

MECH 3140: Homework #6

To be worked by Monday, 10/2/2023

Block Diagrams

Chapter 5, Problems 2, 3

Transfer Functions

Chapter 2, Problems 45, 46, 47

1) Given the following differential equation:

$$\begin{aligned}\dot{x} + 2x &= y \\ \dot{y} + 3y &= x + u\end{aligned}$$

- Find the two transfer functions $\frac{X[s]}{U[s]}$ and $\frac{Y[s]}{U[s]}$
- What is the characteristic equation for the system?
- What are the eigenvalues?
- Place the equations into state space and verify you get the same characteristic equation from the state transition matrix (A).

To be worked by Wednesday, 10/4/2023

2nd Order Mechanical Modeling

Chapter 4, Problems: 13,18, 22, 23, 65 (Find the EOM(s) for each system. Disregard comments about natural frequency or energy methods)

2nd Order Electrical Modeling

Chapter 6, Problems: 14, 25 (disregard instructions about impedance), 36, 37

Supplemental Problems:

First Order Review: Make sure you have reworked the exam problems from Exam #1. Be able to find the eigenvalues and time constants for all the problems. You should also rework using transfer functions and block diagram where appropriate.

Chapter 4, Problems 14,16, 30 (disregard instructions about energy methods), 37 (disregard instructions about Rayleigh's method, just find EOM), 53, 54

Chapter 6, Problem 15 (disregard instructions about impedance)