(A4) Problem Statement :

Using any of open method for root-finding (Newton-Raphson Method) finding value of ω that results in an impedance of $75\,\Omega$ for following parameters.

knowns,

$R = 225\,\Omega$

$C = 0.6 \times 10^{-6}\,F$

$L = 0.5\,H$

$Z = 75\,\Omega$ Impidence

equation,

$$\frac{1}{Z} = \sqrt{\frac{1}{R^2} + \left(\omega C - \frac{1}{\omega L}\right)^2}$$

Sol^n :

$$\frac{1}{75} = \sqrt{\frac{1}{(225)^2} + \left(\frac{\omega^2 (0.6 \times 10^{-6})(0.5) - 1}{\omega (0.5)}\right)^2}$$

$$\left(\frac{1}{75}\right)^2 - \left(\frac{1}{225}\right)^2 = \left(\frac{\omega^2 (0.6 \times 10^{-6})(0.5) - 1}{\omega (0.5)}\right)^2$$

$$\frac{50625 - 5625}{(75)^2 (225)^2}$$

$$f(\omega) = \left(\frac{\omega^2 (0.6 \times 10^{-6})(0.5) - 1}{\omega (0.5)}\right)^2 + \left(\frac{1}{225}\right)^2 - \left(\frac{1}{75}\right)^2$$

$$f'(\omega) = \left(\frac{\omega (0.6 \times 10^{-6})\cancel{(0.5)}}{\cancel{(0.5)}} - \frac{1}{\omega (0.5)}\right)^2 + \left(\frac{1}{225}\right)^2 - \left(\frac{1}{75}\right)^2$$

$$f'(\omega) = 2\left((0.6 \times 10^{-6}) + \frac{1}{\omega^2 (0.5)}\right)^{4} + 0 + 0$$

Now, applying formula

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

value of ω = 0.3516590..