

Exercise 1. Average Voltage

If the voltage is $V(t) = V_0 \sin(\omega t)$, what is the average voltage?

- (a) $V_{\text{avg}} = 4V_0/\omega$
- (b) $V_{\text{avg}} = 2V_0/\pi$ *
- (c) $V_{\text{avg}} = V_0/\sqrt{2}$
- (d) $V_{\text{avg}} = 4V_0 \sin(\omega t)/\omega$
- (e) $V_{\text{avg}} = 2V_0 \sin(\omega t)/\pi$
- (f) $V_{\text{avg}} = V_0 \sin(\omega t)/\sqrt{2}$

Exercise 2. RMS Voltage

If the voltage is $V(t) = V_0 \sin(\omega t)$, what is the RMS voltage?

- (a) $V_{\text{rms}} = 4V_0/\omega$
- (b) $V_{\text{rms}} = 2V_0/\pi$
- (c) $V_{\text{rms}} = V_0/\sqrt{2}$ *
- (d) $V_{\text{rms}} = 4V_0 \sin(\omega t)/\omega$
- (e) $V_{\text{rms}} = 2V_0 \sin(\omega t)/\pi$
- (f) $V_{\text{rms}} = V_0 \sin(\omega t)/\sqrt{2}$

Exercise 3. RMS Power

If $P_{\text{rms}} = \sqrt{\int_T dt P^2(t)/T}$, and $P = IV$ where $I(t) = I_0 \cos(\omega t)$ and $V = V_0 \cos(\omega t + \theta)$, show that $P_{\text{avg}} = I_0 V_0 \cos(\theta)/2$.
 Hint: $\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta)$.

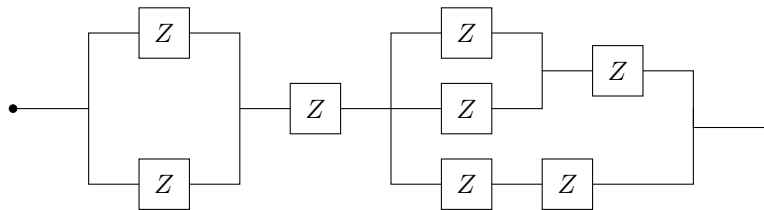
Exercise 4. Phase Angle

Let $f(t) = (1 - \sin(t)/t) + 2i$. What is the phase angle for large times?

- (a) $\theta(f(t)) = \tan^{-1}(2)$ *
- (b) $\theta(f(t)) = \tan^{-1}(\pi/2)$
- (c) $\theta(f(t)) = \tan^{-1}(1/2)$
- (d) $\theta(f(t)) = \tan^{-1}(2/\pi)$

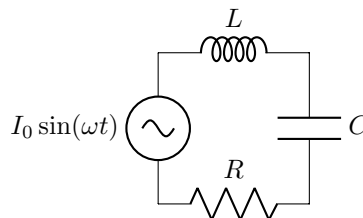
Exercise 5. Equivalent Impedance

Find the equivalent impedance of the following circuit:



Exercise 6. Resonance I

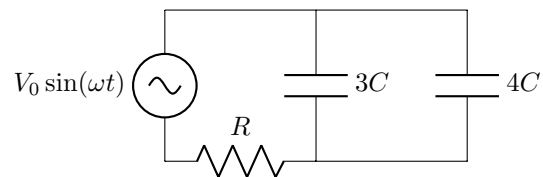
Resonance occurs when impedance is at its minimum. Find ω such that the impedance is minimized in the following circuit:



Exercise 7. Resonance II

Find the phase angles $\theta(V_L(t))$, $\theta(V_C(t))$ and $\theta(V_R(t))$ for the circuit when driven at the resonance frequency.

Exercise 8. Impedant Circuit I



What is the equivalent impedance of the circuit above as measured across the voltage source? What is $|Z|$?

Exercise 9. Impedant Circuit II

Find $V_R(t)$ and $V_{3C}(t)$. Does $V_{3C}(t) = V_{4C}(t)$?

Exercise 10. Impedant Circuit III

Find $\theta(V_R(t))$ and $\theta(V_{3C}(t))$, what is the phase difference. Is it constant?