EE3541, Experiment 1
Steady-State Simulation of AC Networks Using MATLAB®

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1 Problem Statement

The primary objective of this lab assignment is to become familiar with performing computations related to AC excitation on passive elements in MATLAB®.

1.1 Individual Load Excitation

An electrical network is excited with a sinusoidal voltage of $120\sqrt{2}\cos(120\pi t)$. Compute the instantaneous power on all the elements in the circuit for the three impedance values as shown below:

1. $\overline{Z}_1 = 2.5\angle 0°$
2. $\overline{Z}_2 = 2.0\angle 60°$
3. $\overline{Z}_3 = 1.5\angle -30°$

Calculate the real power (P), reactive power (Q) and apparent power (S) for each load case.

1.2 Series Connection of Loads

If the three impedances $\overline{Z}_1$, $\overline{Z}_2$, and $\overline{Z}_3$ are connected in series, calculate the current, voltage, active power, reactive power and apparent power using a pen and a paper, show your work.

Now simulate the same on MATLAB and verify your work.

1.3 Parallel Connected Loads

If the three impedances $\overline{Z}_1$, $\overline{Z}_2$, and $\overline{Z}_3$ are connected in parallel, calculate the current, voltage, active power, reactive power and apparent power using a pen and a paper, show your work.

Now simulate the same in MATLAB and verify your work.

2 Questions

1. What are the conclusions of exciting pure passive elements with sinusoidal voltages? Your answers should comment on the nature of the active, reactive, and apparent power consumption. and the phase angle of the current.

2. Do inductors and capacitors absorb active power? Explain.

3. Draw the power triangles for RL and RC networks and denote the power components.