SOLUTION OF EXPERIMENT 2

May 26, 2020

Task 1:

Here, in fig 1 proposed RLC circuit is given first of all to derive transfer function we have to draw its free voltage distribution circuit as shown in fig. 2

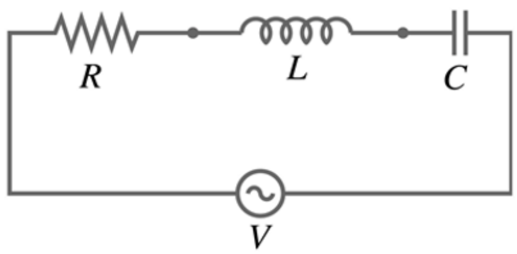

Fig. 1

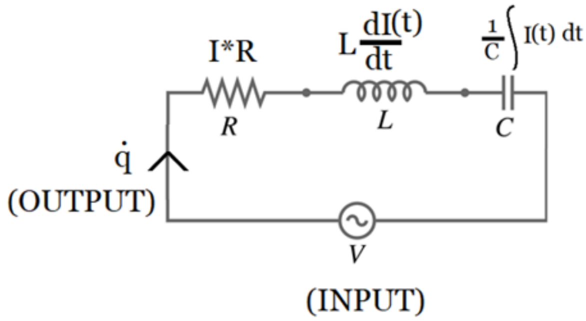

Fig. 2

The distributed voltages are also shown in fig.2 where external voltage V is getting applied. And current I is flowing through all as they are in series. Because of that current voltage drop across the register is I*R, voltage drop across the inductor is L*dI/dt and same way voltage drop across the capacitor is as shown in fig. 2. So our equation will be

$$v(t) = I * R + L\frac{dI(t)}{dt} + \frac{1}{C}\int I(t)dt$$

as our output is instantaneous charge not current so putting I = dq/dt we get,

$$v(t) = \dot{q} * R + L * \ddot{q} + \frac{q}{c}$$

Task 2:

To derived the transfer function we have to convert equation 1 in to the Laplace domain for that that the Laplace conversion table is given as below

$$L\{Y(t)\} = Y(s)$$

$$L\{y'\} = sY(s) - Y(0)$$

$$L\{y''\} = s^2Y(s) - sy(0) - y(0)$$

and so on..

In our case applying these quick conversions we will get the equation...

$$V(s) = s * R * Q(s) + L * s^2 * Q(s) + \frac{Q(s)}{C}$$

Re arranging these equation we can derive transfer function as below.

$$T.F = \frac{Output}{Input} = \frac{Q(s)}{V(s)} = \frac{1}{Ls^2 + sR + 1/c}$$