Circuitos Electricos II

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Monitoria Circuitos II

GIT-HUB: https://github.com/brrsanchezfi/Circuitos_2022_1

Soluciones propuestas para los ejercicios del taller 4

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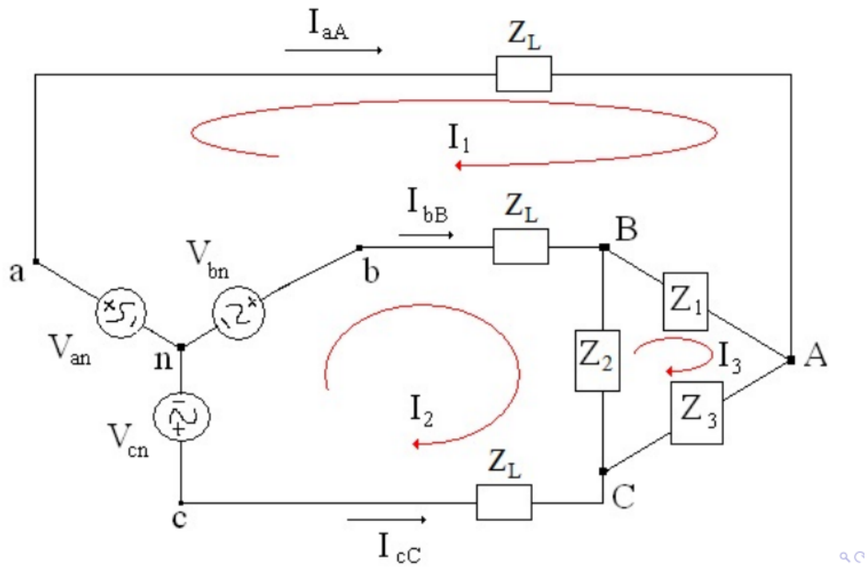
1.Analisis por Matlab symbolic

Circuito Y-D

El siguiente metodo es la solucion que considero mas facil a la hora de entender el circuito.



Fuente trifásica: $V_{an} = 100\angle 0V$, sec +
Impedancia líneas: $Z_L = 0.5\ \Omega$.

1. Proponga valores para las impedancias de carga.
2. Calcule la potencia compleja $S = VI^*$ para cada elemento del circuito.
3. Calcule la potencia de pérdidas.
4. Muestre el balance de potencia.

```
Voltaje = 100;

    %{
    La funcion "pol_com(magnitud,angulo)" convierte un fasor a rectangular
    por medio de la identidad de euler
    %}

V_an_x = pol_com(Voltaje/sqrt(2),0);
V_bn_x = pol_com(Voltaje/sqrt(2),-120);
V_cn_x = pol_com(Voltaje/sqrt(2),120);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%1. En estos blocks proporcionamos los valores de impedancia

Z1_x = 8+7i;
Z2_x = 6+3i;
Z3_x = 5+5i;

Z_L_x = 0.5;

syms I1 I2 I3 Z_L V_an V_bn V_cn Z1 Z2 Z3

Sys = [V_an - V_bn == Z_L*(I1) + Z1*(I1-I3) + Z_L*(I1-I2);
       V_bn - V_cn == Z_L*(I2-I1) + Z2*(I2-I3) + Z_L*(I2);
```

```
        0 == Z1*(I3-I1) + Z2*(I3-I2) + Z3*(I3)]
```

Sys =

$$\begin{pmatrix} V_{\mathrm{an}} - V_{\mathrm{bn}} = I_1\, Z_L + Z_1\, (I_1 - I_3) + Z_L\, (I_1 - I_2) \\ V_{\mathrm{bn}} - V_{\mathrm{cn}} = I_2\, Z_L + Z_2\, (I_2 - I_3) - Z_L\, (I_1 - I_2) \\ 0 = I_3\, Z_3 - Z_1\, (I_1 - I_3) - Z_2\, (I_2 - I_3) \end{pmatrix}$$

```
Sol = solve(Sys,[I1, I2, I3]);

I1 = Sol.I1   %reescribo la variable I1,I2,I3 con el nuevo valor simbolico
```

I1 =

$$-\frac{V_{\mathrm{bn}}\, Z_2\, Z_3 - V_{\mathrm{an}}\, Z_2\, Z_3 - V_{\mathrm{an}}\, Z_1\, Z_2 + V_{\mathrm{cn}}\, Z_1\, Z_2 - 2\, V_{\mathrm{an}}\, Z_1\, Z_L - 2\, V_{\mathrm{an}}\, Z_2\, Z_L - 2\, V_{\mathrm{an}}\, Z_3\, Z_L + V_{\mathrm{bn}}\, Z_1\, Z_L + V_{\mathrm{bn}}\, Z_2\, Z}{3\, Z_1\, {Z_L}^2 + 3\, Z_2\, {Z_L}^2 + 3\, Z_3\, {Z_L}^2 + Z_1\, Z_2\, Z_3 + 2\, Z_1\, Z_2\, Z_L + 2\, Z_1\, Z_3\, Z_L +}$$

```
I2 = Sol.I2;
I3 = Sol.I3;

%CORRIENTES DE MALLAS

I1 = subs(I1,[V_an V_bn V_cn Z1 Z2 Z3 Z_L],[V_an_x V_bn_x V_cn_x Z1_x Z2_x Z3_x Z_L_x]);
I2 = subs(I2,[V_an V_bn V_cn Z1 Z2 Z3 Z_L],[V_an_x V_bn_x V_cn_x Z1_x Z2_x Z3_x Z_L_x]);
I3 = subs(I3,[V_an V_bn V_cn Z1 Z2 Z3 Z_L],[V_an_x V_bn_x V_cn_x Z1_x Z2_x Z3_x Z_L_x]);

%CORRIENTES DE LINEAS

I_aA = I1;
I_bB = I2 - I1;
I_cC = -I2;

%convertimos las variables simbolicas a una de tipo numero

I_aA = double(I_aA)
```

I_aA = 16.0506 - 14.9532i

```
I_bB = double(I_bB)
```

I_bB = -15.9733 - 12.9620i

```
I_cC = double(I_cC)
```

I_cC = -0.0772 + 27.9152i

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%2. Calcule la potencia compleja

    %Para hallar las potencias complejas usamos la formula suministrada en el
    %ununciado, omito la demostracion del por que el conjugado (dogma de fe)

S_a = V_an_x*conj(I_aA)      %potencia entragada por las fuentes
```

```
S_a = 1.1349e+03 + 1.0574e+03i
```

```
S_b = V_bn_x*conj(I_bB)
```

```
S_b = 1.3585e+03 + 5.1989e+02i
```

```
S_c = V_cn_x*conj(I_cC)
```

```
S_c = 1.7122e+03 + 9.8222e+02i
```

```

S = round(S_a+S_b+S_c, 0)    %Potencia total compleja redondeada
```

```
S = 4.2060e+03 + 2.5590e+03i
```

```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%3. Calcule la potencia de perdidas, aplicamos ley ohm para impedancias y
%aplicamos ley watt

S_ZL = round(Z_L_x * (abs(I_aA^2) + abs(I_bB^2)+ abs(I_cC^2)),0)    %potencia perdida por la re
```

```
S_ZL = 842
```

```

%CORRIENTES DE CARGA

I_Z1 = double(I1-I3);
I_Z2 = double(I2-I3);
I_Z3 = double(I3);

S_Z1 = abs(I_Z1*I_Z1)*Z1_x;
S_Z2 = abs(I_Z2*I_Z2)*Z2_x;
S_Z3 = abs(I_Z3*I_Z3)*Z3_x;

S_Z_carga = round(S_Z1+S_Z2+S_Z3)     %potencia consumida por la cargas
```

```
S_Z_carga = 3.3640e+03 + 2.5590e+03i
```

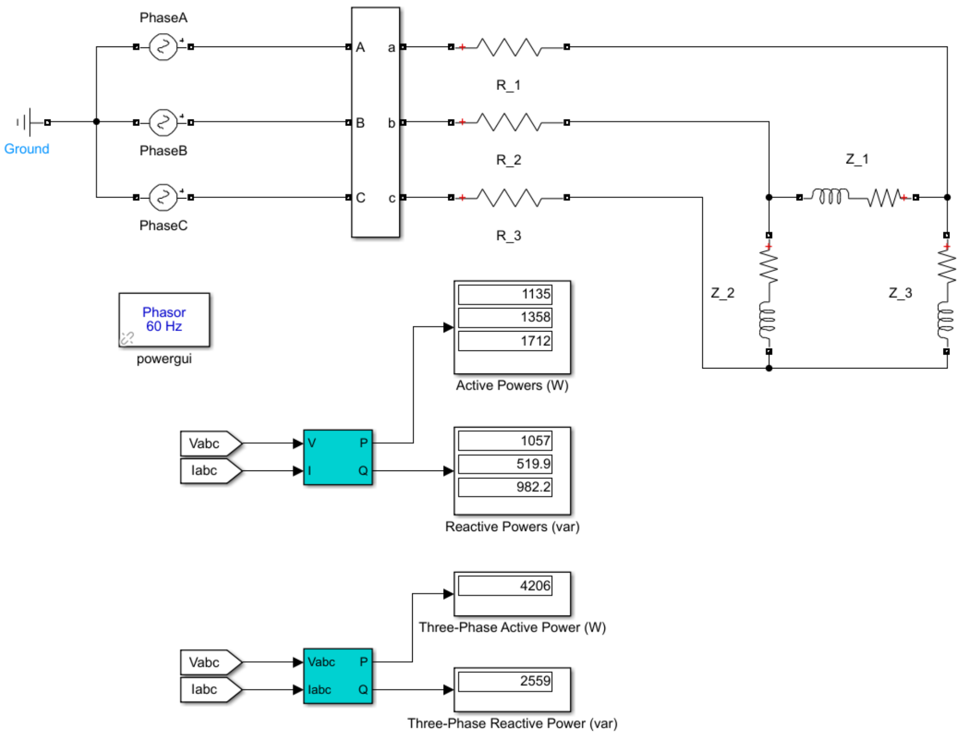
```

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%4. Balance de potencia


Balance = round(S_ZL + S_Z_carga - S, 0)
```

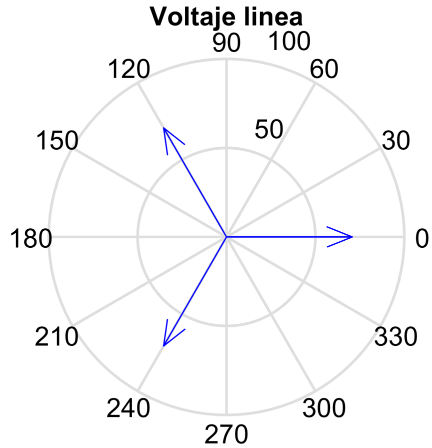
```
Balance = 0
```

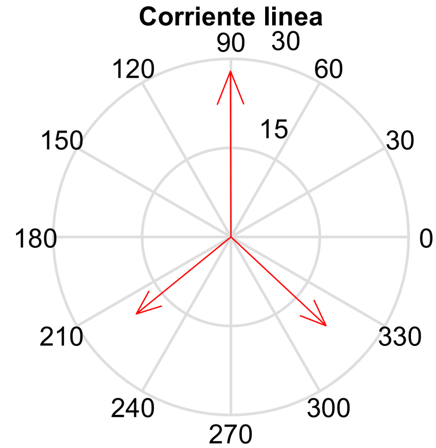
Simulacion




```
%herramienta interesante

tiledlayout(1,2)
ax1 = nexttile;
compass(ax1,[V_an_x V_bn_x V_cn_x],'b')
title(ax1,'Voltaje linea')
ax2 = nexttile;
compass(ax2,[I_aA I_bB I_cC],'r')
title(ax2,'Corriente linea')
```

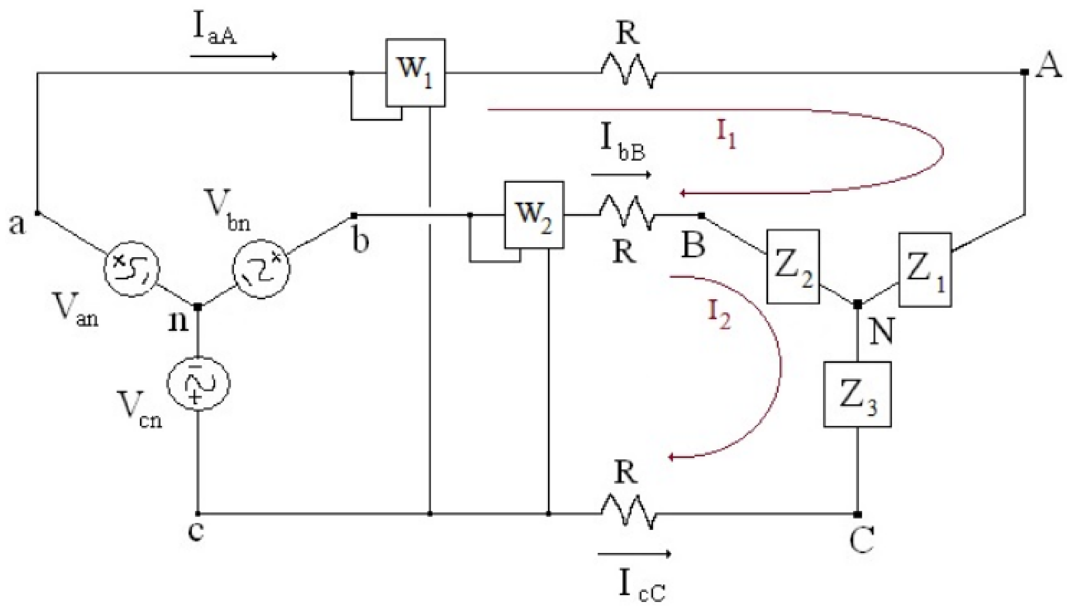





```
% hold off
```

2.Analisis por determinantes(Cramer) y metodo de Aron (2 vatimeros)

Circuito Y-Y



Fuente trifásica: $V_{an} = 100\angle 0V$, sec +
Resistencia líneas: R = 0.5 Ω.

1. Proponga valores para las impedancias de carga.
2. Calcule la potencia compleja $S = VI^*$ para cada elemento del circuito.
3. Calcule la potencia de pérdidas.
4. Calcule las potencias de los dos vatímetros.
5. Muestre el balance de potencia.

```
Voltaje = 100;

V_an = pol_com(Voltaje/sqrt(2),0);      %Valores RMS
V_bn = pol_com(Voltaje/sqrt(2),-120);
V_cn = pol_com(Voltaje/sqrt(2),120);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%1. En estos blocks proporcionamos los valores de impedancia

Z1 = 5+5i;
Z2 = 5+5i;
Z3 = 5+5i;

R = 0.5;


M_1=[(R+Z1+Z2+R); -(R+Z2)]        %impedancia malla 1
```

```
M_1 = 2×1 complex
```

```
  11.0000 +10.0000i
  -5.5000 - 5.0000i
```

```
M_2=[-(R+Z2); (R+Z2+Z3+R)]       %impedancia malla 2
```

```
M_2 = 2×1 complex
  -5.5000 - 5.0000i
  11.0000 +10.0000i
```

```
M_V=[(V_an-V_bn); (V_bn-V_cn)]   %Voltajes
```

```
M_V = 2×1 complex
10^2 ×
   1.0607 + 0.6124i
   0.0000 - 1.2247i
```

```
%DETERMINANTES

DM_1_2=det([M_1,M_2]);      %  det
DM_V_2=det([M_V,M_2]);      %  I1
DM_1_V=det([M_1,M_V]);      %  I2


%CORRIENTE DE MALLA

I=[(DM_V_2/DM_1_2);(DM_1_V/DM_1_2)];
I1=I(1,1)
```

```
I1 = 7.0391 - 6.3992i
```

```
I2=I(2,1)
```

```
I2 = -2.0223 - 9.2956i
```

```
%CORRIENTE DE LINEA

I_aA = I1
```

```
I_aA = 7.0391 - 6.3992i
```

```
I_bB = I2- I1
```

```
I_bB = -9.0614 - 2.8964i
```

```
I_cC = -I2
```

```
I_cC = 2.0223 + 9.2956i
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%2. Calcule la potencia compleja

S_a = V_an*conj(I_aA);
```

```
S_b = V_bn*conj(I_bB);
S_c = V_cn*conj(I_cC);

S = round(S_a+S_b+S_c, 0)
```

```
S = 1.4930e+03 + 1.3570e+03i
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%3. Calcule la potencia de perdidas, aplicamos ley ohm para impedancias y
%aplicamos ley watt

S_R = round(R * (abs(I_aA^2) + abs(I_bB^2)+ abs(I_cC^2)),0)    %potencia perdida por la resiste
```

```
S_R = 136
```

```
%CORRIENTES DE CARGA

I_Z1 = double(I1);
I_Z2 = double(I2-I1);
I_Z3 = double(-I2);

S_Z1 = abs(I_Z1*I_Z1)*Z1;
S_Z2 = abs(I_Z2*I_Z2)*Z2;
S_Z3 = abs(I_Z3*I_Z3)*Z3;

S_Z_carga = round(S_Z1+S_Z2+S_Z3)     %potencia consumida por la cargas
```

```
S_Z_carga = 1.3570e+03 + 1.3570e+03i
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%4. Calcule la potencia de los dos vatimetros
```

$$P_{\text{total}} = P_{\text{w1}} + P_{\text{w2}}$$

$$P_{\text{w1}} \ = P_{\text{fase}-\text{fase}} \cdot \text{conj}(I_{\text{linea}})$$

```
W1 = (V_an-V_cn)*conj(I_aA)
```

```
W1 = 1.1385e+03 + 2.4768e+02i
```

```
W2 = (V_bn-V_cn)*conj(I_bB)
```

```
W2 = 3.5474e+02 + 1.1098e+03i
```

```
W_total = (W1 + W2)
```

```
W_total = 1.4932e+03 + 1.3575e+03i
```

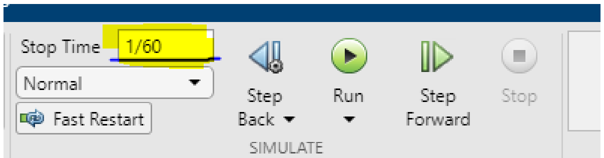
```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

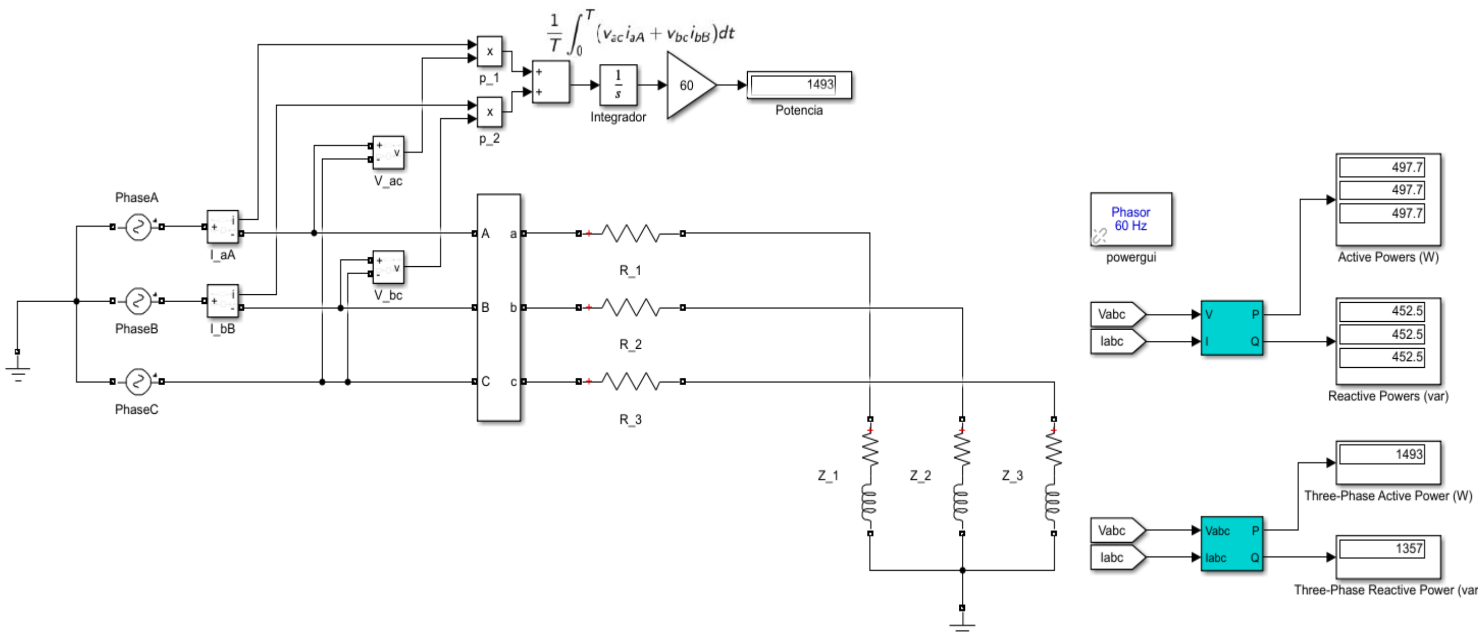
```
%5. Balance de cargas

Balance = round(S_R + S_Z_carga - S, 0)
```

```
Balance = 0
```

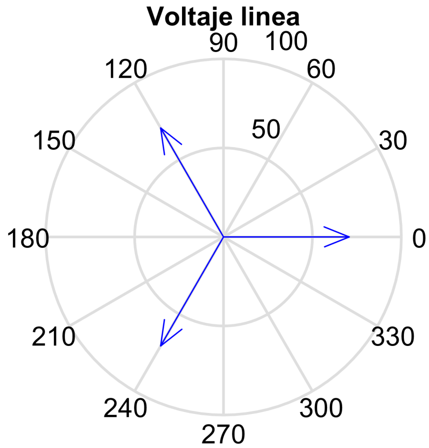
Simulacion

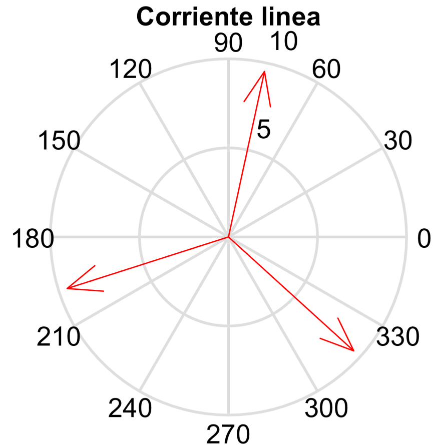





```
%herramienta interesante

tiledlayout(1,2)
ax1 = nexttile;
compass(ax1,[V_an V_bn V_cn],'b')
title(ax1,'Voltaje linea')
ax2 = nexttile;
compass(ax2,[I_aA I_bB I_cC],'r')
title(ax2,'Corriente linea')
```





3.Demostracion

Verificar la siguiente igualdad,

$$\frac{1}{T}\int_0^T (v_{an}i_{aA} + v_{bn}i_{bB} + v_{cn}i_{cC})dt = \frac{1}{T}\int_0^T (v_{ac}i_{aA} + v_{bc}i_{bB})dt$$

```
function Complejo = pol_com(M,A)  % magnitud, angulo

Complejo = M * exp (deg2rad (A) * 1i);

end
```