
MATHEMATICAL QUESTIONS

Question 1

Consider the triangle periodic signal shown in Fig. 1.

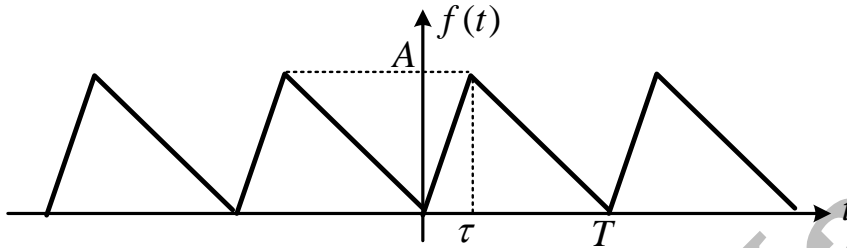


Figure 1: Triangle periodic signal.

(a) Express the periodic signal $f(t)$ in terms of elementary signals for $0 \leq t < T$.

(b) Find the average and RMS values of $f(t)$.

(c) Plot $f'(t)$, the derivative of $f(t)$.

(d) Let $g(t) = B + f(t)$, where B is a real number. Find the average and RMS values of $g(t)$.

Question 2

Calculate the delivered power and voltage of the dependent source in Fig. 2.

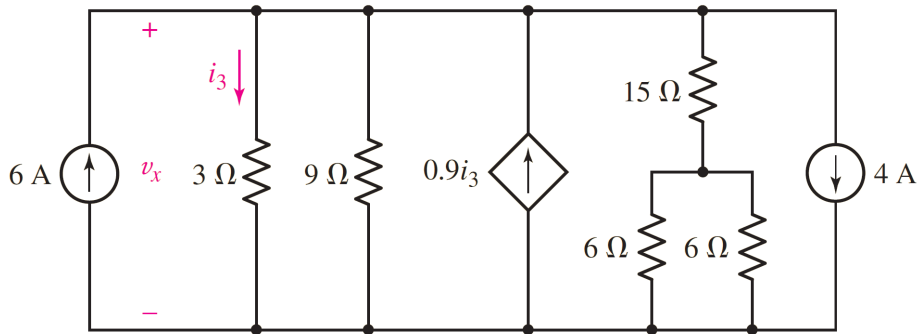


Figure 2: A circuit with dependent source.

Question 3

Consider the linear time-variant capacitor of Fig. 3 with the capacitance $C(t) = C_0 + C_1 \cos(\omega_1 t)$.

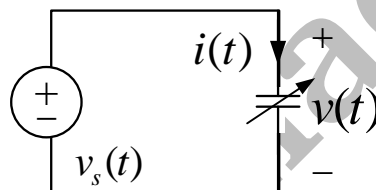


Figure 3: A linear time-variant capacitor with capacitance $C(t) = C_0 + C_1 \cos(\omega_1 t)$.

(a) Find the capacitor current if $v_s(t) = A \cos(\omega_2 t)$. Further, calculate the energy stored in the capacitor during the interval $[0, t]$.

(b) Find the capacitor current if $v_s(t) = A$. Further, calculate the energy stored in the capacitor during the interval $[0, t]$. Does the capacitor act like open circuit as $t \rightarrow \infty$?

(c) Find the capacitor current if $v_s(t) = A$ and $C_1 = 0$. Does the capacitor act like open circuit as $t \rightarrow \infty$?

Question 4

In the circuit shown in Fig. 4, $v_s(t) = A \cos(\omega t)u(t)$ and $i_s(t) = B(1 - e^{-\alpha t})u(t)$. Calculate $v_L(t)$ and $i_C(t)$. Is $v_L(t)$ continuous? How about $i_C(t)$?

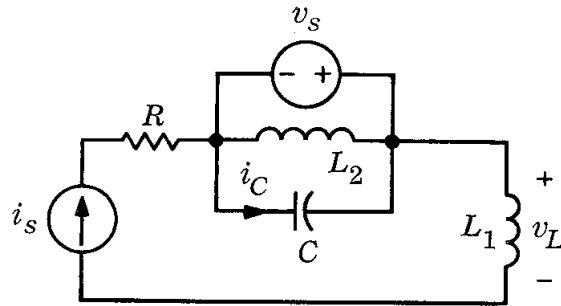


Figure 4: A circuit with LTI elements.

SOFTWARE QUESTIONS

Question 5

Write a simple MATLAB program that calculates the average and RMS values of a given periodic signal $f(t)$. The function $f(t)$ is represented by a function handle in its fundamental period $t \in [0, T]$.

BONUS QUESTIONS

Question 6

Find the RMS and average values of the real periodic signal $f(t) = a_0 + \sum_{k=1}^{\infty} [a_k \cos(\frac{2\pi k}{T}t) + b_k \sin(\frac{2\pi k}{T}t)]$ expanded in its Fourier series form.

Question 7

Return your answers by filling the \LaTeX template of the assignment.

EXTRA QUESTIONS

Question 8

Feel free to solve the following questions from the book "*Basic Circuit Theory*" by C. Desoer and E. Kuh.

1. Chapter 2, question 2.
2. Chapter 2, question 7.
3. Chapter 2, question 8.
4. Chapter 2, question 10.
5. Chapter 2, question 15.
6. Chapter 2, question 16.
7. Chapter 2, question 17.
8. Chapter 2, question 18.

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