

- As shown in Figure. 1, a motor M is connected to a $240V_{rms}$, 60Hz source by a transmission line with resistance $R_{line} = 1\Omega$. The motor has power factor (pf) 0.5 lagging, and it would draw 4.8kW if operated at 240V . However, the resistance of the transmission line reduces the voltage at the motor and wastes power. Please answer the following questions:
 (a) Find the equivalent impedance of the motor. [5] (b) Determine the capacitance C that should be connected in parallel with the motor to minimize the line loss. [10] (c) Compare the power-transfer efficiency (from source to the motor) before and after the capacitor C is installed. [10]
- For the series RLC network shown in Figure 2 with $L=0.5\text{H}$, $R=20\Omega$, and $C=5\text{mF}$, if the input voltage source is given as: $v_s(t) = 12\text{V}$ for $t < 0$ and $v_s(t) = 0\text{V}$ for $t \geq 0$.
 (a) Determine the resonant frequency of the circuit. [5] (b) Determine the inductor current $i_L(t)$ for $t \geq 0$. [10] (c) Determine the capacitor voltage $v_C(t)$ for $t \geq 0$. [10]
- Design the op-amp circuit shown in Figure 3 (a) to get the asymptotic gain curve shown in Figure 3(b). Let all capacitors be $1\mu\text{F}$. [25]
- For the circuit network shown in Figure 4, please determine (a) the voltage V_x [10] and (b) the power supplied by the independent source [15].

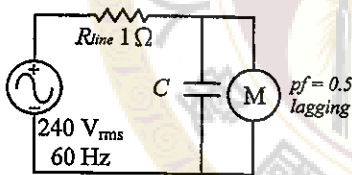


Figure 1

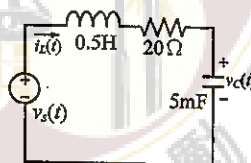


Figure 2

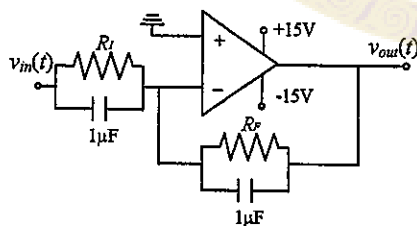


Figure 3(a)

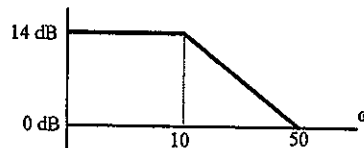


Figure 3(b)

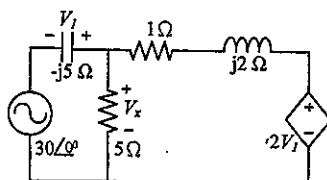


Figure 4

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