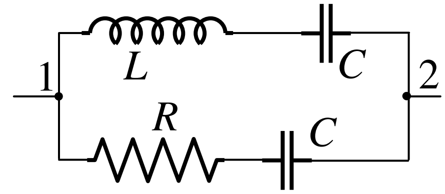


**Find z($\omega$).** This circuit has two branches (top and bottom), each of which has two parts. Each element can be treated like a resistor for purposes of finding impedance:

$$z_{top} = i\omega L - \frac{1}{\omega C} i = \frac{\omega^2 LC - 1}{\omega C} i$$
$$z_{bottom} = R - \frac{1}{\omega C} i = \frac{R\omega C - i}{\omega C}$$

Combining these in parallel:

$$\frac{1}{z_{total}} = \frac{1}{z_{top}} + \frac{1}{z_{bottom}} \qquad \frac{1}{z_{total}} = \frac{\omega C}{(\omega^2 LC - 1)i} + \frac{\omega C}{R\omega C - i}$$

Use a complex conjugate: $$\frac{1}{z_{total}} = \frac{-\omega Ci}{(\omega^2 LC - 1)} + \left[\frac{\omega C}{R\omega C - i}\right]\left[\frac{R\omega C + i}{R\omega C + i}\right]$$

$$\frac{1}{z_{total}} = \frac{-\omega Ci}{(\omega^2 LC - 1)} + \frac{R\omega^2 C^2}{R^2\omega^2 C^2 + 1} + \frac{\omega Ci}{R^2\omega^2 C^2 + 1}$$

Common denominator: $$\frac{1}{z_{total}} = \frac{(R^2\omega^2 C^2 + 1)(-\omega Ci) + (R\omega^2 C^2 + \omega Ci)(\omega^2 LC - 1)}{(\omega^2 LC - 1)(R^2\omega^2 C^2 + 1)}$$

Flip it over: $$z_{total} = \frac{(\omega^2 LC - 1)(R^2\omega^2 C^2 + 1)}{(R^2\omega^2 C^2 + 1)(-\omega Ci) + (R\omega^2 C^2 + \omega Ci)(\omega^2 LC - 1)}$$

Obviously, this could be simplified more. Also, in hindsight, it probably would have been advisable to do this all in Euler ("exponential") notation.

Here are some numerical values: Given

$\omega$ = 377 rad/s (standard $\omega$ for AC power)
$L$ = 2 H
$R$ = 150 Ω
$C$ = $1 \times 10^{-5}$ F

Then

$z_{\text{total}}$ = 494.56 – 248.13i Ω
$\theta = -26.6°$
$|z_{\text{total}}|$ = 553.3 Ω