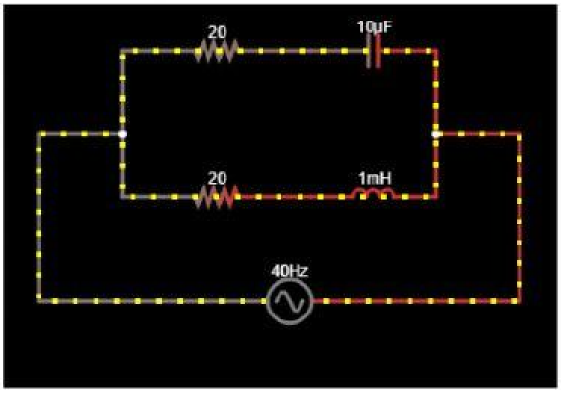
Using Complex numbers to solve RLC Circuits – M2 Worksheet



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 the impedance in the upper branch:

ZA=-----------+ ------------- j

Step 4: Convert ZA to the polar form:

$ZA = \mathrm{r1} < \theta 1$

Step 5: Calculate the impedance in the lower branch:

ZB=-----------+ ------------- j

Step 6: Convert ZB to the polar form:

$ZB = \mathrm{r2} < \theta 2$

Step 7: Calculate the total impedance:

$\frac{1}{Z} = \frac{1}{ZA} + \frac{1}{ZB} = \frac{1}{r1} < -\theta 1 + \frac{1}{r2} < -\theta 2$ =---------------- + ---------------------

Step 8: Write each part of $\frac{1}{Z}$ in Cartesian form that you can add them up:

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Hint: convert $\frac{1}{r1}$<$-\theta 1$ and $\frac{1}{r2}$<$-\theta 2$ to the Cartesian form:

$\frac{1}{r1}$<$-\theta 1$ =---------------+------------------- j

$\frac{1}{r2}$<$-\theta 2$ =---------------+------------------- j

Then add them up together and find $\frac{1}{Z}$ in Cartesian:

$\frac{1}{Z}$= -------------- + -------------- j

Step 9: Convert the Cartesian above to polar form to flip it and find Z:

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

Step 10: invert $\frac{1}{Z}$ to get Z:

Z= $\frac{1}{r}$<$-\theta$ = ----------------------------

Step 11: write Z in Cartesian form:

----=r×Cos(ϴ)

-----= r×Sin(ϴ)

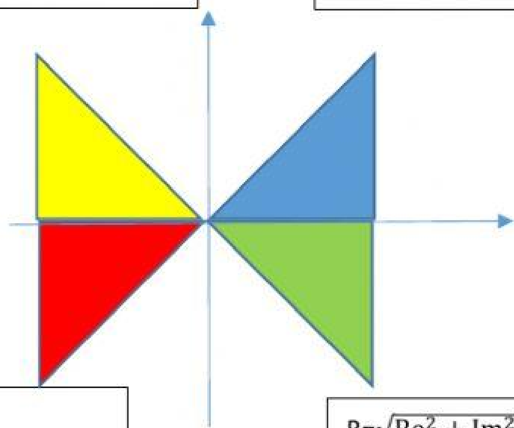
Z= ------------- + ------------- j

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)



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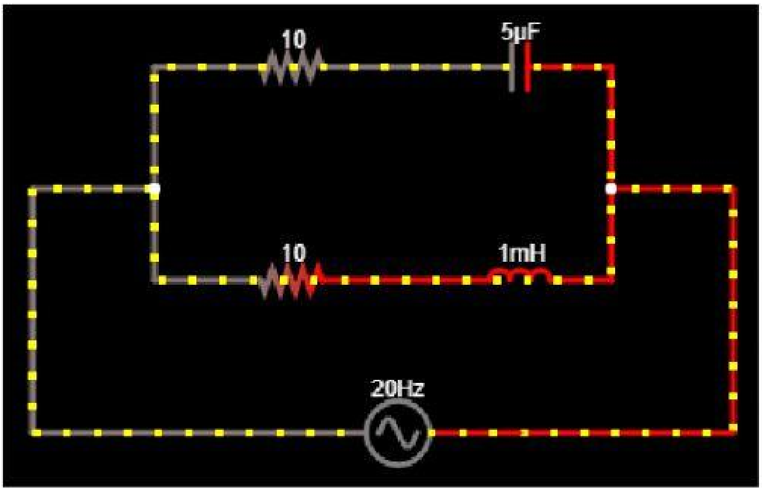

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Θ=$\tan^{-1}$(Im/Re)