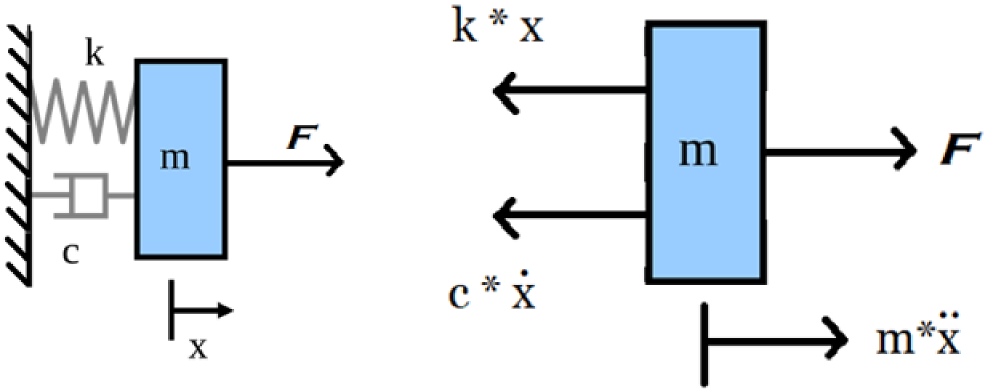
Solution of experiment 1

May 26, 2020

Task 1:

here, in fig 1 proposed spring mass damper system is given first of all to derive transfer function we will draw its free body diagram as shown in the figure



The applied forces are also shown in the figure where external force F is getting applied in positive x axis direction and force due to spring is acting on the body in negative x direction with the amplitude of x*k and same way damper is also applying force with the value of c*dx/dt. And because of that our body is having acceleration of d2x /dt2 so our differential equation will be.

$$F - k * x - c * \dot{x} = m * \ddot{x} \tag{1}$$

Task 2:

To derive the transfer function we have to convert equation 1 into Laplace domain, for 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...

$$F(s) - k * X(s) - c * s * X(s) = m * s^2 * X(s)$$

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

$$T.F = \frac{Input}{Output} = \frac{X(s)}{F(s)} = \frac{1}{k + c * s + m * s^2}$$