

ECE2101L
Electrical Circuit Analysis II Laboratory

Lab 9
Real, reactive, complex power and power factor

Prelab

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April 6, 2020

1 Power calculation

Given $Z = 35\angle -27^\circ \Omega$ and $I = 52\angle 43^\circ \text{A}$:

1.1 Real, reactive, apparent, and complex power

1.1.a Complex Power

$$S = VI^* = IZI^* = I_{rms}^2 Z = \frac{52^2}{2} 35\angle -27^\circ$$
$$S = 47320\angle -27^\circ = 42162 - 21483j \text{ VA}$$

1.1.b Real Power

$$P = 42162 \text{ W}$$

1.1.c Reactive Power

$$Q = -21483 \text{ VAR}$$

1.1.d Apparent Power

$$|S| = 47320 \text{ VA}$$

1.2 Power factor

$$PF = \cos(\theta_v - \theta_i) = \cos(\arg(Z)) = \cos(-27^\circ) = 0.8910$$

As $Q < 0$, the power factor is leading.

1.3 Load power triangle and load impedance triangle

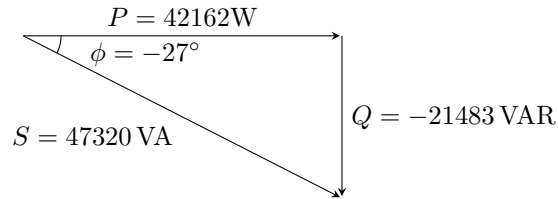


Figure 1: Load Power Triangle

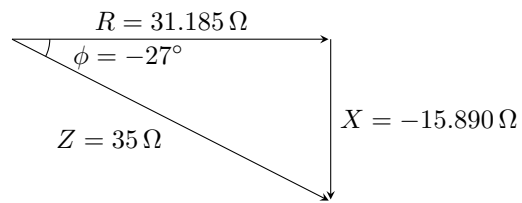


Figure 2: Load Impedance Triangle

2 The above calculation was reproduced in MATLAB

```

ECE2101L_Lab09_A2.m x +
1 -   clc
2 -   clear
3 -   %ok<*NOPTS>
4 -   Z=35*cosd(-27)+35*sind(-27)*1j;
5 -   I=52*cosd(43)+52*sind(43)*1j;
6 -   Irms=abs(I)/sqrt(2);
7 -   S=(Irms)^2*Z
8 -   P=real(S)
9 -   Q=imag(S)
10 -  Smag=abs(S)

Command Window

S =

    4.2162e+04 - 2.1483e+04i

P =

    4.2162e+04

Q =

   -2.1483e+04

Smag =

    4.7320e+04

fx >>

```