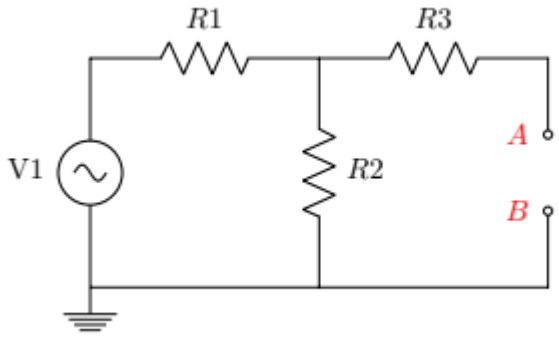


calculamos el equivalente thevenin

```
clc, clear, close all
format short g

vf = 5; %rms
r1 = 50;
r2 = 30;
r3 = 100;

zeq = r1+r2
```

```
zeq =
    80
```

```
If = vf/zeq %[A] rms
```

```
If =
       0.0625
```

```
vth = If*r2 %tension thevenin
```

```
vth =
        1.875
```

```
vth_max = vth*sqrt(2)
```

```
vth_max =
       2.6517
```

corriente norton

```
syms i1 i2

ec1= simplify(vf+(r1*i1)+r2*(i1-i2) == 0)
```

ec1 = $6\,i_2 = 16\,i_1 + 1$

```
ec2= simplify(r2*(i2-i1)+r3*i2 == 0)
```

ec2 = $3\,i_1 = 13\,i_2$

```
m = [-16 6; 3 -13];
n = [1;0];
h = m\n
```

```
h = 2×1
    -0.068421
    -0.015789
```

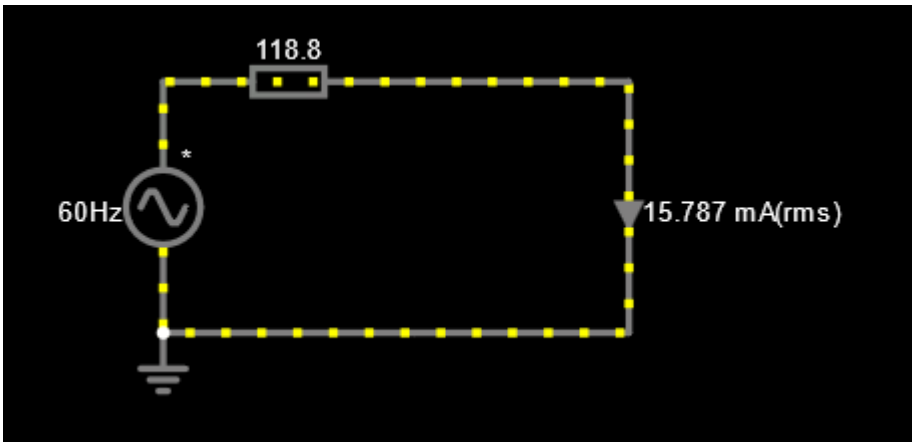
```
In = h(2) %[A] rms
```

```
In =
    -0.015789
```

```
rth = vth/In
```

```
rth =
      -118.75
```

Equivalente thevenin



Diseño 1:

Circuito RL diseño para angulo de -70°

```
l = 5e-3;
r = 118.75;
vf = 5; %rms

syms angulo f L R

ec1 = solve(tan(angulo)==(2*pi*f*L)/R,f)
```

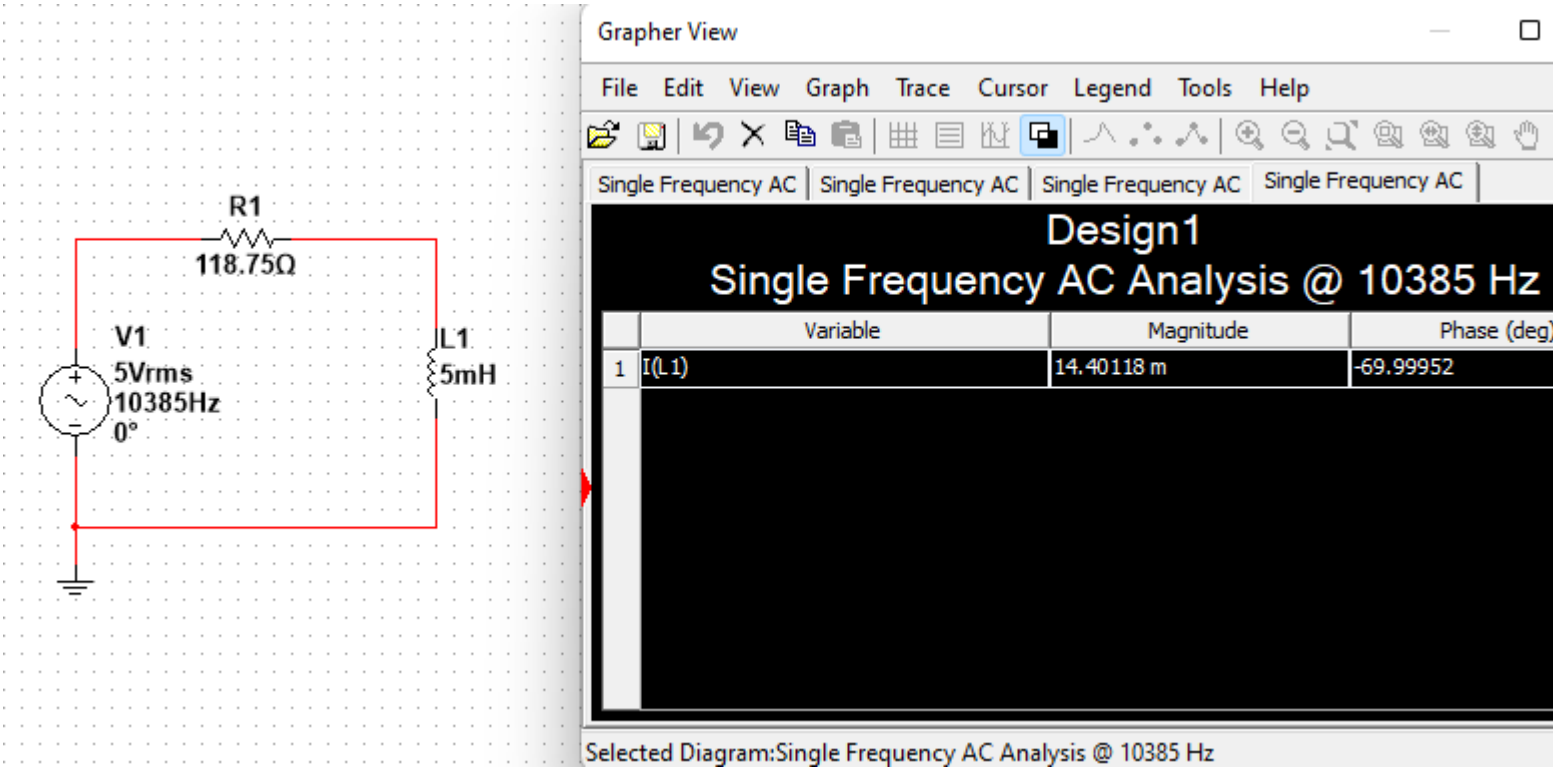
```
ec1 =
```

$$\frac{R\tan(\text{angulo})}{2\,L\,\pi}$$

```
f = abs((r*tand(-70))/(2*l*pi)) %frecuencia necesaria
```

```
f =
        10385
```

Asi obtenemos la frecuencia necesaria para obtener un desfase de -70 grados en la correinte del inductor, lo verificamos en el simulador:



ya que sabemos la frecuencia calculamos la corriente y tension en el inductor:

```
xl = (2*pi*f*l)*j
```

```
xl =
           0 +     326.26i
```

```
zrl = r + xl
```

```
zrl =
       118.75 +     326.26i
```

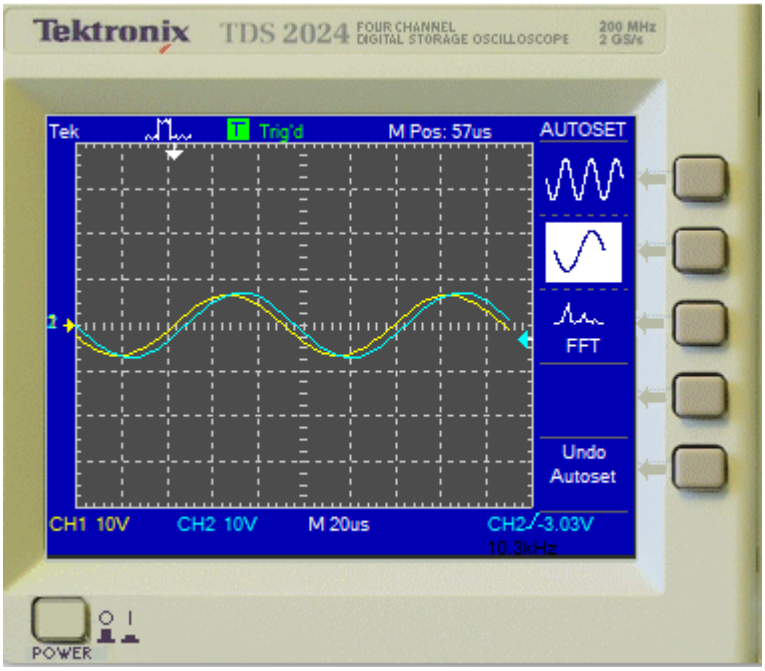
```
Il = vf/zrl;
Il_fasor = [abs(Il) angle(Il)*180/pi] %fasor corriente en el inductor [A]
```

```
Il_fasor = 1×2
     0.014401          -70
```

```
vl = Il*(xl);
vl_fasor = [abs(vl) angle(vl)*180/pi] %fasor voltaje en el inductor
```

```
vl_fasor = 1×2
       4.6985           20
```

verificamos en el simulador:



tension de la fuente (amarillo) comparada con la tension en el inductor (azul)

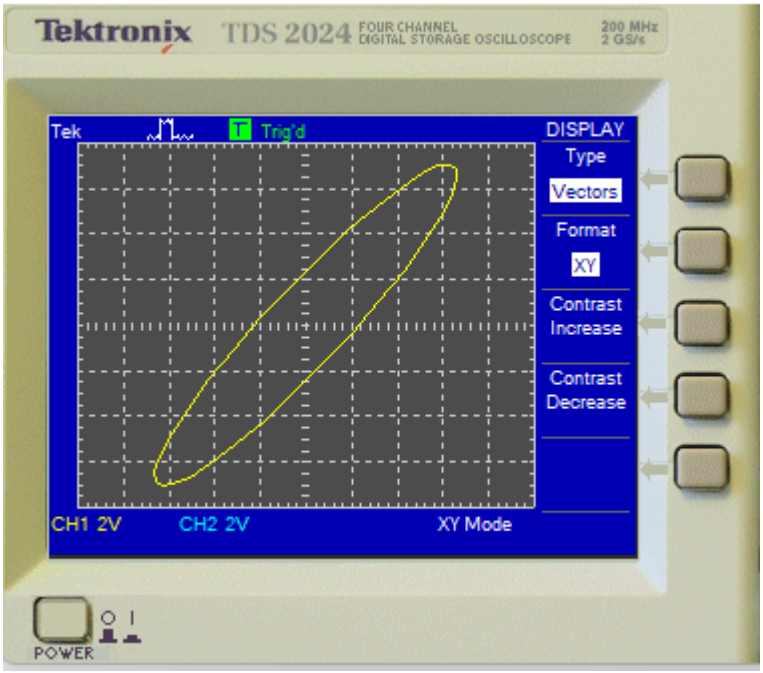


figura de lissajous

Diagrama fasorial

```
u = [real(vl) real(Il)*1e2 real(vf)];
v = [imag(vl) imag(Il)*1e2 imag(vf)];
co = compass(u,v);
c1 = co(1);
c1.LineWidth = 2;
c1.Color = 'r';
c2 = co(2);
```

```
c2.LineWidth = 2;
c2.Color = 'b';
c3 = co(3);
c3.LineWidth = 2;
c3.Color = 'g';
```

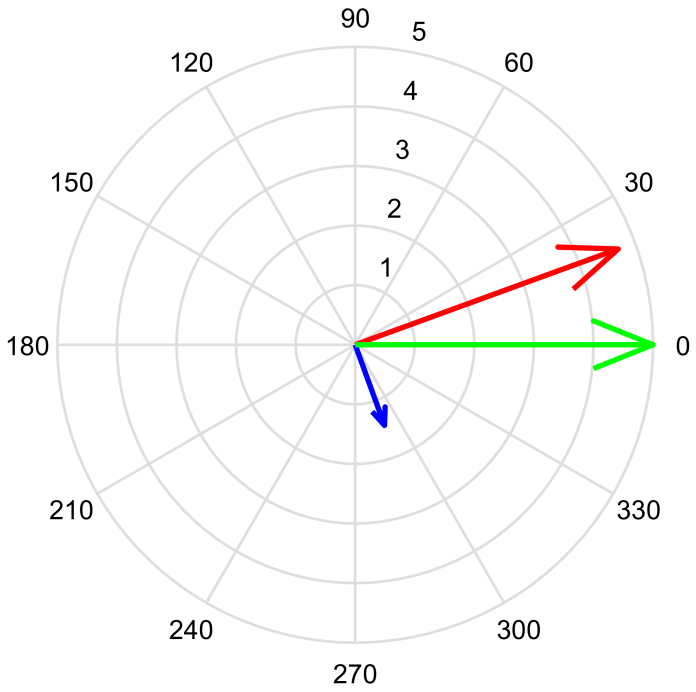


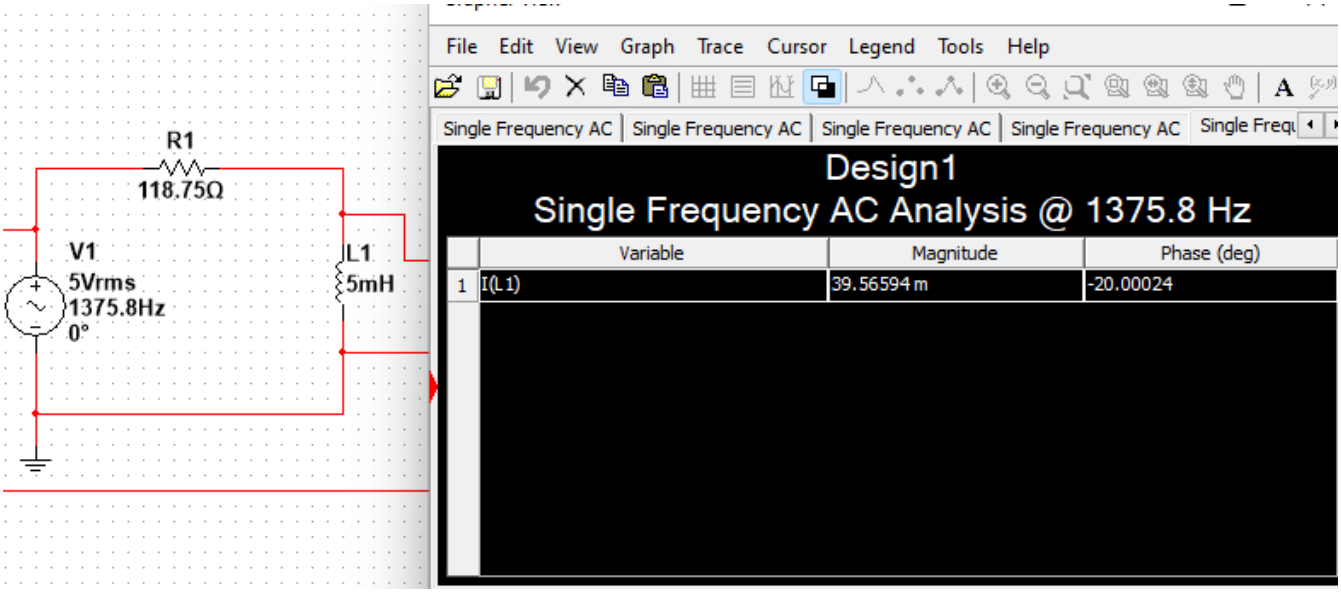
diagrama fasorial, tension de la fuente (verde), tension en el inductor (rojo), corriente en el indcutor (azul)

Circuito RL diseño para -20°

```
f = abs((r*tand(-20))/(2*l*pi)) %frecuencia necesaria
```

```
f =
       1375.8
```

verificamos en el simulador:



calculamos correintes y tensiones en el inductor:

```
xl = (2*pi*f*l)*j
```

```
xl =
           0 +     43.221i
```

```
zrl = r + xl
```

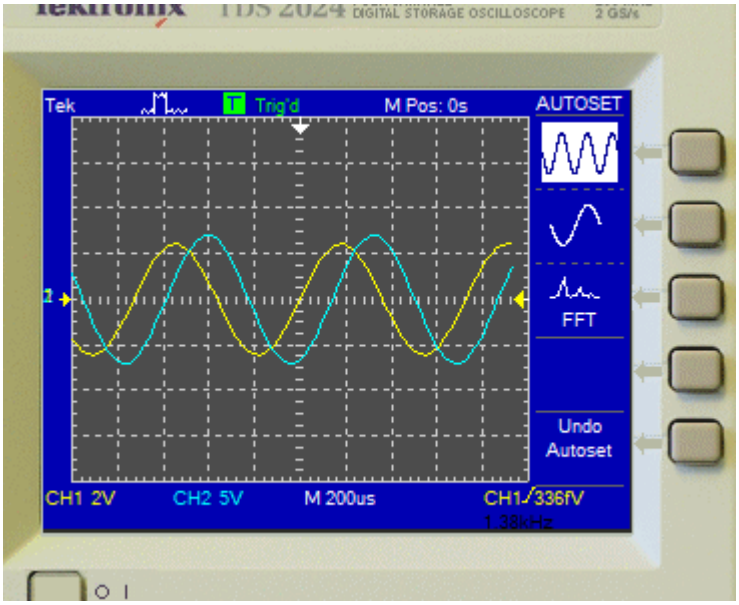
```
zrl =
       118.75 +     43.221i
```

```
Il = vf/zrl;
Il_fasor = [abs(Il) angle(Il)*180/pi] %fasor corriente en el inductor [A]
```

```
Il_fasor = 1×2
     0.039566          -20
```

```
vl = Il*(xl);
vl_fasor = [abs(vl) angle(vl)*180/pi] %fasor voltaje en el inductor
```

```
vl_fasor = 1×2
       1.7101           70
```



tension de la fuente (amarillo) comparada con la tension en el inductor (azul)

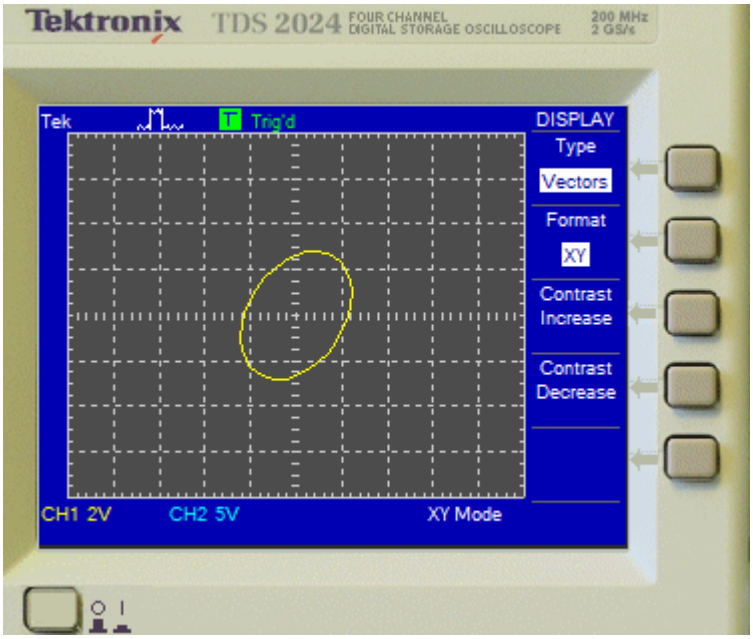


figura de lissajous

diagrama fasorial

```
u = [real(vl) real(Il)*1e2 real(vf)];
v = [imag(vl) imag(Il)*1e2 imag(vf)];
co = compass(u,v);
c1 = co(1);
c1.LineWidth = 2;
c1.Color = 'r';
c2 = co(2);
c2.LineWidth = 2;
c2.Color = 'b';
```

```
c3 = co(3);
c3.LineWidth = 2;
c3.Color = 'g';
```

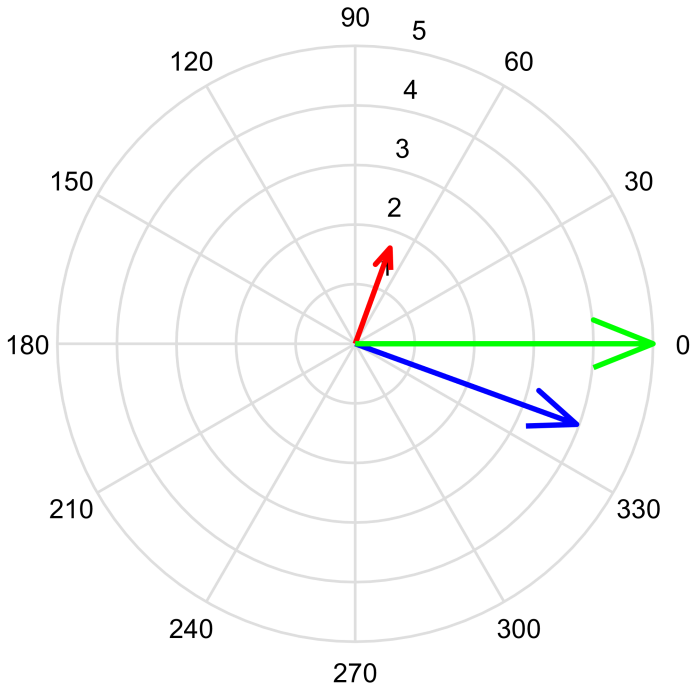


diagrama fasorial, tension de la fuente (verde), tension en el inductor (rojo), corriente en el indcutor (azul)

DISEÑO 2

circuito RC diseño para 70°

```
c = 1e-6;

syms angulo f C R

ec1 = solve(tan(angulo)==(1/(2*pi*f*C))/R,f)
```

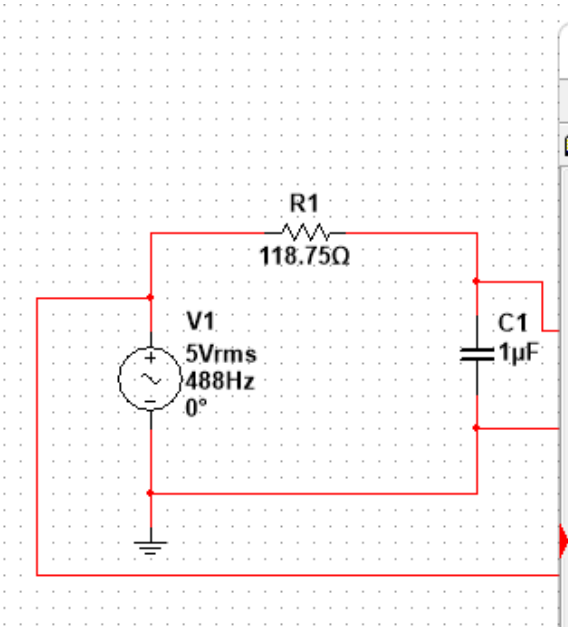
```
ec1 =
```

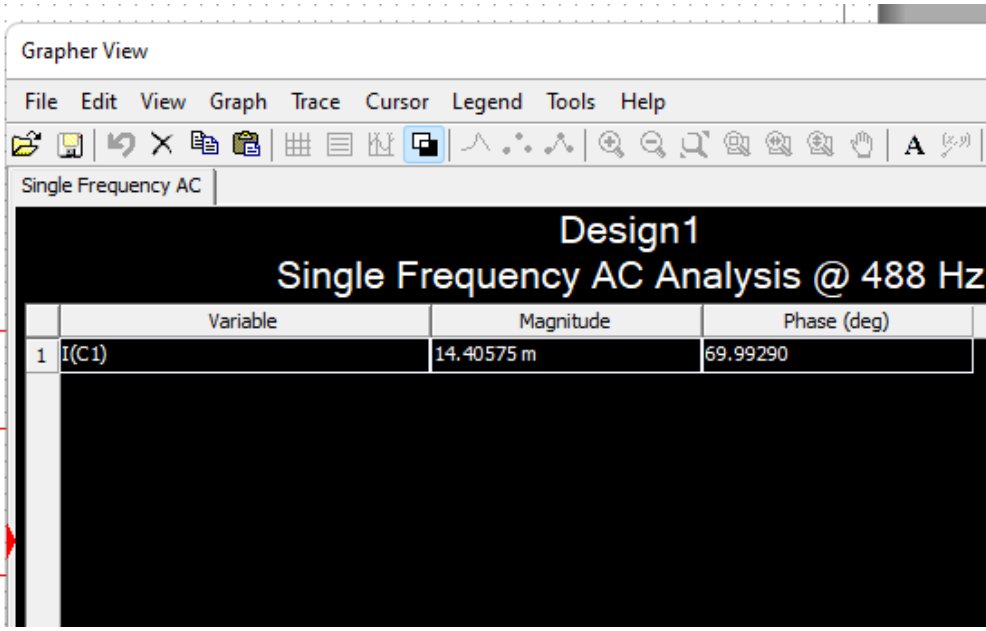
$$\frac{1}{2\,C\,R\,\pi\,\tan(\text{angulo})}$$

```
f = 1/(2*c*r*pi*tand(70)) %frecuencia necesaria
```

```
f =
       487.81
```

verificamos en el simulador






```
xc = -(1/(2*pi*f*c))*j
```

```
xc =
           0 -     326.26i
```

```
zrc = r + xc
```

```
zrc =
       118.75 -     326.26i
```

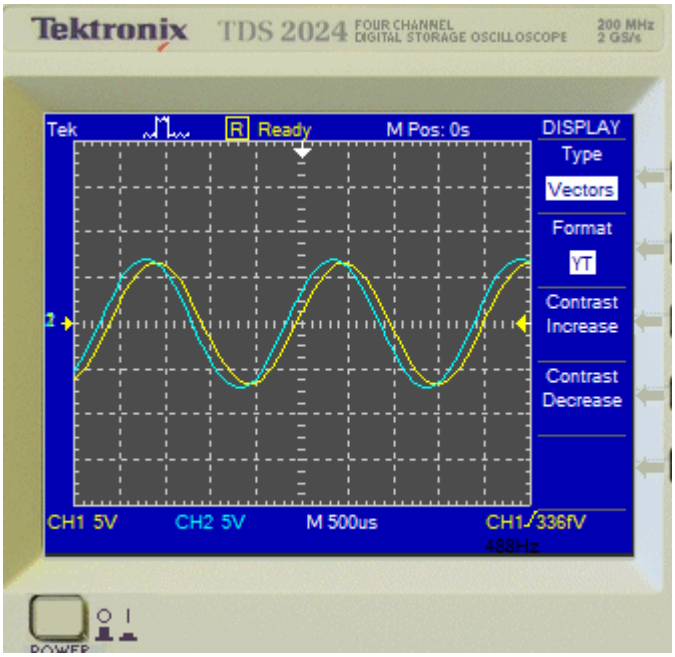
```
Ic = vf/zrc;
Ic_fasor = [abs(Ic) angle(Ic)*180/pi] %fasor corriente en el capacitor [A]
```

```
Ic_fasor = 1×2
     0.014401          70
```

```
vc = Ic*(xc);
vc_fasor = [abs(vc) angle(vc)*180/pi] %fasor voltaje en el capacitor [V]
```

```
vc_fasor = 1×2
       4.6985         -20
```

verificamos en el osciloscopio



tension de la fuente (amarillo) comparada con la tension en el capacitor (azul)

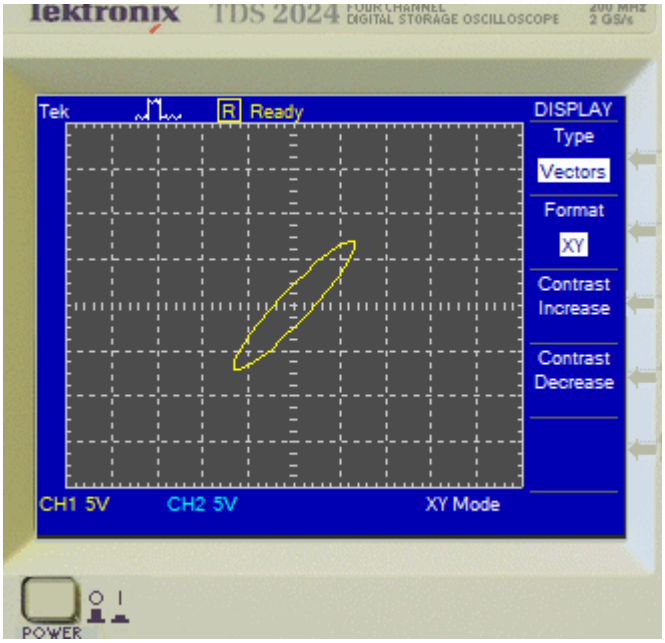


figura de lissajous

Diagrama fasorial

```
u = [real(vc) real(Ic)*1e2 real(vf)];
v = [imag(vc) imag(Ic)*1e2 imag(vf)];
co = compass(u,v);
c1 = co(1);
c1.LineWidth = 2;
c1.Color = 'r';
c2 = co(2);
c2.LineWidth = 2;
```

```
c2.Color = 'b';
c3 = co(3);
c3.LineWidth = 2;
c3.Color = 'g';
```

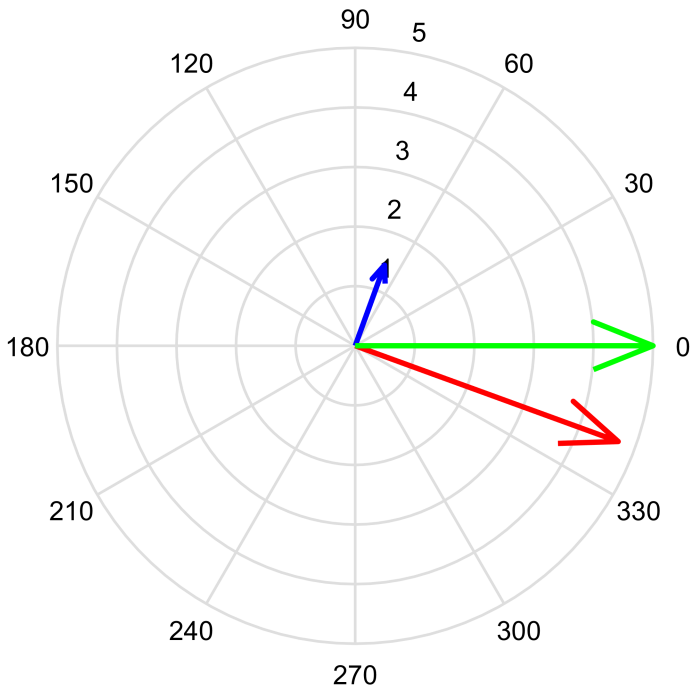
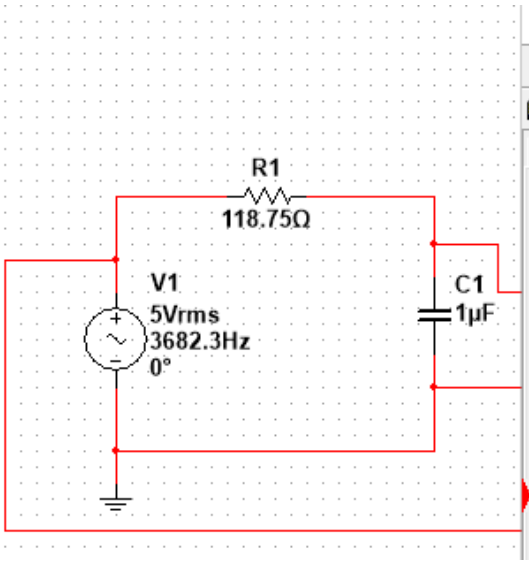


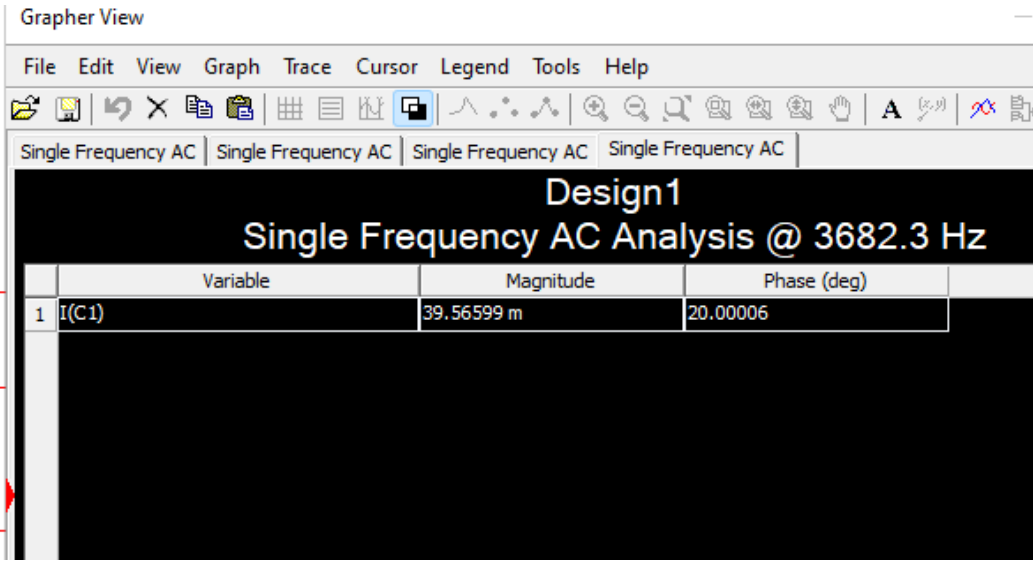
diagrama fasorial, tension de la fuente (verde), tension en el capacitor (rojo), corriente en el capacitor (azul)

Circuito RC diseño para 20°

```
f = 1/(2*c*r*pi*tand(20)) %frecuencia necesaria
```

```
f =
       3682.3
```






```
xc = -(1/(2*pi*f*c))*j
```

```
xc =
           0 -     43.221i
```

```
zrc = r + xc
```

```
zrc =
       118.75 -     43.221i
```

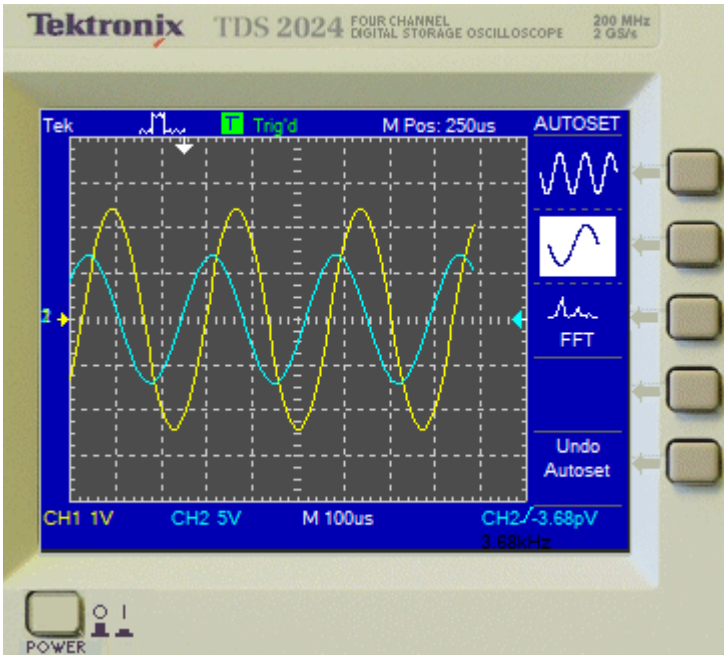
```
Ic = vf/zrc;
Ic_fasor = [abs(Ic) angle(Ic)*180/pi] %fasor corriente en el capacitor [A]
```

```
Ic_fasor = 1×2
     0.039566          20
```

```
vc = Ic*(xc);
vc_fasor = [abs(vc) angle(vc)*180/pi] %fasor voltaje en el capacitor [V]
```

```
vc_fasor = 1×2
       1.7101         -70
```

Verficamos en el simulador:



tension de la fuente (amarillo) comparada con la tension en el capacitor (azul)

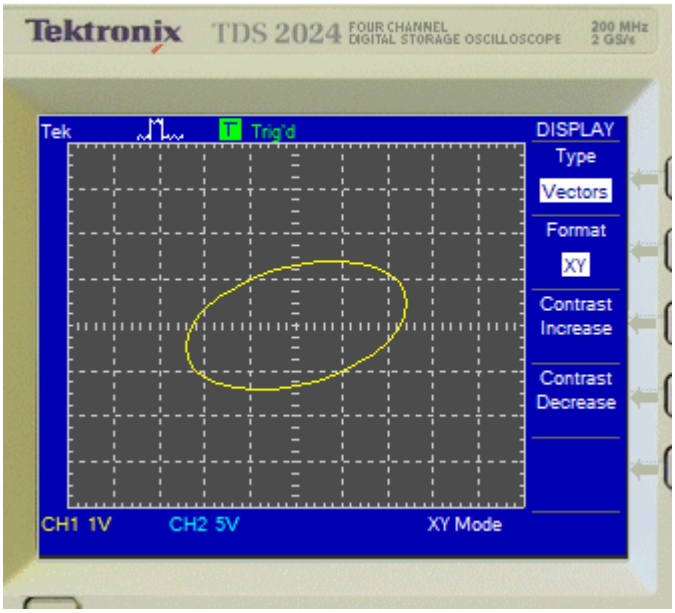


figura de lissajous

Diagrama fasorial

```
u = [real(vc) real(Ic)*1e2 real(vf)];
v = [imag(vc) imag(Ic)*1e2 imag(vf)];
co = compass(u,v);
c1 = co(1);
c1.LineWidth = 2;
c1.Color = 'r';
c2 = co(2);
c2.LineWidth = 2;
c2.Color = 'b';
```

```
c3 = co(3);
c3.LineWidth = 2;
c3.Color = 'g';
```

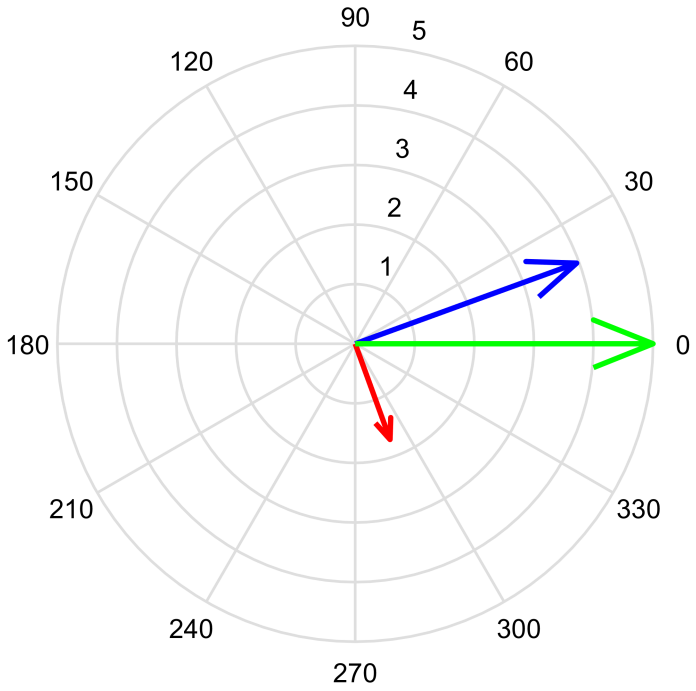


diagrama fasorial, tension de la fuente (verde), tension en el capacitor (rojo), corriente en el capacitor (azul)

DISEÑO 3

Circuito RLC diseño

```
syms angulo f L C R

frec = solve(tan(angulo)==((2*pi*f*L)-(1/(2*pi*f*C)))/R,f)
```

```
frec =
```

$$\begin{pmatrix} \frac{\sqrt{C\ (C\ R^2\tan(\text{angulo})^2+4\ L)}+C\ R\tan(\text{angulo})}{4\ C\ L\ \pi} \\ -\frac{\sqrt{C\ (C\ R^2\tan(\text{angulo})^2+4\ L)}-C\ R\tan(\text{angulo})}{4\ C\ L\ \pi} \end{pmatrix}$$

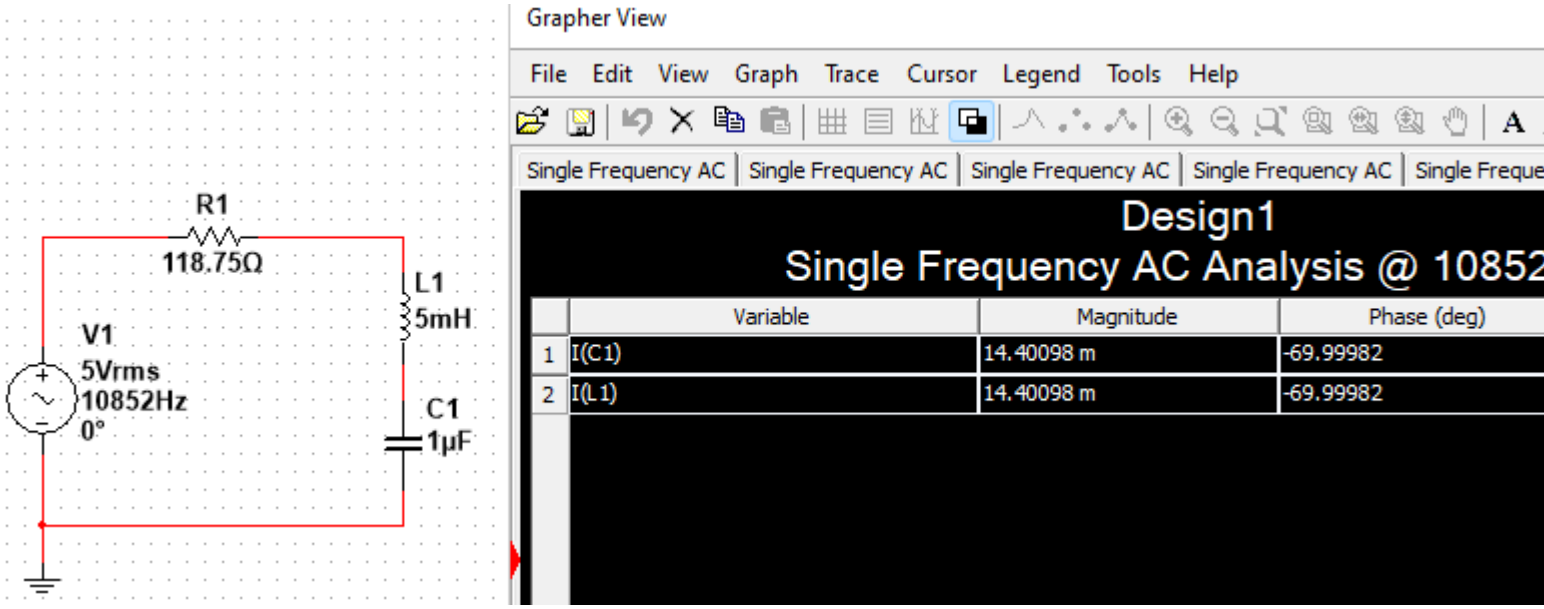
```
f1 = ( sqrt(c*(c*(r^2)*(tand(-70)^2)+4*l)) + (c*r*tand(-70)) )/(4*c*l*pi) %frecuencia para angu
```

```
f1 =
       466.83
```

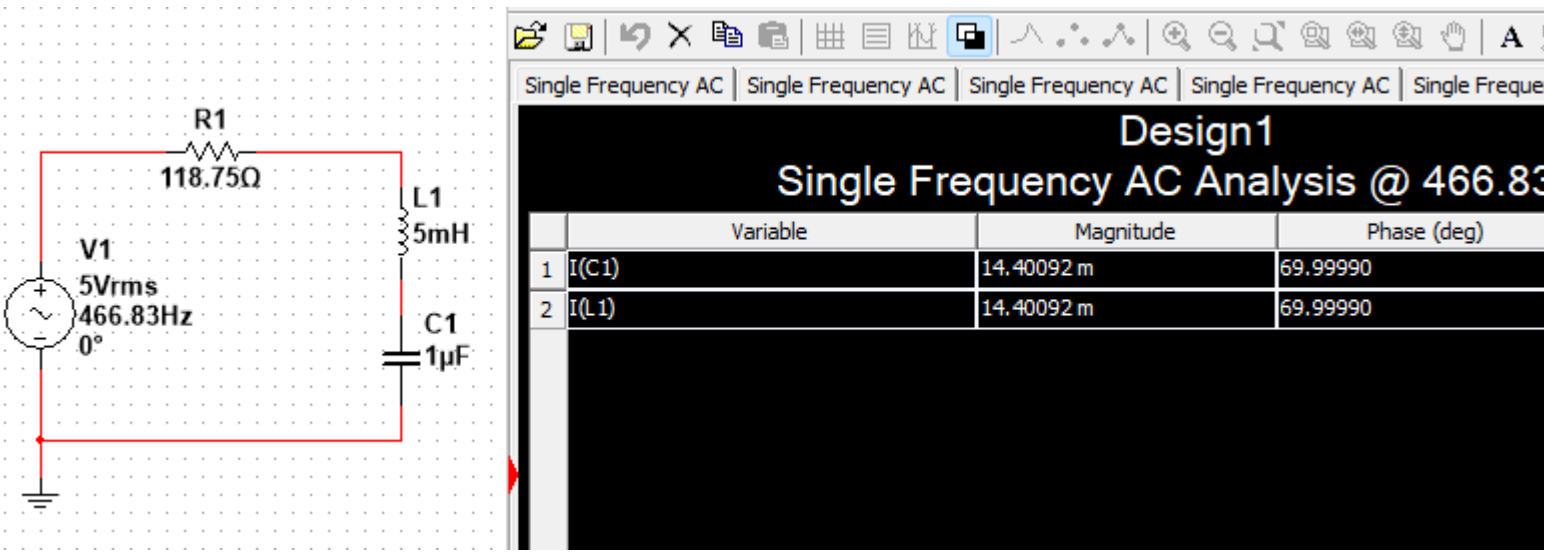
```
f2 = abs(-( sqrt(c*(c*(r^2)*(tand(-70)^2)+4*l)) - (c*r*tand(-70)) )/(4*c*l*pi)) %frecuencia par
```

```
f2 =
        10852
```

verificamos en el simulador



correinte con angulo de desfase **negativo (-70°)**



corriente con angulo de desfase **positivo (70°)**

Ahora calculamos las corrientes y tensiones en cada elemento reactivo para ambos diseños

Angulo negativo:

```
xl = (2*pi*f2*l)*j
```

```
xl =
           0 +     340.93i
```

```
xc = -(1/(2*pi*f2*c))*j
```

```
xc =
           0 -     14.666i
```

```
zrlc = r + xl + xc
```

```
zrlc =
       118.75 +     326.26i
```

```
Irlc = vf/zrlc;
Irlc_fasor = [abs(Irlc) angle(Irlc)*180/pi] %fasor corriente en el circuit rlc [A]
```

```
Irlc_fasor = 1×2
     0.014401          -70
```

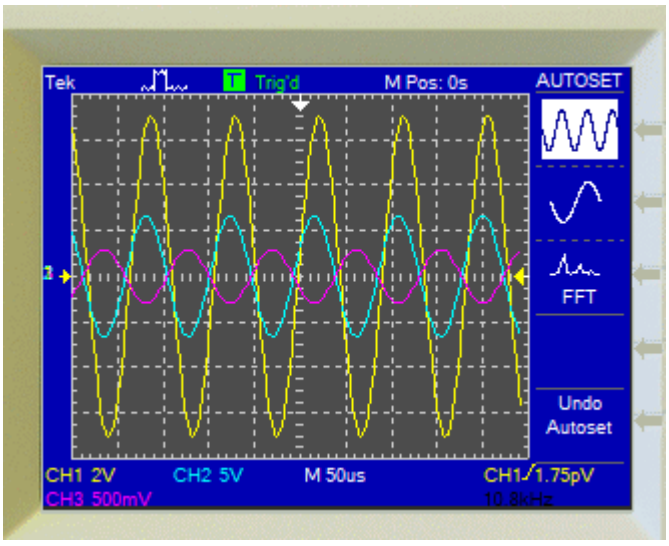
```
vl = Irlc*(xl);
vl_fasor = [abs(vl) angle(vl)*180/pi] %fasor voltaje en el inductor
```

```
vl_fasor = 1×2
       4.9097           20
```

```
vc = Irlc*(xc);
vc_fasor = [abs(vc) angle(vc)*180/pi] %fasor voltaje en el capacitor
```

```
vc_fasor = 1×2
       0.2112         -160
```

verificamos en el osciloscopio



tension de la fuente (amarillo) comparada con la tension en el inductor (azul) y la tension en el capacitor (violeta)

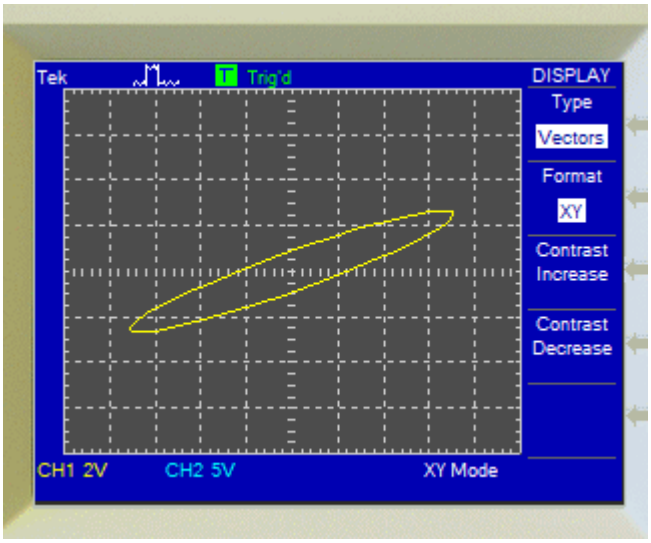


figura de lissajous

diagrama fasorial

```
u = [real(vc)*10 real(Irlc)*1e2 real(vf) real(vl)];
v = [imag(vc)*10 imag(Irlc)*1e2 imag(vf) imag(vl)];
co = compass(u,v);
c1 = co(1);
c1.LineWidth = 2;
c1.Color = 'r';
c2 = co(2);
c2.LineWidth = 2;
c2.Color = 'b';
c3 = co(3);
c3.LineWidth = 2;
c3.Color = 'g';
c4 = co(4);
c4.LineWidth = 2;
c4.Color = 'magenta';
```

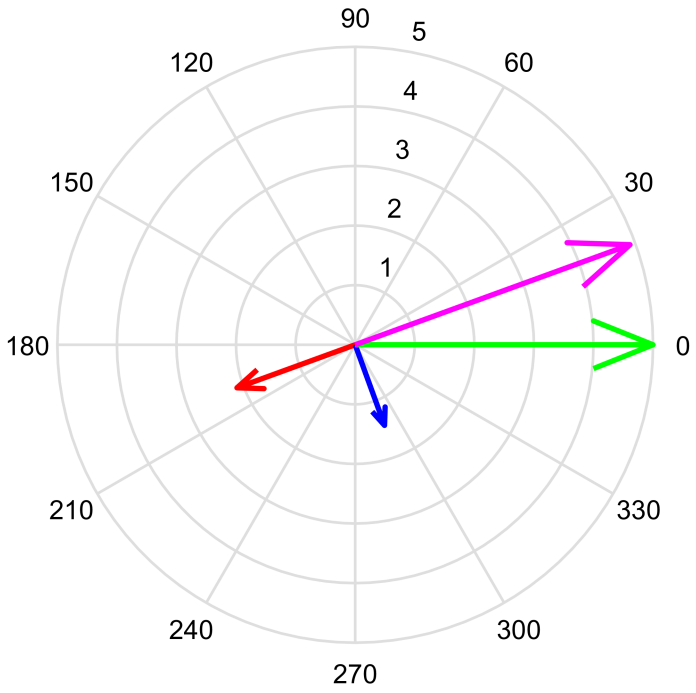


Diagrama fasorial, tension de la fuente (verde), tension en el capacitor (rojo), corriente en el circuito (azul), tension en el inductor (magenta)

Angulo positivo:

```
xl = (2*pi*f1*l)*j
```

```
xl =
           0 +    14.666i
```

```
xc = -(1/(2*pi*f1*c))*j
```

```
xc =
           0 -    340.93i
```

```
zrlc = r + xl + xc
```

```
zrlc =
      118.75 -    326.26i
```

```
Irlc = vf/zrlc;
Irlc_fasor = [abs(Irlc) angle(Irlc)*180/pi] %fasor corriente en el circuito rlc [A]
```

```
Irlc_fasor = 1×2
    0.014401          70
```

```
vl = Irlc*(xl);
vl_fasor = [abs(vl) angle(vl)*180/pi] %fasor voltaje en el inductor
```

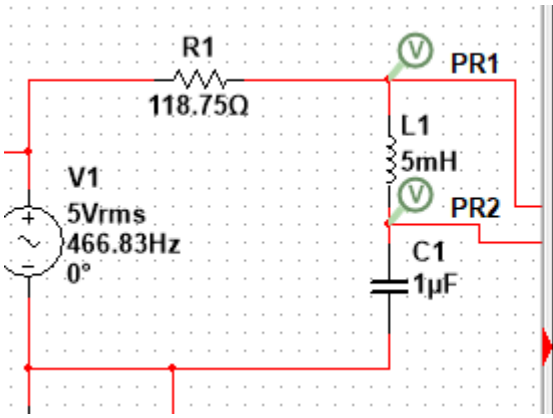
```
vl_fasor = 1×2
```

```
        0.2112         160
```

```
vc = Irlc*(xc);
vc_fasor = [abs(vc) angle(vc)*180/pi] %fasor voltaje en el capacitor
```

```
vc_fasor = 1×2
        4.9097         -20
```

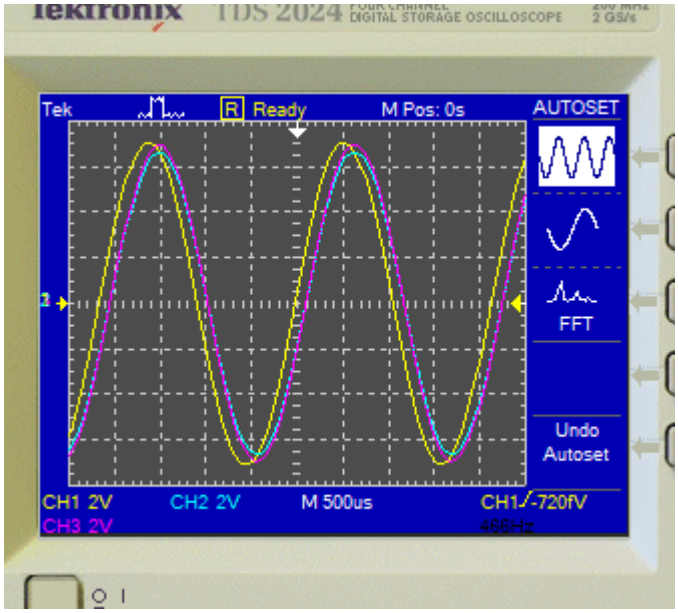
verificamos en el simulador



Single Frequency AC Analysis @ 466.8

	Variable	Magnitude	Phase (deg)
1	V(2) | V(PR2)	4.90966	-20.00010
2	I(C1)	14.40092 m	69.99990
3	I(L1)	14.40092 m	69.99990
4	V(PR1)-V(PR2)	211.20242 m	159.99990

verificamos en el osiloscopio



tension de la fuente (amarillo) comparada con la tension en el inductor (azul) y la tension en el capacitor (violeta)

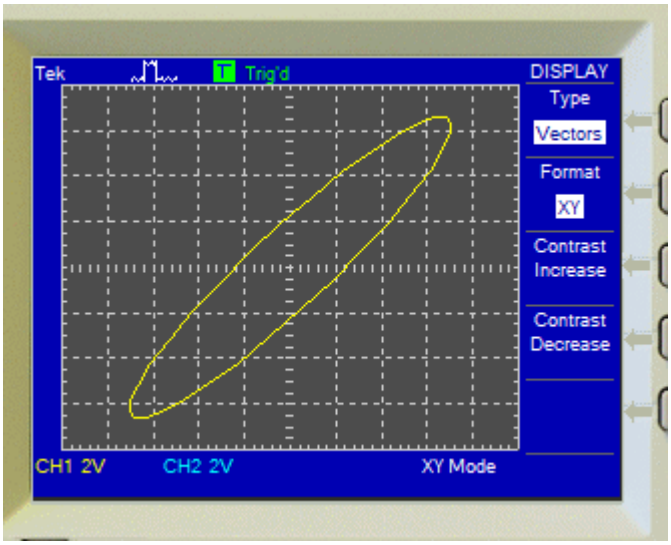


figura de lissajois

Diagrama fasorial

```
u = [real(vc) real(Irlc)*1e2 real(vf) real(vl)*10];
v = [imag(vc) imag(Irlc)*1e2 imag(vf) imag(vl)*10];
co = compass(u,v);
c1 = co(1);
c1.LineWidth = 2;
c1.Color = 'r';
c2 = co(2);
c2.LineWidth = 2;
c2.Color = 'b';
c3 = co(3);
c3.LineWidth = 2;
c3.Color = 'g';
c4 = co(4);
c4.LineWidth = 2;
c4.Color = 'magenta';
```

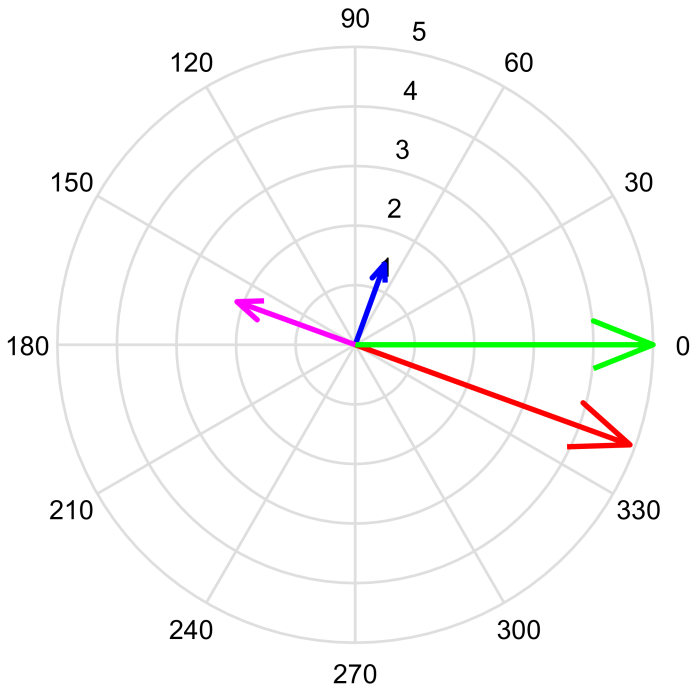


Diagrama fasorial, tension de la fuente (verde), tension en el capacitor (rojo), corriente en el circuito (azul), tension en el inductor (magenta)