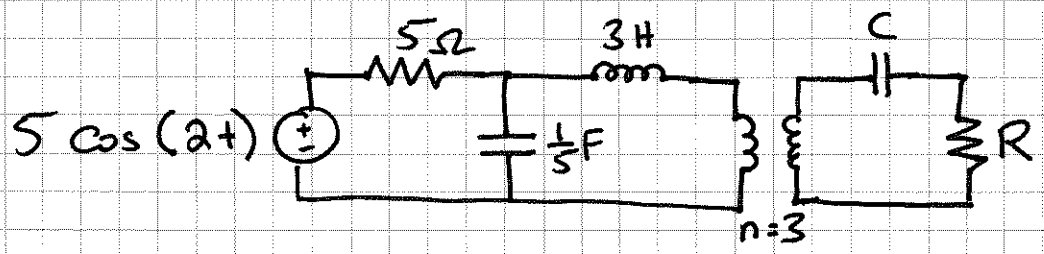
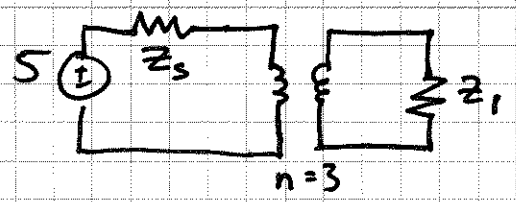


Find R and C to maximize the power dissipated by R

Solution

① C does not dissipate power (C and L never do) so to maximize power dissipated by R we maximize the power dissipated by C ⊣⊢ R. Call that impedance Z_1.

② Find the Thev equiv to left of transformer, as below (in frequency domain)



③ Plug in Thev equiv to right of transformer

by law of max. power transfer, max power in load occurs when $Z_s = \left(\frac{Z_1}{9}\right)^*$

④ Solve Z_s

Z_s, as seen from transformer is: $\left(Z_C = \frac{1}{j\omega C},\ Z_L = j\omega L\right)$

$Z_s = 5 \,//\, \frac{1}{j2(1/5)} + j2.3 = 1 + j4$

⑤ Solve for Z_1 : $Z_1 = \frac{1}{j(2)C} + R$

⑥ Apply Law of Max. Power: $Z_s = \left(\frac{Z_1}{9}\right)^*$

$1 + j4 = \left(\frac{1}{j18C} + \frac{R}{9}\right)^*$ but $\left(\frac{1}{j}\right)^* = (-j)^* = j$

$1 + j4 = \frac{1}{18C} + \frac{R}{9}$ equate real, Imag parts

$1 = \frac{R}{9} \Rightarrow \boxed{R = 9\,\Omega}$

$4 = \frac{1}{18C} \Rightarrow \boxed{C = \frac{1}{72}\,F}$