Assignment 3

April 5, 2023

1   Question 1A

Force $f(t)$ acting on the mass is the input and its acceleration $a(t)$ is the output.

$$a(t) = \frac{f(t)}{m}$$

Taking the laplace transform of the equation above

$$A(S) = \frac{F(S)}{m}$$

$$A(S) = \frac{1}{m}F(S)$$

$$H(S) = \frac{A(S)}{F(S)} = \frac{1}{m}$$

Inverse laplace transform and impulse response of the equation above

$$h(t) = \frac{1}{m}\delta(t)$$

The system is a zero order and static system.

2   Question 1B

Force $f(t)$ acting on the mass is the input and its velocity $v(t)$ is the output.

$$v(t) = \int_0^t \frac{f(t)}{m}dt$$

$$v(t) = \frac{1}{m}\int_0^t f(t)dt$$

Converting to laplace domain

$$V(S) = \frac{1}{m}F(S)$$

$$H(S) = \frac{V(S)}{F(S)} = \frac{1}{ms}$$

Inverse laplace transform and impulse response of the equation above

$$h(t) = \frac{1}{ms}u(t)$$

The system is a first order and dynamic system.

3 Question 1C

Force $f(t)$ acting on the mass is the input and its position $x(t)$ is the output.

$$x(t) = \frac{1}{m} \int \int F(S)$$

Converting it to laplace domain

$$X(S) = \frac{F(S)}{ms^2}$$

Inverse laplace transform and impulse response of the equation above

$$h(t) = \frac{t}{m}$$

The system is a second order and dynamic system.