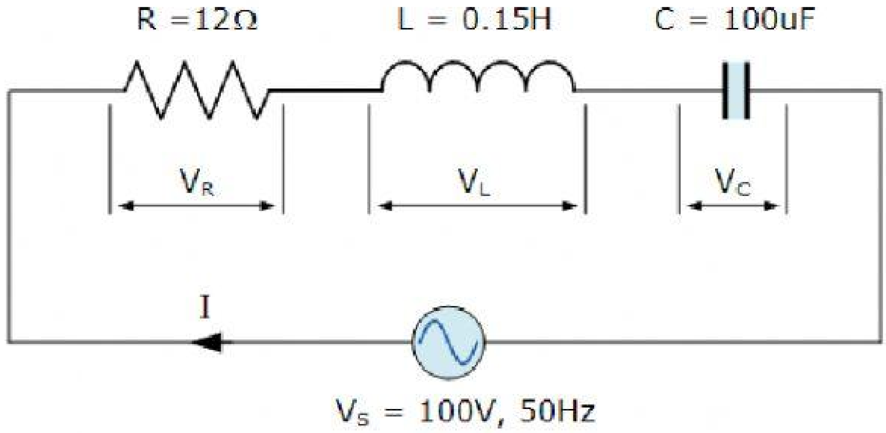
Using Complex numbers to solve RLC Circuits – M2 Worksheet



Step 1: Calculate angular velocity of this circuit:

W=2πf=

Step 2: Calculate individual impedances for each component:

XL=(W×L) j =

XC=$\frac{-j}{WC}$ =

Step 3: Calculate total impedance:

Z= R+(XL+XC) =

Step 4: Now find out in which quadrant of the state space z is located and then convert Z to the polar form:

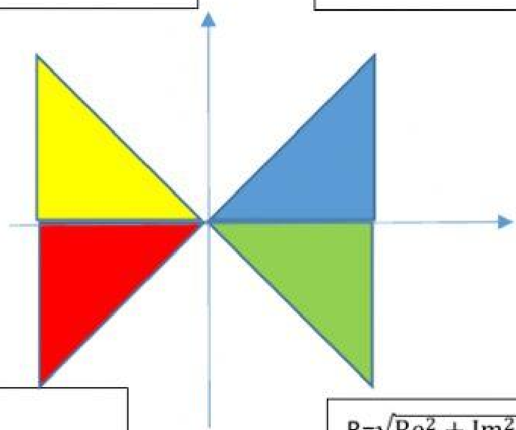
Z=r<Θ=

R=$\sqrt{\mathrm{Re}^2 + \mathrm{Im}^2}$

Θ=180-tan-1(abs(Im/Re))

R=$\sqrt{\mathrm{Re}^2 + \mathrm{Im}^2}$

Θ=$\tan^{-1}$(Im/Re)



R=$\sqrt{\mathrm{Re}^2 + \mathrm{Im}^2}$

Θ=180+tan-1(abs(Im/Re))

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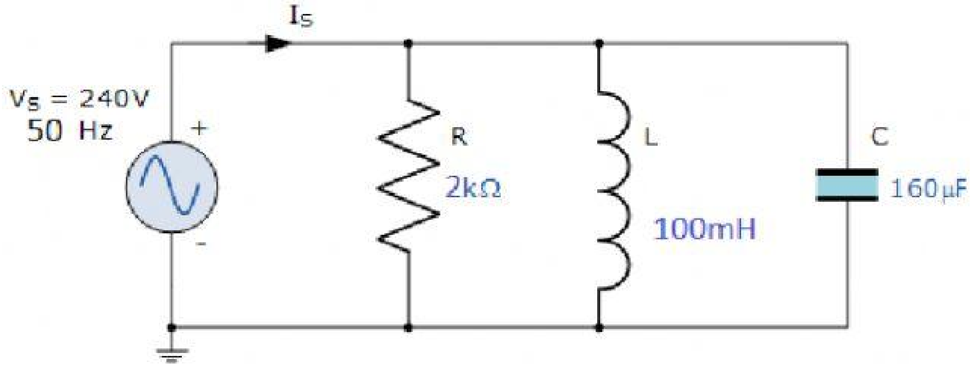

Step 1: Calculate angular velocity of this circuit:

W=2πf=

Step 2: Calculate individual impedances for each component:

XL=(W×L) j =

XC=$\frac{-j}{WC}$ =

Step 3: Calculate total impedance:

$\frac{1}{Z} = \frac{1}{R} + \frac{1}{XC} + \frac{1}{XL}$ =

Step 4: bring up j in XC and XL to the nominator and simplify them:

$\frac{1}{Z} = \frac{1}{R} + \frac{1}{XC} + \frac{1}{XL}$ =

Step 5: write 1/Z in Cartesian form:

1/Z=(Real)+(Imaginary) j = a+bj =

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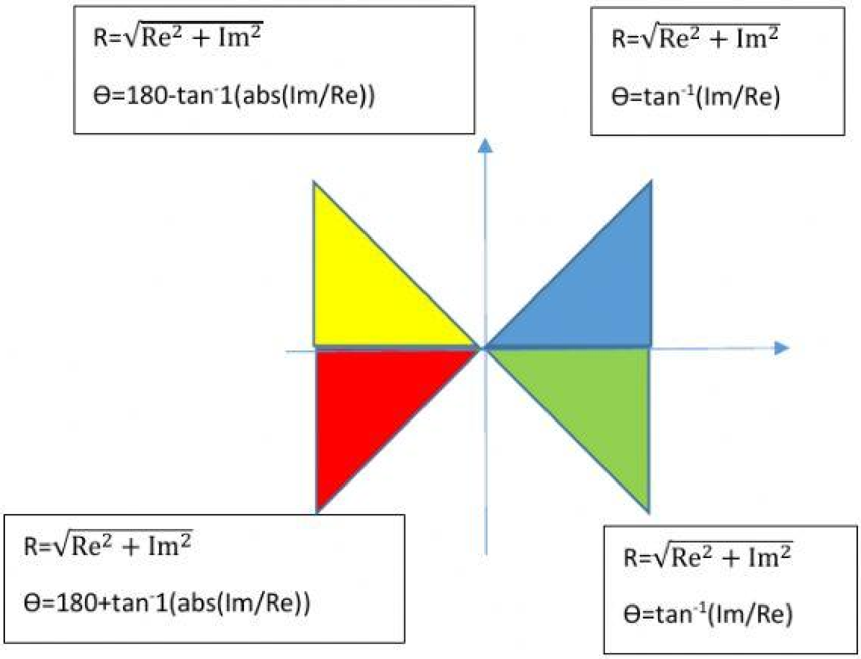
Step 6: Now find out in which quadrant of the state space 1/Z is located and then convert 1/Z to the polar form:

$\frac{1}{z} = \mathrm{r} < \Theta$=



Step 7: Now flip 1/Z to find Z (total impedance):

Guidance: when you flip a complex number in polar form you need to flip r and just change the sign of angle, as it is described below:

$$Z = \frac{1}{\mathrm{r}} < -\Theta =$$

Step 8: Now that you found Z in polar form you can easily convert it to the Cartesian:

----------= r×Cos(Θ)

----------= r×Sin(Θ)

Z= -------- +--------- j