EE447 - Fall 2024
In-Class Exercise 01

October 1, 2024

1 Laplace Transform

1.1

$$\mathcal{L}\{0.01e^{-32t}\} =$$

1.2

$$\mathcal{L}\{16\ddot{x} + 47\dot{x} + 128x + 10\} =$$

1.3

$$\mathcal{L}\{J\ddot{x} + (B_1 + 2B_2)\dot{x} + K_3x\} =$$

2 Inverse Laplace Transform

2.1

$$\mathcal{L}^{-1}\{\frac{1}{(s+2)}\} =$$

2.2

$$\mathcal{L}^{-1}\{\frac{1200}{s+2-10j} + \frac{1200}{s+2+10j}\} =$$

(Reduce this answer to have 0 imaginary component)

3 Partial Fraction Expansion

Expand

$$G(s) = \frac{10^5(s+50)}{(s+0.1)(s+500)(s+10^6)}$$

4 Transfer Function

Find the transfer function $G(s) = C(s)/R(s)$ corresponding to the differential equation

$$\frac{d^3c}{dt^3} + 3\frac{d^2c}{dt^2} + 7\frac{dc}{dt} + 5c = \frac{d^2r}{dt^2} + 4\frac{dr}{dt} + 3r$$

5 Block Diagram

Consider the lateral dynamics of a vectored thrust aircraft as described in the block diagram below. Use this to compute the transfer functions from u_1 to x.

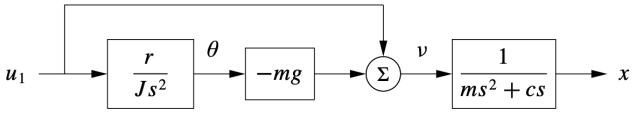

Figure 1: Vectored Thrust Aircraft

6 Equations of Motion

6.1

Find the equations of motion (EOMs) for the system in Figure 2.

6.2

Find the transfer function $\frac{X_1(s)}{F(s)}$ for the system in Figure 2.

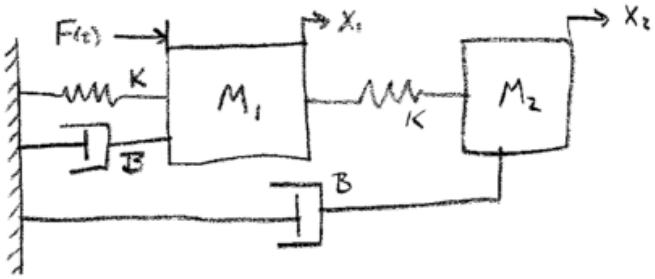

Figure 2: B and K have the same values