Homework 6

CSE Spring 2023

Due: 29 Mar 2023

Note: if you do this homework using ChatGPT you will shoot yourself in the foot. I tried and not only did I get a wrong answer (your mileage may vary), questions like this might appear at the exam. If you don't go through the process of trying to convert ODEs to state-space form here, then you will have a hard time doing so at the exam.

1. *(5 points)* Rewrite the following two sets of ODEs in state-space form. This is, determine the matrixes A, B, C and D.

   (a)
   $$\dddot{y} + 7\ddot{y} - 5y = 2$$
   The only output of interest is y.

   (b)
   $$2\,\dddot{y}_1 - 4\ddot{y}_1 + y_2 + 2\dot{y}_1 = -10$$
   $$\ddot{y}_2 + \dot{y}_1 + 5\ddot{y}_1 + y_1 = -2$$
   The only output of interest is y_1.

2. *(5 points)* Convert the following differential equations into state-space form (find A, B, C and D). Assume that the measure signals (outputs of interest) are $[x_1, \dot{x}_2, u_1(t)]$.
   $$2\,\dddot{x}_1 - 4x_1 + 2x_2 - \dot{x}_2 = 5u_1(t)$$
   $$2\ddot{x}_2 - 2x_2 - \dot{x}_2 + \ddot{x}_1 + 5x_1 = u_1(t) - u_2(t)$$