Series Resonance - Summary

General Series R-L-C Circuit

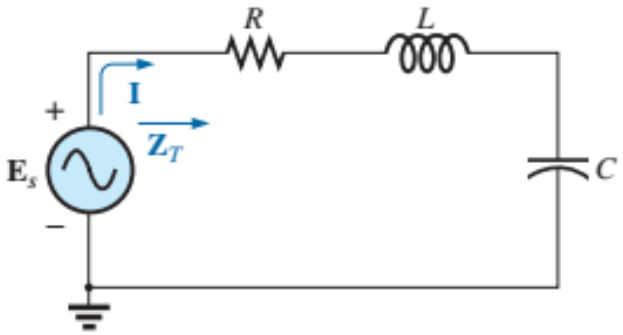
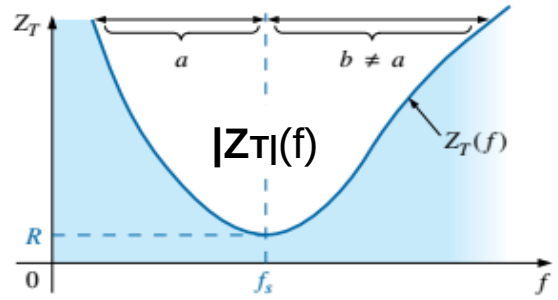


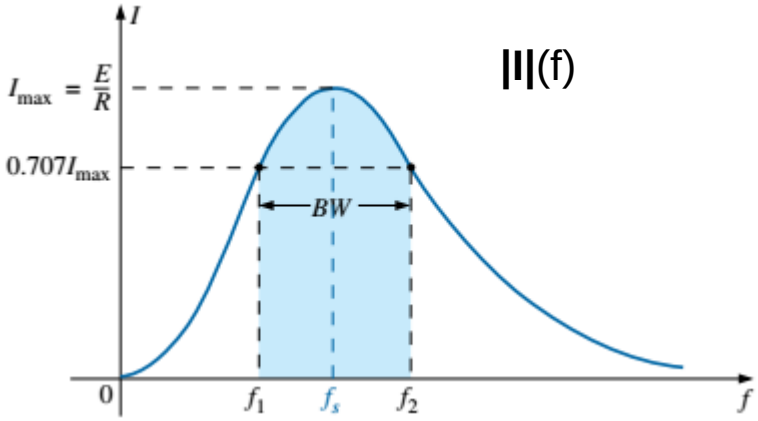
TABLE 21.1

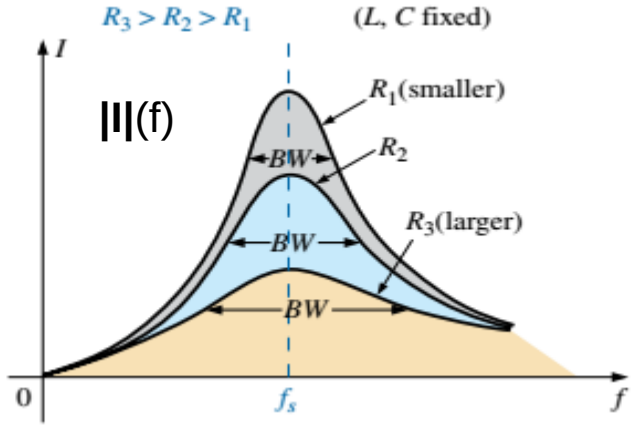
Important equations related to series resonant circuits.

At Resonance	Additional Equations
$X_L = X_C$	$P_{HPF} = \frac{1}{2}P_{max}$
$Z_{T_s} = R$	
$f_s = \frac{1}{2\pi\sqrt{LC}}$	$f_2 = \frac{1}{2\pi}\left[\frac{R}{2L} + \frac{1}{2}\sqrt{\left(\frac{R}{L}\right)^2 + \frac{4}{LC}}\right]$
$V_{L_s} = V_{C_s} = Q_s E$	$f_1 = \frac{1}{2\pi}\left[-\frac{R}{2L} + \frac{1}{2}\sqrt{\left(\frac{R}{L}\right)^2 + \frac{4}{LC}}\right]$
$F_{P_s} = 1$	
$Q_s = \frac{X_L}{R} = \frac{1}{R}\sqrt{\frac{L}{C}}$	$BW = f_2 - f_1 = \frac{R}{2\pi L}$
	$f_s = \sqrt{f_1 f_2}$

BW = fs/Qs







Series Resonance – In Class problem

Problem 9 – A Team HW Problem

*9. a. Design a series resonant circuit with an input voltage of $5\ V_{pk} \angle 0^{\circ}$ to have the following specifications:
—Peak current of 500 mA at resonance
—Bandwidth of 120 Hz
—Resonant frequency of 8400 Hz

b. Find the value of L and C and the cutoff frequencies.

Approach:

- Draw the circuit
- List the knowns
- List the unknowns (to solve for)
- Develop a strategy