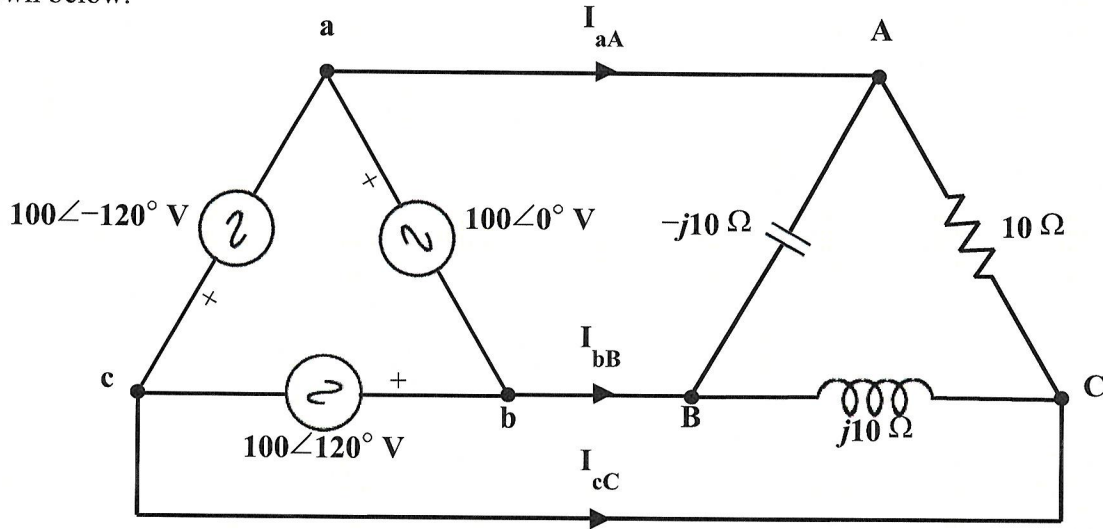


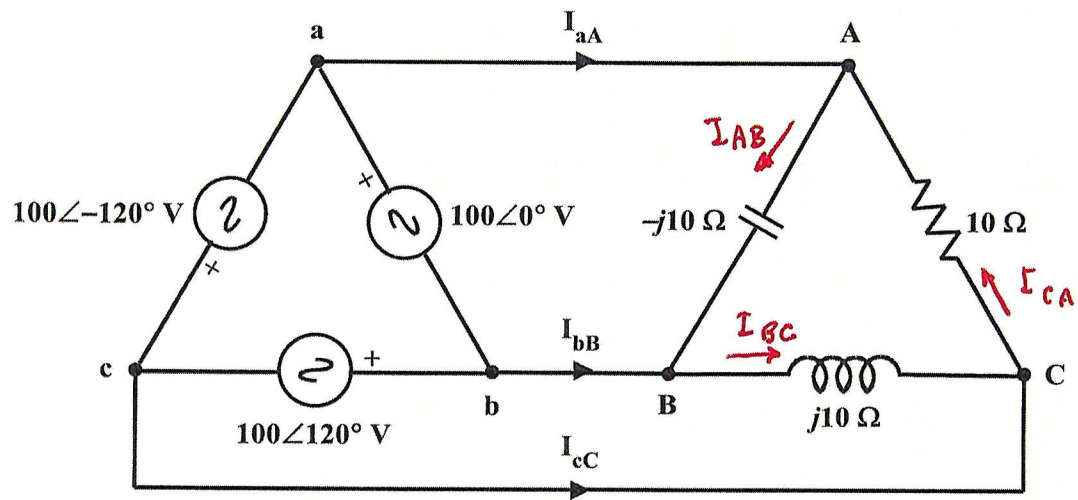
EE 3340
Homework Problem #043

Find the line currents, I_{aA} , I_{bB} and I_{cC} (in polar form) in the unbalanced three-phase circuit shown below.



See the attached pages for MATLAB and LTspice solutions.

Find the line currents I_{aA} , I_{bB} and I_{cC} (in polar form) in the unbalanced three-phase $\Delta-\Delta$ circuit shown.



See next page for MATLAB solution.

Using MATLAB:

```
>> IAB=100/(-j*10)
```

```
IAB =
```

```
0.0000 + 10.0000i
```

```
>> IBC=100*(cosd(120)+j*sind(120))/(j*10)
```

```
IBC =
```

```
8.6603 + 5.0000i
```

```
>> ICA=100*(cosd(-120)+j*sind(-120))/10
```

```
ICA =
```

```
-5.0000 - 8.6603i
```

```
>> IaA=IAB-ICA
```

```
IaA =
```

```
5.0000 + 18.6603i
```

```
>> abs(IaA)
```

```
ans =
```

```
19.3185
```

```
>> angle(IaA)*180/pi
```

```
ans =
```

```
75.0000
```

$$I_{aA} \approx 19.32 \angle 75^\circ \text{ A}$$

```
>> IbB=IBC-IAB
```

```
IbB =
```

```
8.6603 - 5.0000i
```

```
>> abs(IbB)
```

```
ans =
```

```
10
```

```
>> angle(IbB)*180/pi
```

```
ans =
```

```
-30.0000
```

$$I_{bB} = 10 \angle -30^\circ \text{ A}$$

```
>> IcC=ICA-IBC
```

```
IcC =
```

```
-13.6603 - 13.6603i
```

```
>> abs(IcC)
```

```
ans =
```

```
19.3185
```

```
>> angle(IcC)*180/pi
```

```
ans =
```

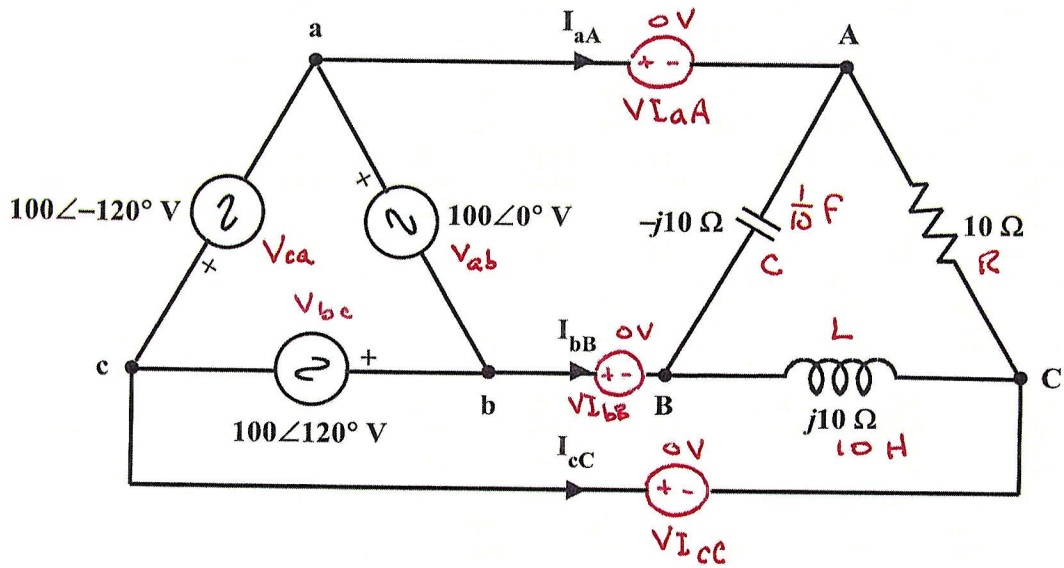
```
-135
```

$$I_{cC} \approx 19.32 \angle -135^\circ \text{ A}$$

Using LTspice:

Assume $\omega = 1 \text{ rad/s}$.

$$f = \frac{1}{2\pi} \approx 0.159154943 \text{ Hz}$$



Vca	sc	sa	AC	100	-120
Vbc	sb	sc	AC	100	120
Vab	sa	sb	AC	100	0
Vl_aA	sa	A	DC	0	
Vl_bB	sb	B	DC	0	
Vl_cC	sc	C	DC	0	
C	A	B	{1/10}		
L	B	C	10		
R	A	C	10		
.AC	LIN	1	0.159154943	0.159154943	

```

[!spice XVII] - [0 cir]
File Edit View Simulate Tools Window Help
050.cir
* Q:\Websites\RES\EE 3340\homework problems\043.cir
Vca sc sa AC 100 -120
Vbc sb sc AC 100 120
Vab sa sb AC 100 0
VIaA sa A DC 0
VIbB sb B DC 0
VIcC sc C DC 0
C A B {1/10}
L B C 10
R A C 10
Ra sa 0 1T
Rb sb 0 1T
Rc sc 0 1T
.AC LIN 1 0.159154943 0.159154943
.end
Ready

```

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--- AC Analysis ---

frequency:	0.159155	Hz		
V(sc):	mag: 57.7339	phase: -90.0003°	voltage	
V(sa):	mag: 57.7353	phase: 30.0011°	voltage	
V(sb):	mag: 57.7359	phase: 149.999°	voltage	
V(a):	mag: 57.7353	phase: 30.0011°	voltage	
V(b):	mag: 57.7359	phase: 149.999°	voltage	
V(c):	mag: 57.7339	phase: -90.0003°	voltage	
I(C):	mag: 10	phase: 90°	device_current	
I(L):	mag: 10	phase: 30.0057°	device_current	
I(Rc):	mag: 5.77339e-011	phase: -90.0003°	device_current	
I(Rb):	mag: 5.77359e-011	phase: 149.999°	device_current	
I(Ra):	mag: 5.77353e-011	phase: 30.0011°	device_current	
I(R):	mag: 10	phase: 60°	device_current	
I(Vicc):	mag: 19.3188	phase: -134.997°	device_current	
I(Vibb):	mag: 9.99913	phase: -29.9971°	device_current	
I(Viaa):	mag: 19.3185	phase: 75°	device_current	
I(Vab):	mag: 39.598	phase: -135°	device_current	
I(Vbc):	mag: 43.2779	phase: -147.895°	device_current	
I(Vca):	mag: 24.824	phase: -157.899°	device_current	

I_{cC} →
 I_{bB} →
 I_{aA} →

$$I_{aA} = 19.32 \angle 75^\circ \text{ A}$$

$$I_{bB} = 10 \angle -30^\circ \text{ A}$$

$$I_{cC} = 19.32 \angle -135^\circ \text{ A}$$