Example 1 - Kirchhoff's Laws

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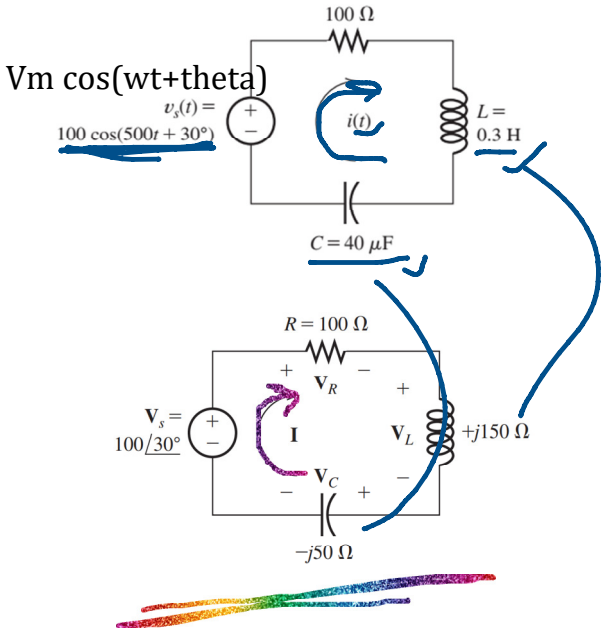
- **Find the steady-state current for the circuit shown in Figure.**
- **Also, find the phasor voltage across each element and construct a phasor diagram.**



Step 1: To convert circuit elements of AC circuit using complex impedances

W=500

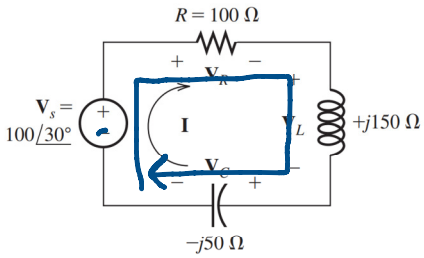
Zl = jwL = j*500*0.3 = 150j

Zc = 1/jwC = 1/(j*500*40*10^-6) = -50j

Step 2: To convert the voltage or currents in phasor form

Vs(t)=100 cos(500t+30)

Vs = 100∠30



Step 3: KVL

-100∠30 + 100 (I) + (150j) I + (-50j)I = 0

(100+150j-50j) I = 100∠30

I = 100∠30/(100+100j)

I = (100(cos(30)+jsin(30)))/(100+100j)

=

Vr = 100 * I

VL = 150j * I

Vc = -50j * I

Example 2 - Node-Voltage Analysis

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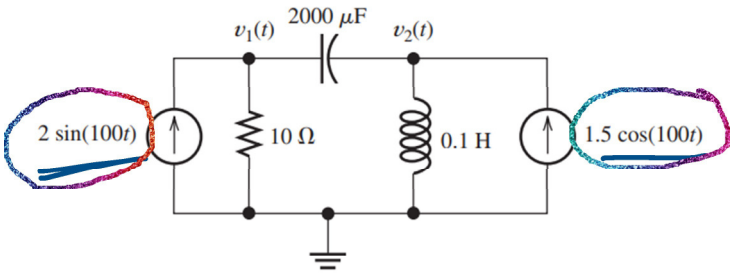
- Use the node-voltage technique to find v1(t) and v2(t) in steady state for the circuit shown in Figure



Step 1: Convert the Circuit elements in to complex impedances

W = 100

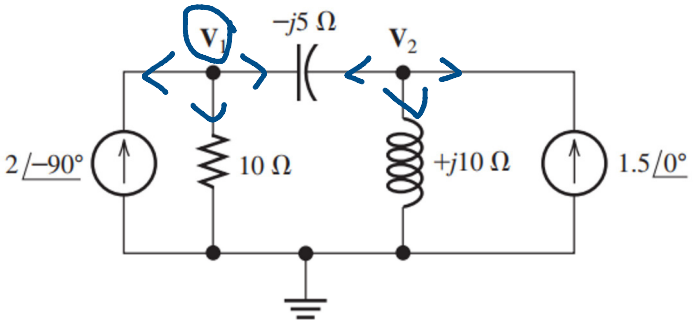
ZL = jwL = j*100*0.1 = 10j

ZC = 1/(jwC) = -5j

Step 2: Convert the voltage or currents sources into phasor form

2sin(100t) -- > 2∠-90

1.5cos(100t) --- >1.5∠0



Step 3:

Node 1:
(V1-0)/10 + (V1-V2)/(-5j) -2∠-90 = 0

Node 2:
(V2-V1)/(-5j) + (V2-0)/10j -1.5∠0 = 0

(1/10 -1/5j) v1 + (1/5j) v2 = 2∠-90 = 2(cos(-90)+jsin(-90)) = 2 (0+j(-1)) = -2j
(1/5j) v1 + (-1/5j+1/10j) v2 = 1.5∠0 = 1.5 (cos(0)+jsin(0)) = 1.5 (1+0)=1.5

A= [1/10-1/5j 1/5j
1/5j -1/5j+1/10j]

B=[-2j
1.5]

V1 =14.0000 + 8.0000i
V2 = 28.0000 + 1.0000i

Example 3 - Mesh Current Analysis

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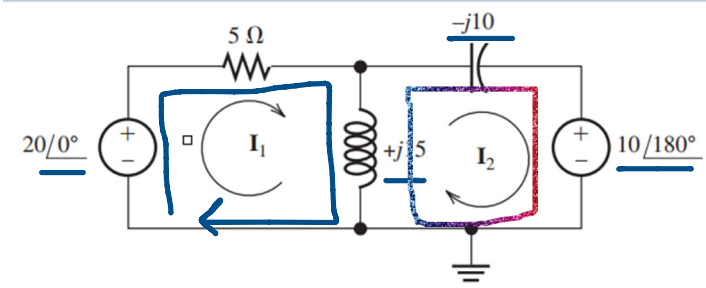

- **Solve for the mesh currents I1 and I2**

Step 1 & Step 2: X

Step 3:

Loop 1:
5(I1) + 15j (I1-I2) -20∠0 = 0

Loop 2:
-10j(I2) + 15j (I2-I1) + 10∠180 = 0

() I1 + () I2 =
() I1 + () I2 =

I1 and I2

Example 4 - AC Power Calculations

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