MATLAB Circuit Analysis 1

```
%%Analysis of Single phase AC power Supply
%Oliver Nanasy
%04/03/2019

clear;
clc;

%Initial Variables;
vrms = 115; freq = 400;
T = 1/freq; t = 0: T/100 : 4*T;
v_s = vrms*sin(2513*t);

%Variables in Complex notation
vs = vrms + j*0 ;

%#ok<*IJCL>
r1 = 10 + j*0;
r2 = 2 + j*0;
xl1 = 0 + j*10;
xl2 = 0 + j*6;
xc = 0 - j*15;

% calculate total impedance
z1 = r1;
z2 = xl1+r2;
z3 = xl2+xc;
z_parallel = (z2*z3)/(z2+z3);
z_total = z1+z_parallel;
z_total_mag = abs(z_total); z_total_phi_rad = angle(z_total);
z_total_phi_deg = z_total_phi_rad/pi*180;

%calculate total current and power factor
i_total = vs / z_total ;
i_total_mag=abs(i_total);
i_total_phi_rad=angle(i_total);
i_total_phi_deg=i_total_phi_rad/pi*180;
power_factor = real(z_total)/z_total_mag;
i_total_plot = i_total*sin(2*pi*freq*t - (i_total_phi_deg));

%Plotting Graph
[time,hline,yline]=plotyy(t,v_s,t,i_total_plot);
legend('voltage','current');
title('Single Phase AC Circuit');
xlabel('Time')
ylabel('time(1)'),('Voltage (V)') % left y-axis
ylabel(time(2),'Current(A)') % right y-axis

%Calculation Of Power
true_power = abs(i_total) * abs(vs) * cos(z_total_phi_rad);
reactive_power = abs(i_total) * abs(vs) * sin(z_total_phi_rad);
apparent_power =abs(i_total) * abs(vs) ;

%display results to the command window
fprintf( 'Total Impedence = %4.2f Ohms\n',z_total_mag);
fprintf( 'Total Current = %4.2f A\n',vrms/z_total);
fprintf( 'Power Factor = %4.2f \n',power_factor);
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fprintf( 'Phase Angle = %4.2f Degree\n',z_total_phi_deg);
fprintf( 'True Power = %4.2f Watts\n',true_power);
fprintf( 'True Power = %4.2f VAR\n',reactive_power);
fprintf( 'True Power = %4.2f VA\n',apparent_power);
```

MATLAB Circuit Analysis 2

```
%%Analysis of Single phase AC power Supply
%Oliver Nanasy
%04/03/2019

clear;
clc;

%Initial Variables;
vrms = 115; freq = 400;
T = 1/freq; t = 0: T/100 : 4*T;
v_s = vrms*sin(2513*t);

%Variables in Complex notation
vs = vrms + j*0 ;

%#ok<*IJCL>
r1 = 10 + j*0;
r2 = 2 + j*0;
xl1 = 0 + j*10;
xl2 = 0 + j*6;
xc = 0 - j*15;

% calculate total impedance
z1 = r1;
z2 = xl1+r2;
z3 = xl2+xc;
z_parallel = (z2*z3)/(z2+z3);
z_total = z1+z_parallel;
z_total_mag = abs(z_total); z_total_phi_rad = angle(z_total);
z_total_phi_deg = z_total_phi_rad/pi*180;

%calculate total current and power factor
i_total = vs / z_total ;
i_total_mag=abs(i_total);
i_total_phi_rad=angle(i_total);
i_total_phi_deg=i_total_phi_rad/pi*180;
power_factor = real(z_total)/z_total_mag;
i_total_plot = i_total*sin(2*pi*freq*t - (i_total_phi_deg));

%Plotting Graph
[time,hline,yline]=plotyy(t,v_s,t,i_total_plot);
legend('voltage','current');
title('Single Phase AC Circuit');
xlabel('Time')
ylabel('time(1)'),('Voltage (V)') % left y-axis
ylabel(time(2),'Current(A)') % right y-axis

%Calculation Of Power
true_power = abs(i_total) * abs(vs) * cos(z_total_phi_rad);
reactive_power = abs(i_total) * abs(vs) * sin(z_total_phi_rad);
apparent_power =abs(i_total) * abs(vs) ;
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```
%display results to the command window
fprintf( 'Total Impedence = %4.2f Ohms\n',z_total_mag);
fprintf( 'Total Current = %4.2f A\n',vrms/z_total);
fprintf( 'Power Factor = %4.2f \n',power_factor);
fprintf( 'Phase Angle = %4.2f Degree\n',z_total_phi_deg);
fprintf( 'True Power = %4.2f Watts\n',true_power);
fprintf( 'True Power = %4.2f VAR\n',reactive_power);
fprintf( 'True Power = %4.2f VA\n',apparent_power);
```

MATLAB Circuit Analysis 3

```
%Three Phase AC Circuit Analysis
%OliverNanasy
%14-3-2019

clear;
clc;

% Initial Variables
vrms=115;
freq=400;
T = 1/freq;
t = 0: T/100 : 4*T;
v_s = vrms*sin(2513*t);
zl=1+j*2;
zd= 36+j*18;

% Convert Delta to Star
zy=zd./3;

% calculate total impedance
 [theta,rho]=cart2pol(real(zt),imag(zt));
theta = theta*180/pi();
fprintf('Total impedance=%4.2f < %4.2f°Ohms\n',rho,theta);
zt=zl+zy;
zt_mag=abs(zt);



%calculate currents
i_red=(vrms/rho);
i_reddegrees=(0-theta);
format compact
x = i_red * cos(i_reddegrees*pi/180);
y = j * i_red * sin(i_reddegrees*pi/180);
i_redcart=x+y;
i_red_mag=abs(i_redcart);
i_red_phi_rad=angle(i_redcart);
i_red_phi_deg=i_red_phi_rad/pi*180;
i_red_plot = i_red*sin(2*pi*freq*t - (i_red_phi_deg));
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i_yellow=(vrms/rho);
i_yellowdegrees=(i_reddegrees+120);
x1 = i_yellow * cos(i_yellowdegrees*pi/180);
y1 = j * i_yellow * sin(i_yellowdegrees*pi/180);
i_yellowcart=x1+y1;
i_yellow_mag=abs(i_yellowcart);
i_yellow_phi_rad=angle(i_yellowcart);
i_yellow_phi_deg=i_yellow_phi_rad/pi*180;
i_yellow_plot = i_yellow*sin(2*pi*freq*t - (i_yellow_phi_deg));

i_blue=(vrms/rho);
i_bluedegrees=(i_reddegrees-120);
x2 = i_blue * cos(i_bluedegrees*pi/180);
y2 = j * i_blue * sin(i_bluedegrees*pi/180);
i_bluecart=x2+y2;
i_blue_mag=abs(i_bluecart);
i_blue_phi_rad=angle(i_bluecart);
i_blue_phi_deg=i_blue_phi_rad/pi*180;
i_blue_plot = i_blue*sin(2*pi*freq*t - (i_blue_phi_deg));
fprintf('Red current=%4.2f < %4.2f°Amps\n',i_red,i_reddegrees);
fprintf('Yellow current=%4.2f < %4.2f°Amps\n',i_yellow,i_yellowdegrees);
fprintf('Blue current=%4.2f < %4.2f°Amps\n',i_blue,i_bluedegrees);
v=i_red*zt;

%Calculate the magnitude of the line-to-line voltages
[theta2,rho2]=cart2pol(real(zy),imag(zy));
theta2 = theta2*180/pi();
vzy=(i_red*rho2);
vzy_degrees=(i_reddegrees+theta2);
vzy2=(i_yellow*rho2);
vzy2_degrees=(i_yellowdegrees+theta2);
vzy3=(i_blue*rho2);
vzy3_degrees=(i_bluedegrees+theta2);
fprintf('Line to neutral(Red)=%4.2f < %4.2f°V\n',vzy,vzy_degrees);
fprintf('Line to neutral(Yellow)=%4.2f < %4.2f°V\n',vzy2,vzy2_degrees);
fprintf('Line to neutral(Blue)=%4.2f < %4.2f°V\n',vzy3,vzy3_degrees);
vry=vzy*sqrt(3);
vry_degrees=(vzy_degrees+30);
vyb=vzy2*sqrt(3);
vyb_degrees=(vzy2_degrees+30);
vbr=vzy3*sqrt(3);
vbr_degrees=(vzy3_degrees+30);
fprintf('Line to Line(Red to Yellow)=%4.2f < %4.2f°V\n',vry,vry_degrees);
fprintf('Line to Line(Yellow to Blue)=%4.2f < %4.2f°V\n',vyb,vyb_degrees);
fprintf('Line to Line(Blue to Red)=%4.2f < %4.2f°V\n',vbr,vbr_degrees);

%Plotting Graph
subplot (3,1,1)
[time,hline,yline]=plotyy(t,v_s,t,i_red_plot);
legend('voltage','current');
title('Three Phases AC Circuit(Red)');
xlabel('Time');
ylabel(time(1),'Voltage (V)'); % left y-axis
ylabel(time(2),'Current(A)'); % right y-axis

subplot (3,1,2)
[time,hline,yline]=plotyy(t,v_s,t,i_yellow_plot);
legend('voltage','current');
title('Three Phases AC Circuit(Yellow)');
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```
xlabel('Time');
ylabel(time(1),'Voltage (V)'); % left y-axis
ylabel(time(2),'Current(A)'); % right y-axis

subplot (3,1,3)
[time,hline,yline]=plotyy(t,v_s,t,i_blue_plot);
legend('voltage','current');
title('Three Phases AC Circuit(Blue)');
xlabel('Time');
ylabel(time(1),'Voltage (V)'); % left y-axis
ylabel(time(2),'Current(A)'); % right y-axis

%Calculate the true power, reactive power and apparent power
total_true_power=(3*(i_red^2)*12);
total_reactive_power=(3*(i_red^2)*6);
total_apparent_power=(sqrt((total_true_power^2)+(total_reactive_power^2)));
fprintf( 'True Power = %4.2f Watts\n',total_true_power);
fprintf( 'Reactive Power = %4.2f VAr\n',total_reactive_power);
fprintf( 'Apparent Power = %4.2f Va\n',total_apparent_power);

%efficiency of transmission.
ptl=(3*(i_red^2)*1);
pql=(3*(i_red^2)*2);
pal=(sqrt((ptl^2)+(pql^2)));
Eff=(ptl/pal)*100;
fprintf( 'Efficiency of transmission = %4.2f Percent\n',Eff);
```

Results

Total impedance=15.26 < 31.61°Ohms

Red current=7.53 < -31.61°Amps

Yellow current=7.53 < 88.39°Amps

Blue current=7.53 < -151.61°Amps

Line to neutral(Red)=101.08 < -5.04°V

Line to neutral(Yellow)=101.08 < 114.96°V

Line to neutral(Blue)=101.08 < -125.04°V

Line to Line(Red to Yellow)=175.07 < 24.96°V

Line to Line(Yellow to Blue)=175.07 < 144.96°V

Line to Line(Blue to Red)=175.07 < -95.04°V

True Power = 2043.35 Watts

Reactive Power = 1021.67 VAr

Apparent Power = 2284.53 Va

Efficiency of transmission = 44.72 Percent