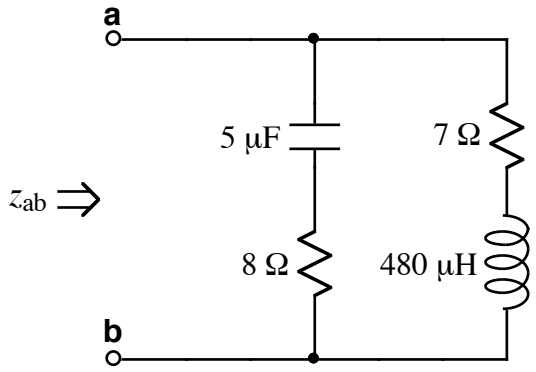
HOMEWORK #15 solution

Ex:



Given ω = 50 k rad/s, find z_{ab}.

soln: We compute impedances using

$$z_R = R, \quad z_L = j\omega L, \quad z_C = \frac{1}{j\omega C} = \frac{-j}{\omega C}.$$

$$\therefore z_L = j \cdot 50\text{k rad/s} \cdot 480\,\mu\text{H}$$

$$= j\, 50 \cdot 480\ \text{m}\Omega$$

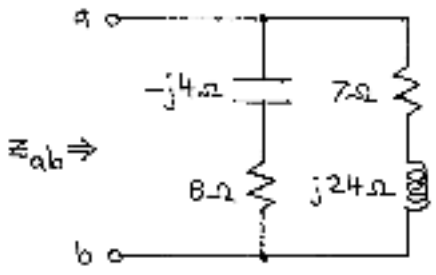
$$= j\ 24\ \Omega$$

$$z_C = \frac{-j}{50\text{k rad/s} \cdot 5\,\mu\text{F}}$$

$$= \frac{-j}{250\text{m}}\ \Omega$$

$$= -j4\ \Omega$$

Now we draw the frequency- (or s-domain) model:



We have $z_{ab} = (8 - j4\,\Omega) \| (7 + j24\,\Omega)$

$$= \frac{(8-j4)(7+j24)\,\Omega}{8-j4+7+j24}$$

$$= \frac{\sqrt{8^2+4^2}\,\angle\tan^{-1}(-4/8)\cdot\sqrt{7^2+24^2}\,\angle\tan^{-1}(24/7)}{15+j20}\,\Omega$$

$$= \frac{4\sqrt{5}\,\angle -26.6^\circ \cdot 25\,\angle 73.7^\circ}{25\,\angle 53.1^\circ}\,\Omega$$

$$= 4\sqrt{5}\,\angle -26.6^\circ + 73.7^\circ - 53.1^\circ\,\Omega$$

$$z_{ab} = 4\sqrt{5}\,\angle -6^\circ\,\Omega$$