Problem 1

2.15 Let a voltage source $v(t) = 4 \cos(\omega t + 60°)$ be connected to an impedance $Z = 2\underline{/30°}$ Ω. (a) Given the operating frequency to be 60 Hz, determine the expressions for the current and instantaneous power delivered by the source as functions of time. (b) Plot these functions along with $v(t)$ on a single graph for comparison. (c) Find the frequency and average value of the instantaneous power.

Pro tip – Desmos (https://www.desmos.com/calculator) is a great resource for plotting.

They even have a phasor plotter! (https://www.desmos.com/calculator/niad5yjthy)

Problem 2

2.21 An industrial plant consisting primarily of induction motor loads absorbs 500 kW at 0.6 power factor lagging. (a) Compute the required kVA rating of a shunt capacitor to improve the power factor to 0.9 lagging. (b) Calculate the resulting power factor if a synchronous motor rated at 500 hp with 90% efficiency

operating at rated load and at unity power factor is added to the plant instead of the capacitor. Assume constant voltage (1 hp = 0.746 kW).

<u>Problem 3</u>

2.26 A small manufacturing plant is located 2 km down a transmission line, which has a series reactance of 0.5 Ω/km. The line resistance is negligible. The line voltage at the plant is $480\underline{/0°}$ V (rms), and the plant consumes 120 kW at 0.85 power factor lagging. Determine the voltage and power factor at the sending end of the transmission line by using: (a) a complex power approach; and (b) a circuit analysis approach.

Problem 4

2.27 An industrial load consisting of a bank of induction motors con-
sumes 50 kW at a power factor of 0.8 lagging from a 220-V, 60-Hz,
single-phase source. By placing a bank of capacitors in parallel
with the load, the resultant power factor is to be raised to 0.95 lag-
ging. Find the net capacitance of the capacitor bank in μF that is
required.