi = \frac{\pi}{2} \quad (16)$$

$$\cos(\phi) = 0 \quad (17)$$

$$P_C = 0 \quad (18)$$

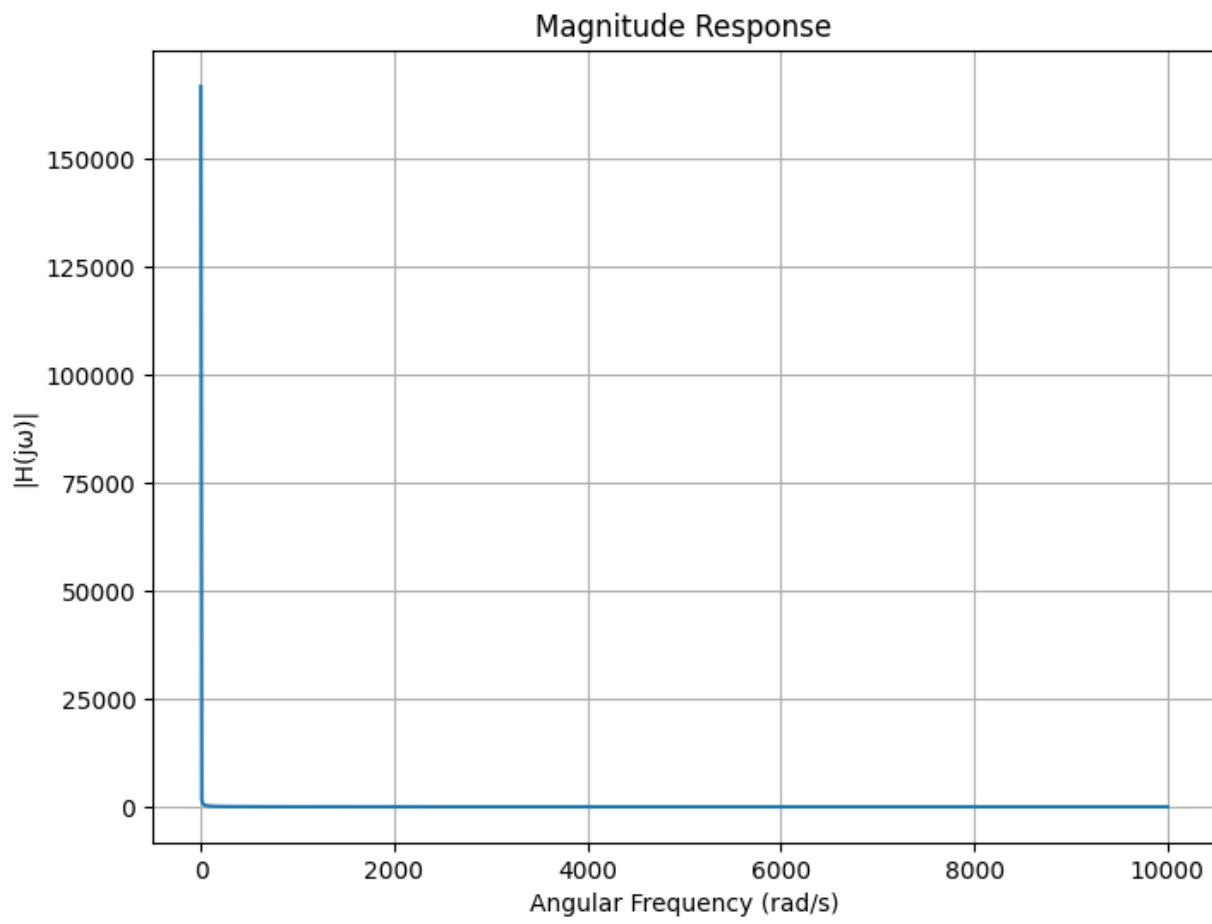


Fig. 6. Plot of equation(14)