# Current Loops with Phasors
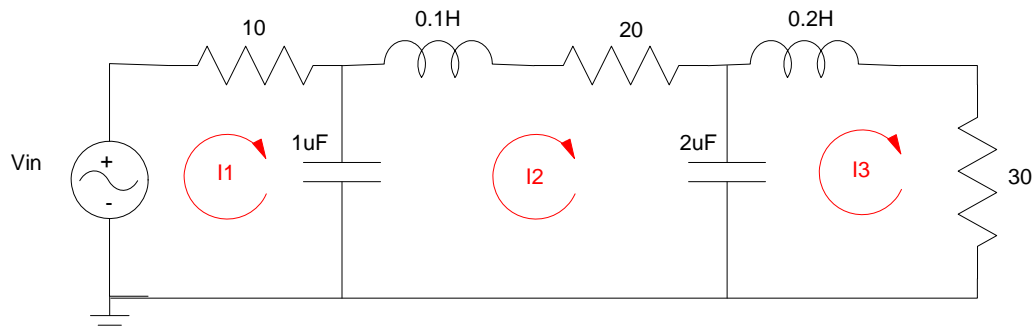
## EE 206 Practice Problems

1) Write the current loop equations for the following circuit. Assume

$$V_{in} = 20\cos(500t) + 5\sin(500t)$$

2) Write the current loop for the following circuit. Assume

$$V_{in} = 30\cos(2000t - 50^0)$$
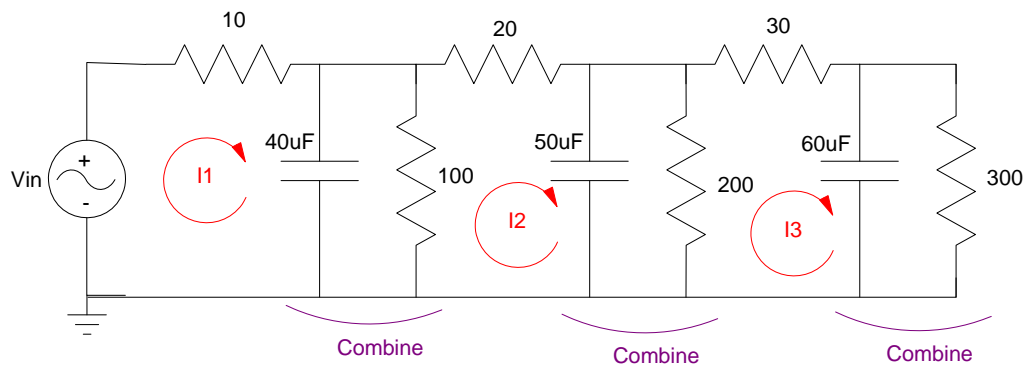


Problem 1 & 2

3) Write the current loop equations for the following circuit. Assume

$$V_{in} = 20\cos(500t) + 5\sin(500t)$$

4) Write the current loop equations for the following circuit. Assume
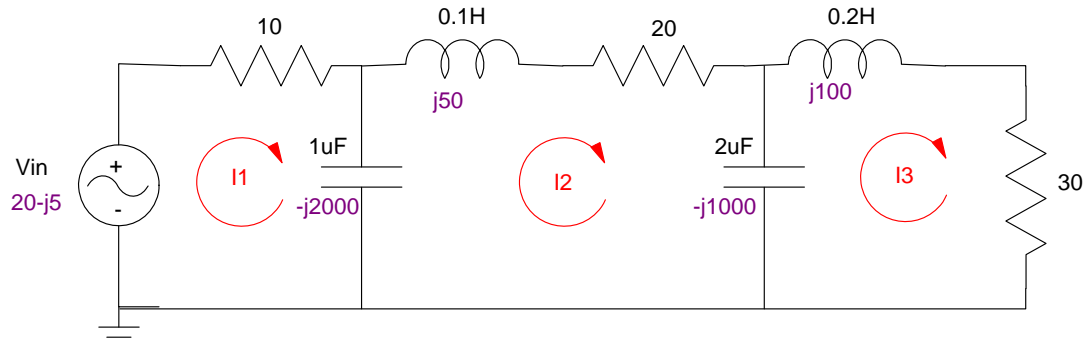
$$V_{in} = 30\cos(2000t - 50^0)$$

## Solutions

1) Write the current loop equations for the following circuit. Assume

$$V_{in} = 20\cos(500t) + 5\sin(500t)$$

Step 1) Convert to phasors (shown in figure below)
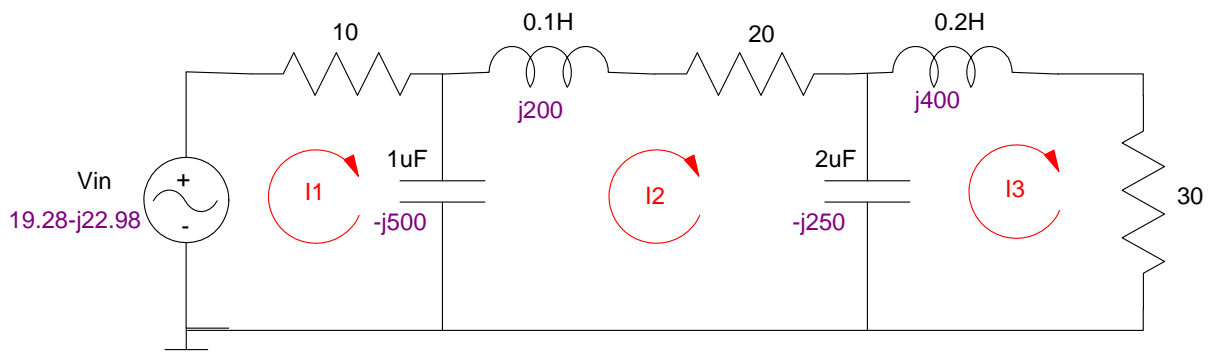


Now write the current loop equations

$$-(20 - j5) + 10I_1 + (-j2000)(I_1 - I_2) = 0$$

$$(-j2000)(I_2 - I_1) + (20 + j50)I_2 + (-j1000)(I_2 - I_3) = 0$$

$$(-j1000)(I_3 - I_2) + (30 + j100)I_3 = 0$$

2) Write the current loop equations for the following circuit. Assume

$$V_{in} = 30\cos(2000t - 50^0)$$



Now write the current loop equations

$$-(19.28 - j22.98) + 10I_1 + (-j500)(I_1 - I_2) = 0$$

$$(-j500)(I_2 - I_1) + (20 + j200)I_2 + (-j250)(I_2 - I_3) = 0$$

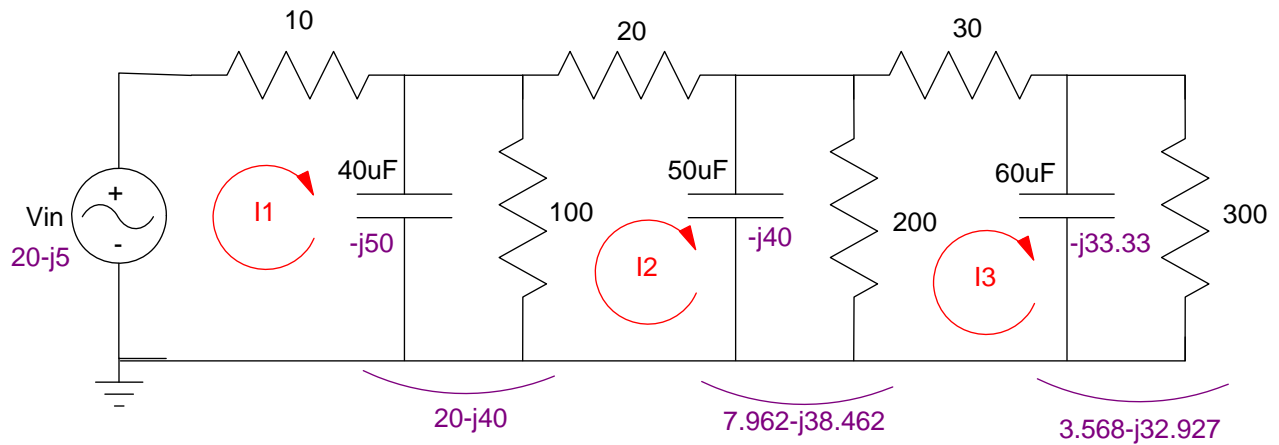$$(-j250)(I_3 - I_2) + (30 + j400)I_3 = 0$$

Problem 3) Write the current loop equations for the following circuit. Assume

$$V_{in} = 20\cos(500t) + 5\sin(500t)$$

Start by converting to phasors

$$\omega = 500$$

$$V_{in} = 20 - j5$$



Combine the resistors and capacitors in parallale

$$100\|(-j50) = 20 - j40$$

$$(-j40)\|200 = 7.962 - j38.462$$

$$-j33.333\|300 = 3.568 = j32.927$$

Now write the current loop equations

$$-(20 - j5) + 10I_1 + (20 - j40)(I_1 - I_2) = 0$$

$$(20 - j40)(I_2 - I_1) + 20I_2 + (7.962 - j38.462)(I_2 - I_3) = 0$$
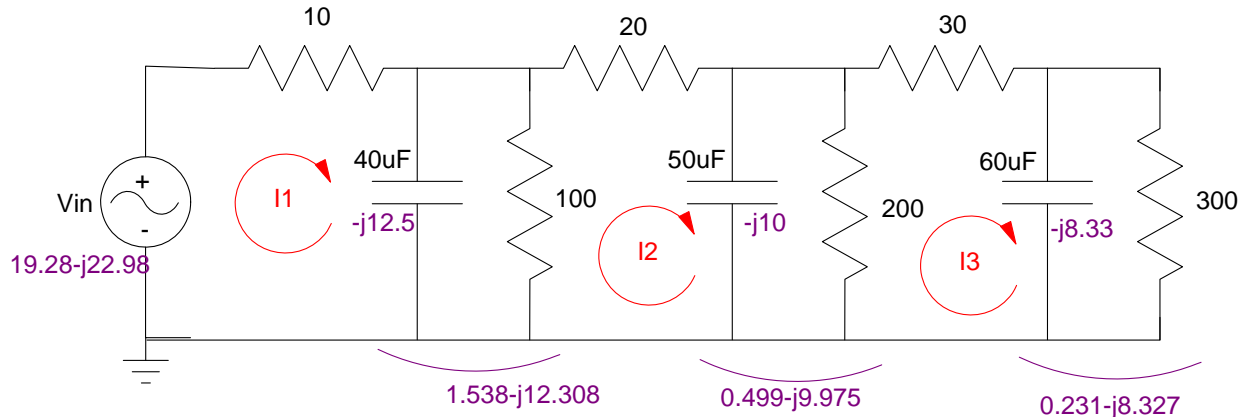
$$(7.962 - j38.462)(I_3 - I_2) + 30I_3 + (3.568 - j32.927)I_3 = 0$$

Problem 4)  Write the current loop equations for the following circuit.  Assume

$$V_{in} = 30\cos\left(2000t - 50^0\right)$$

Start by converting to phasors

$$V_{in} = 30\angle - 50^0 = 19.28 - j22.98$$



Write the loop equations

$$-(19.28 - j22.98) + 10I_1 + (1.538 - j12.308)(I_1 - I_2) = 0$$

$$(1.538 - j12.308)(I_2 - I_1) + 20I_2 + (0.499 - j9.975)(I_2 - I_3) = 0$$

$$(0.499 - j9.975)(I_3 - I_2) + 30I_3 + (0.231 - j8.327)I_3 = 0$$