Assignment 1

**Q2.** Compare the numerical values returned by casadi\_c2d with the results of the analytically discretized model - are they the same?

The numerical values returned from casadi\_c2d correspond to the matrices:

and

The numerical values from analytically derived model in exercise 13 c gives the following matrices:

and

The A matrices is the same for both cases, but the B matrices are different. This is due to the transition from continuous to discrete. The B matrix doesn’t affect the A matrix during the transition, although the B matrices affect itself. See the equations below:

and

**Q3.** How many poles and zeros does the system have? Where are they located? How many poles and zeros do you expect for the discrete-time model, and where should they be located? Was your intuition right?

The continuous system has two poles at origin, i.e. 0 and no zeros. Our intuition was poles at 0 since matrix A’s characteristic polynomial will be lambda^2 = 0 and 0 is the only pole that will fulfill the requirement. See figure 1 below

En bild som visar text, diagram, linje, Parallell

Automatiskt genererad beskrivning

Figure 1 - Poles for continuous system

Regarding the discrete system we expected 2 poles at 1. Which is fulfilled. See the figure 2 below.

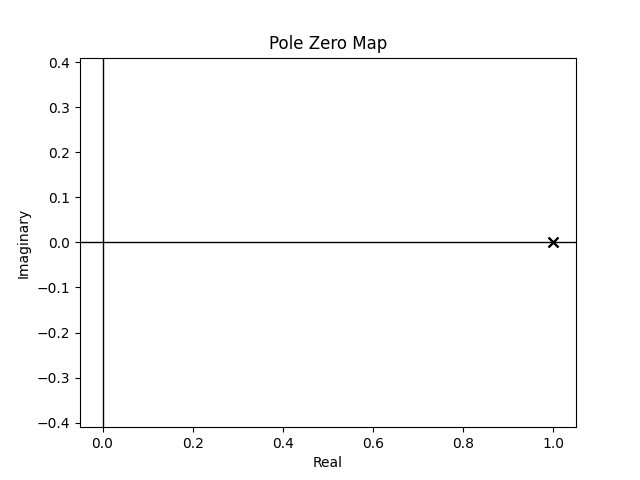


Figure 2 - poles for discrete system

**Q4.** If the control gain for the state feedback controller is designed with the two desired poles at and the requirements , and , see figure 3.

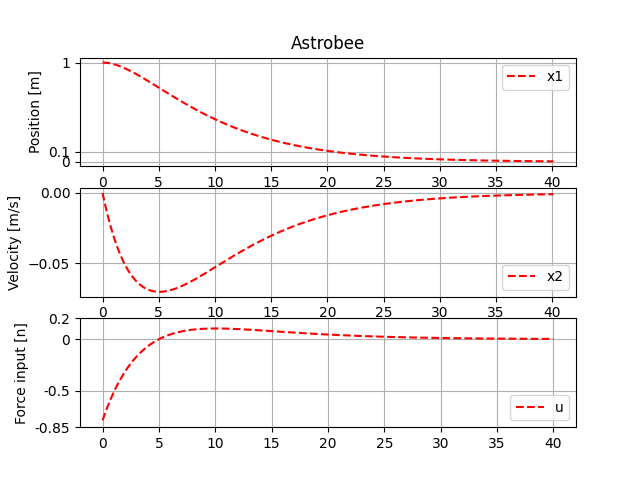


Figure 3: Control of the astrobee - Linear control without disturbance and feedback