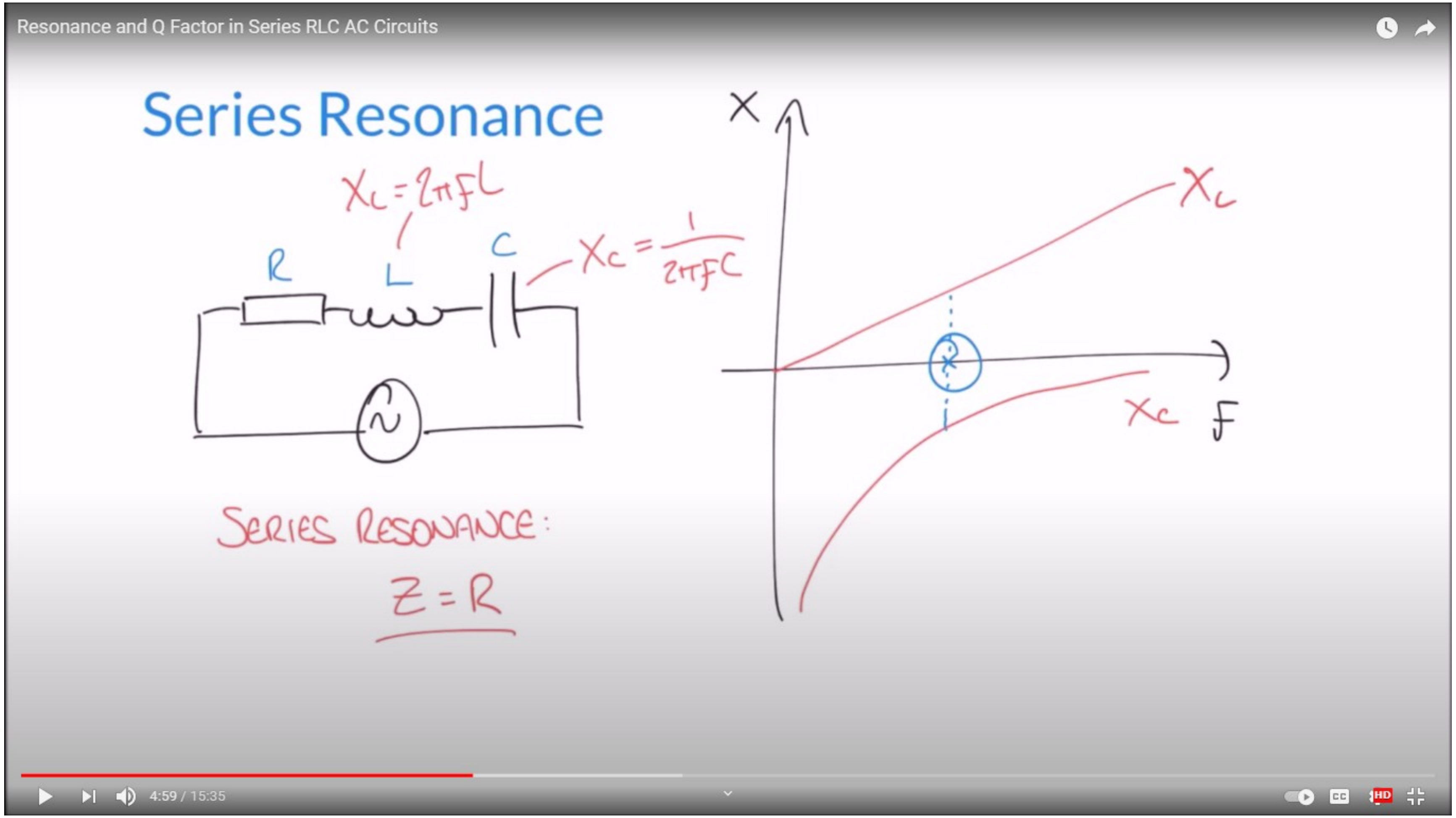
FY BTech
BEEE Lab
Expt No. 8
Based on Unit 6 : AC circuits
R L C Series Resonant Circuit

Inductive reactance Vs frequency
Capacitive reactance Vs frequency



Alternating current in an RLC circuit

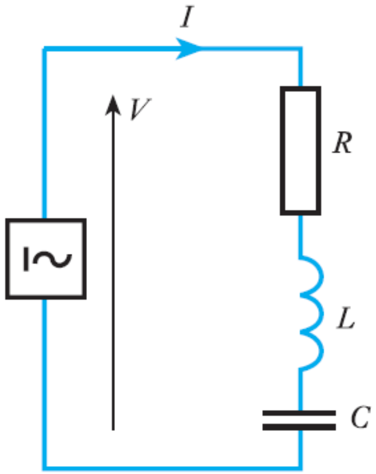


Fig. 10.25 Circuit with R, L and C in series

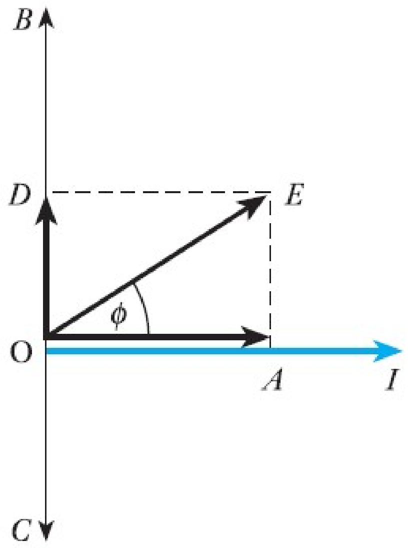


Fig. 10.26 Phasor diagram for Fig. 10.25

$$\tan\phi = \frac{\mathrm{AE}}{\mathrm{OA}} = \frac{\mathrm{OD}}{\mathrm{OA}} = \frac{\mathrm{OB}-\mathrm{OC}}{\mathrm{OA}} = \frac{2\pi fLI - I/(2\pi fC)}{RI}$$

$$= \frac{\text{inductive reactance} - \text{capacitive reactance}}{\text{resistance}}$$

$$\therefore \qquad \tan\phi = \frac{X_L - X_C}{R}$$

$$\mathrm{OE}^2 = \mathrm{OA}^2 + \mathrm{OD}^2 = \mathrm{OA}^2 + (\mathrm{OB}-\mathrm{OC})^2$$

$$\therefore \qquad V^2 = (RI)^2 + \left(2\pi fLI - \frac{I}{2\pi fC}\right)^2$$

so that

$$I = \frac{V}{\sqrt{\left\{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2\right\}}} = \frac{V}{Z}$$

where Z = *impedance* of circuit in ohms

$$Z = \frac{V}{I} = \sqrt{\left\{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2\right\}}$$

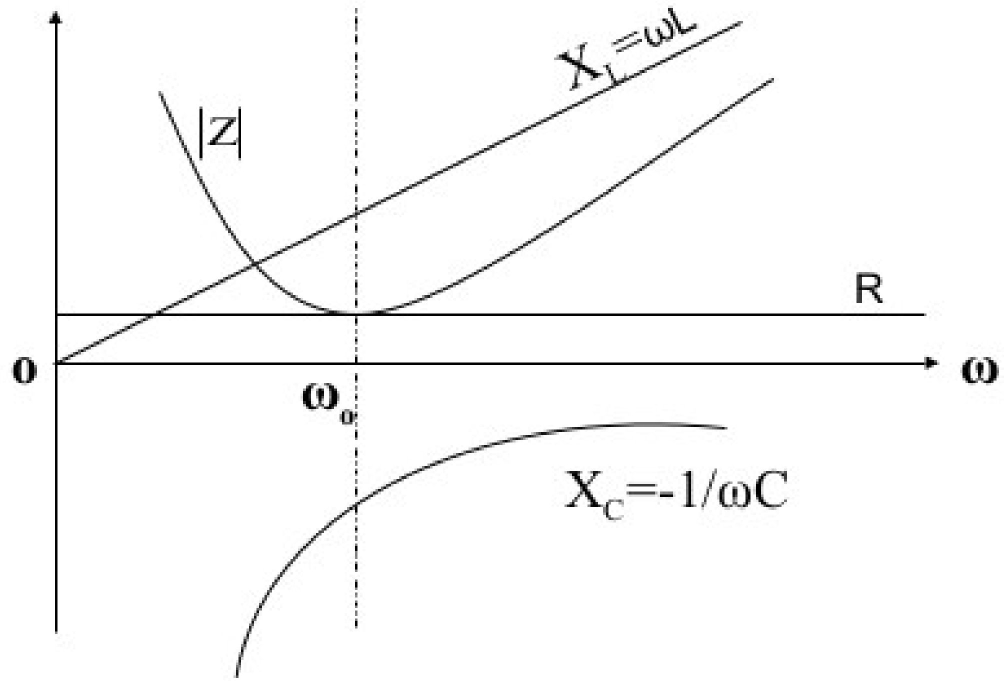
From this expression it is seen that

$$\text{Resultant reactance} = 2\pi fL - \frac{1}{2\pi fC}$$

= inductive reactance – capacitive reactance

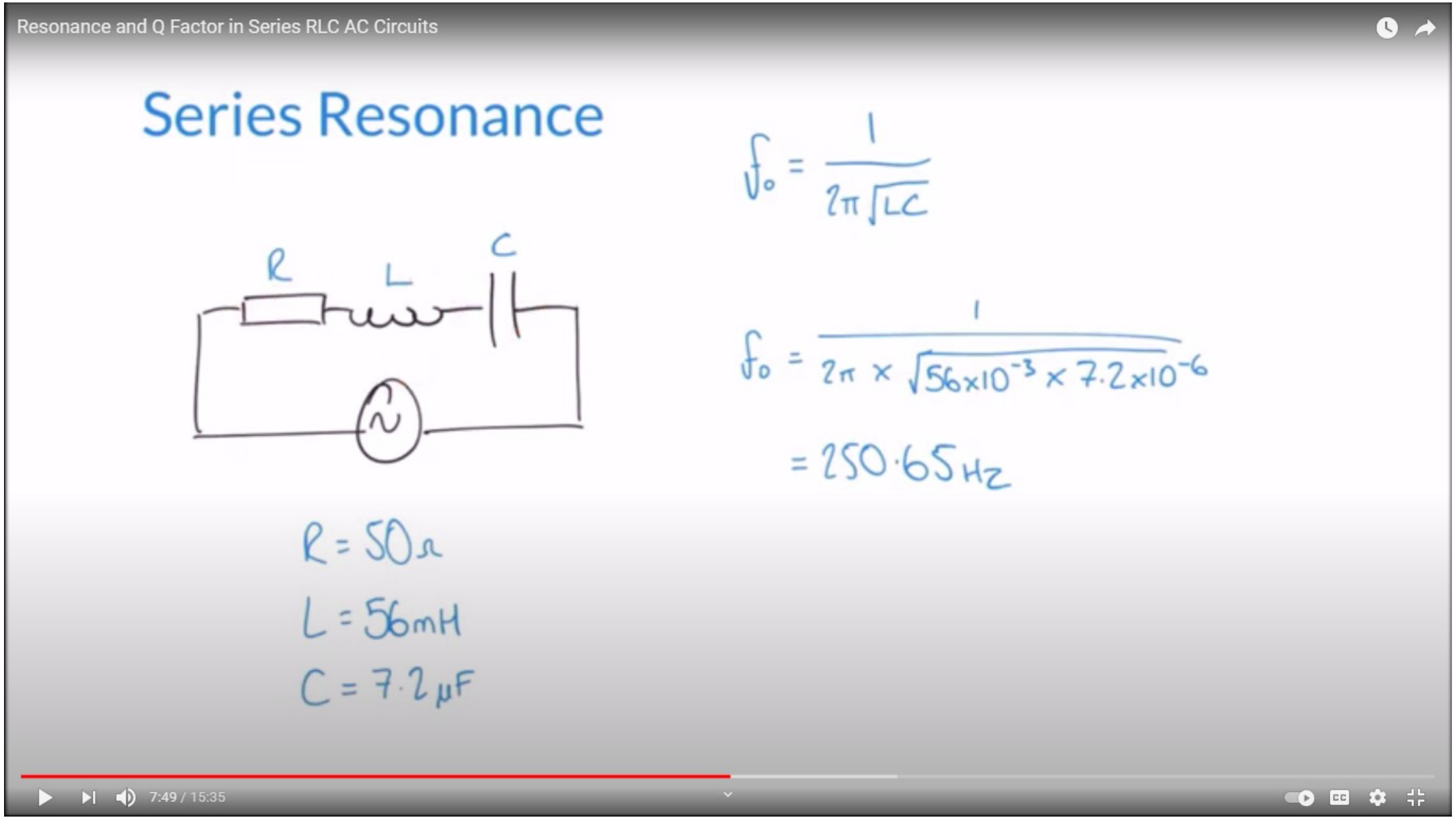
Series Resonance

Variation of reactance with frequency

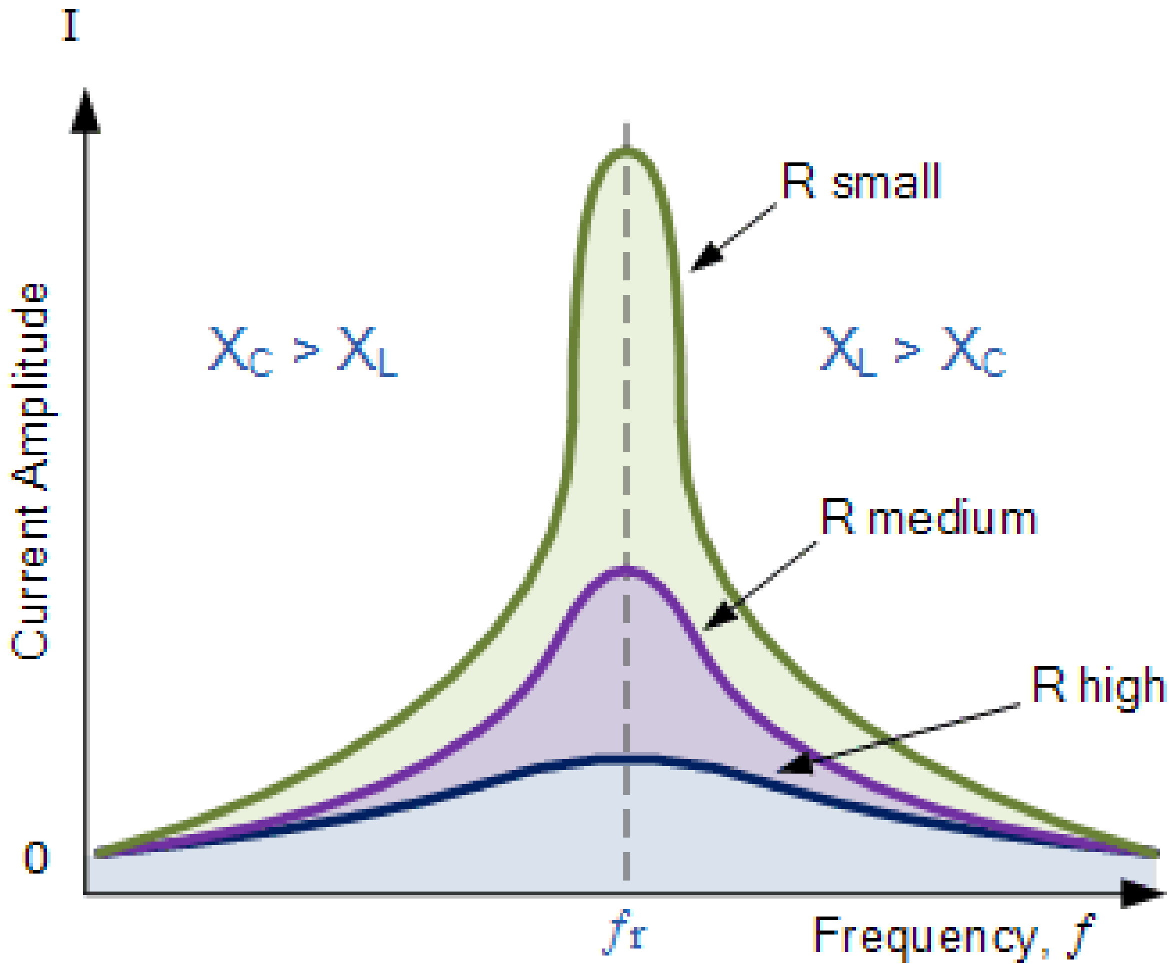


ω_0 is the **resonance frequency**.

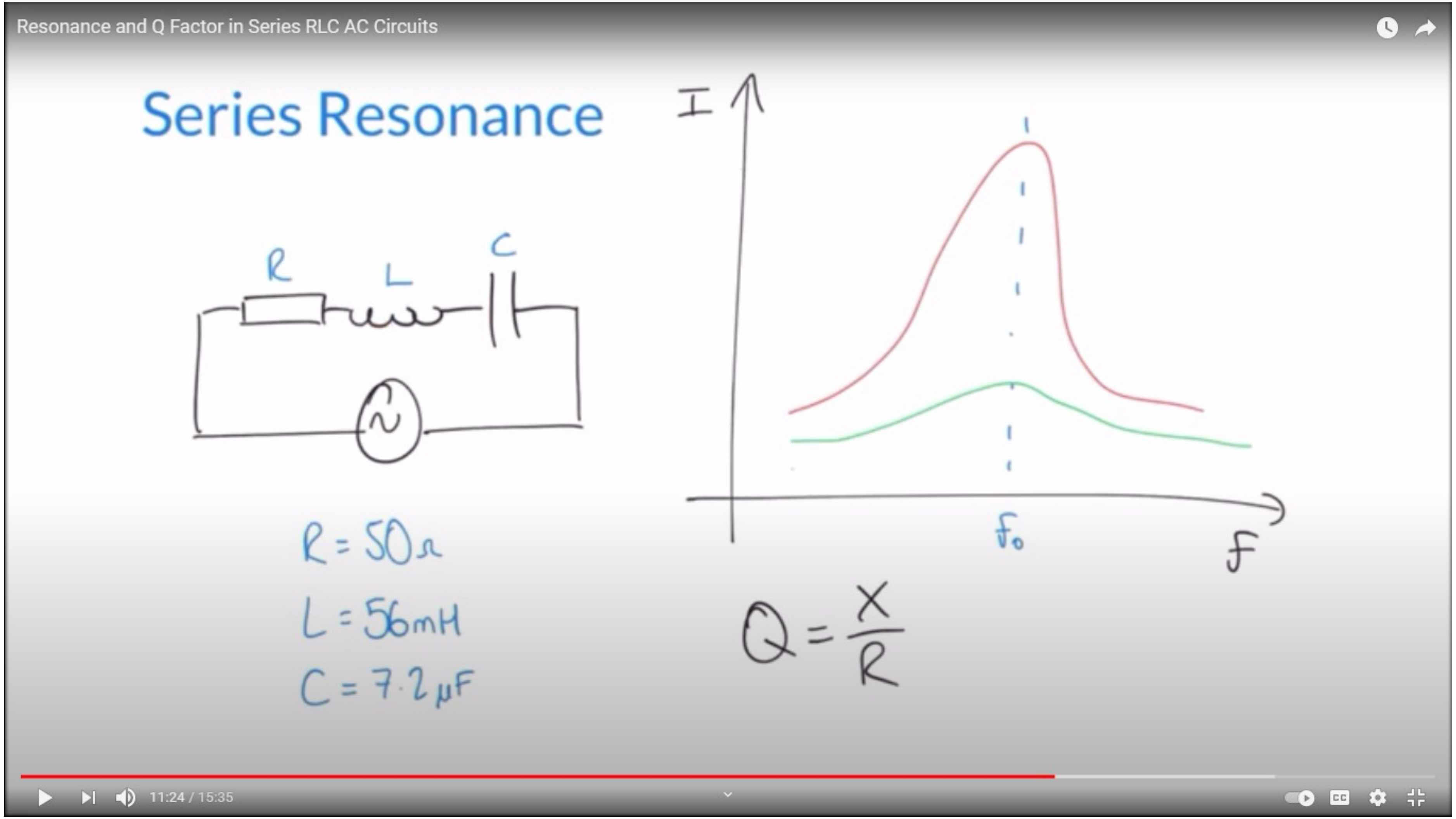
Calculation of resonant frequency



Resonance Curves

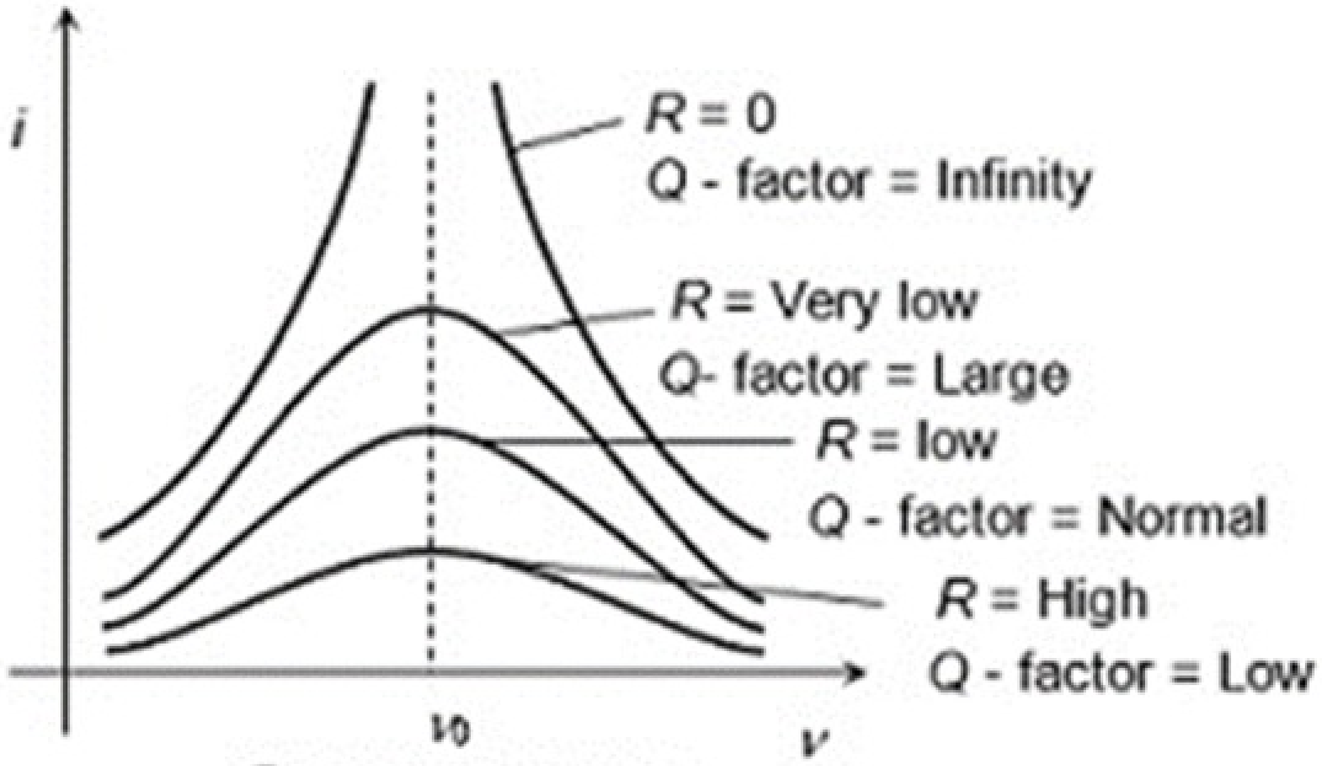


Q Factor



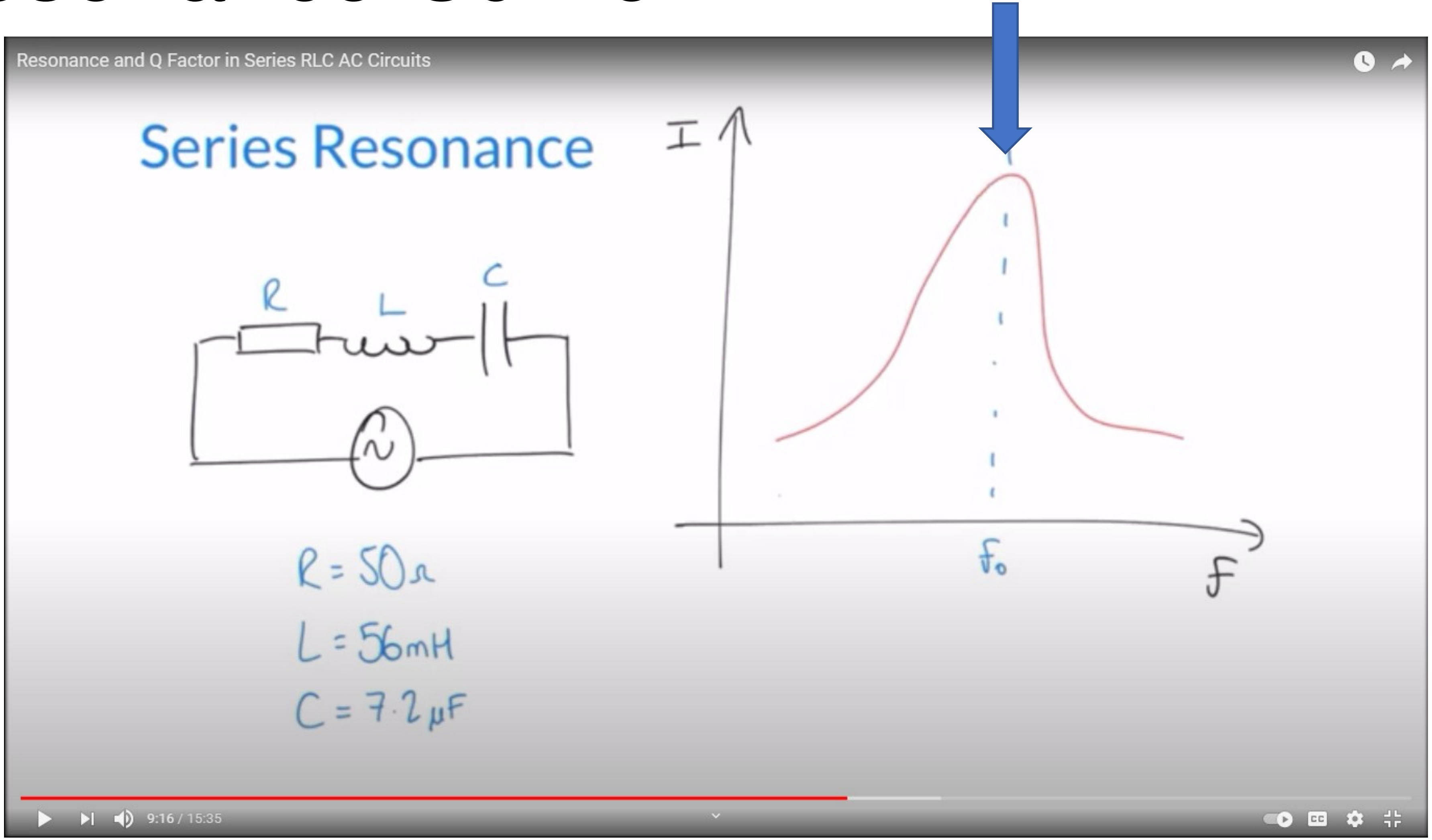
Resonance and Q Factor in Series RLC AC Circuits
Series Resonance
R
L
C
R = 50Ω
L = 56mH
C = 7.2μF
I
f₀
f
Q = X/R
11:24 / 15:35

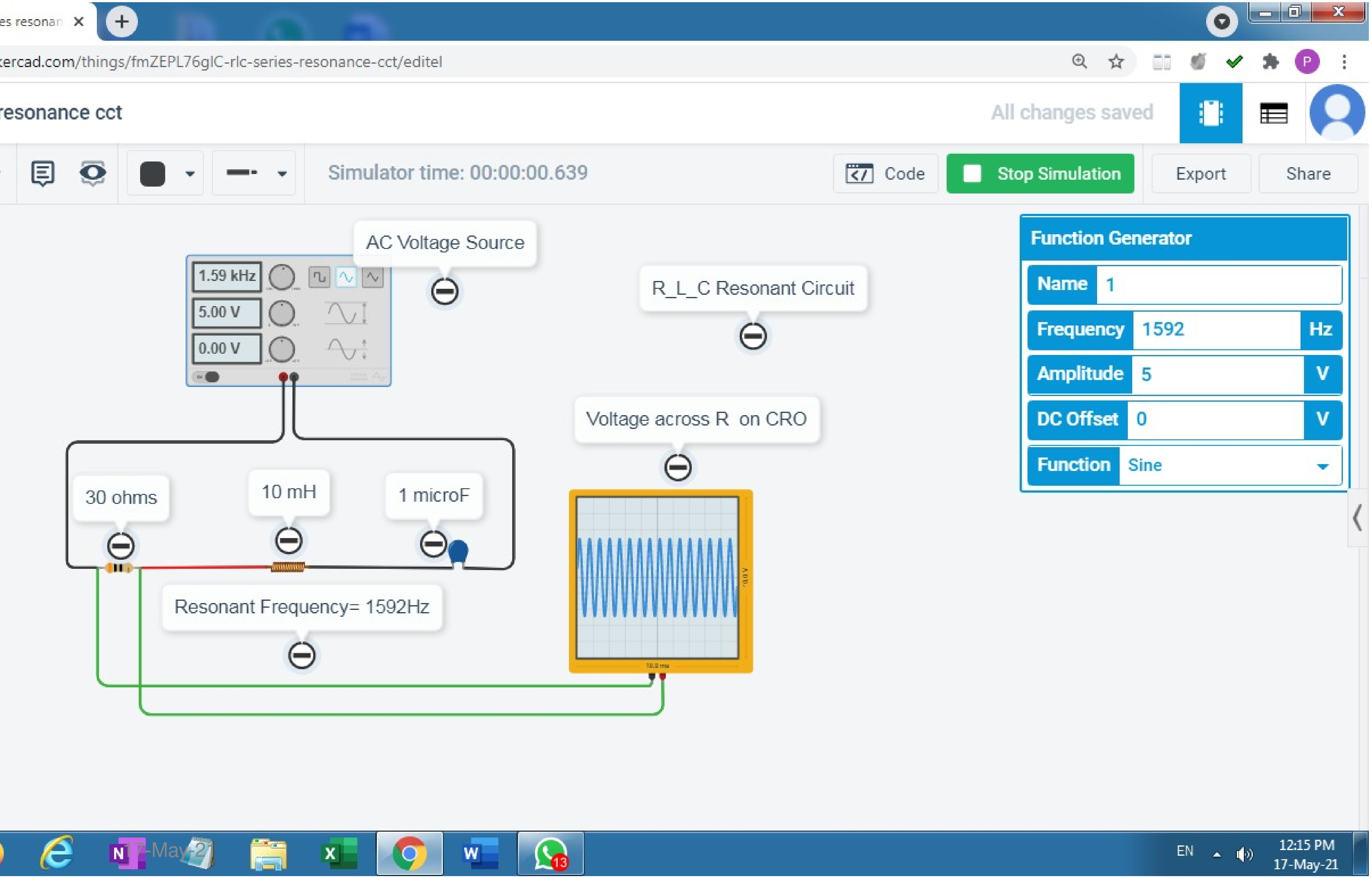
Q Factor



Resonance curve

Resonance Curve




ercad.com/things/fmZEPL76glC-rlc-series-resonance-cct/editel
resonance cct
All changes saved
Simulator time: 00:00:00.639
Code
Stop Simulation
Export
Share
AC Voltage Source
1.59 kHz
5.00 V
0.00 V
R_L_C Resonant Circuit
Voltage across R on CRO
30 ohms
10 mH
1 microF
Resonant Frequency= 1592Hz
Function Generator
Name 1
Frequency 1592 Hz
Amplitude 5 V
DC Offset 0 V
Function Sine
EN
12:15 PM
17-May-21

Observation Table

Sr. No	Frequency (Hz)	AC Voltage across R (V)
1	800	1
2	900	1.2
3	1000	1.5
4	1100	1.8
5	1300	3.0
6	1400	3.8
7	1500	4.75
8	**1600**	**5**
9	1700	4.5
10	2000	2.8
11	2200	2
12	2500	1.5
13	2800	1.2