Alex Gibbs – HW1 – MAE 144

1: https://github.com/axgib/Classes/tree/main/MAE144

2a: Completed (hw1.m)

2b:

Importance of proper functions: It is important to have a proper function because an improper function allows the noise in the system to blow up. With a high frequency input(noise) the magnitude will grow bigger. We see this when analyzing the Bode plot, the system's response needs to roll off with high frequencies, making it proper.

The controller is initially improper because the order of the polynomial in the numerator(order of y = m) is greater than the order of the polynomial in the denominator(order of x = n)

To make m <= n such that D becomes a proper controller, we must add k = 5 number of poles to T.

G(s) = b(s)/a(s)

Find D(s) = y(s)/x(s)

f(s) = 0 at (-1, -1, -3, -3, -6, -6, -20, -20, -20, -20, -20)

We can find x and y using the Diophantine equation(ax + by = fs) which leverages the bezout identity.

Diophantine takes input a, b, and fs and will solve for x and y.

By adding 5 poles to T we increase the order of fs to n = 11(previously n = 6). Adding only 4 poles to T brings the order of fs n=10.

Diophantine eq will retrieve the "best" y which is the smallest option – When the order of f(s) increases, y(s) will also increase because the Euclidean method is finding the greatest common factor of a and b and then Diophantine is finding the smallest y that solves its equation.

3: AJG_C2D_matched.m and AJG_C2D_matched_test.m

My code is better because it can handle symbolic values throughout the function. This will be especially useful when we start varying frequency and step size. My code allows for specific frequencies of interest where we would like to analyze how the system responds at this frequency.