2021-10-17

Some hints for EE6225 CA

First, let's define the Lapace variable s

```
s = tf([1 0],1);
```

Next consider a 1x2 continuous time system

```
Gs = [exp(-s)*1/(10*s+1) exp(-2*s)*1/(20*s+1)]
```

```
Gs =

  From input 1 to output:
                1
  exp(-1*s) * --------
              10 s + 1

  From input 2 to output:
                1
  exp(-2*s) * --------
              20 s + 1

Continuous-time transfer function.
```

If you descretize the Gs with sampling time Ts, you will get

```
Ts =1;  Gz = c2d(Gs,Ts)
```

```
Gz =

  From input 1 to output:
            0.09516
  z^(-1) * -----------
           z - 0.9048

  From input 2 to output:
            0.04877
  z^(-2) * -----------
           z - 0.9512

Sample time: 1 seconds
Discrete-time transfer function.
```

To get a state space model convenient for MPC design, use the absorbDelay command

```
Gz = absorbDelay(Gz)
```

```
Gz =

  From input 1 to output:
     0.09516
  ---------------
  z^2 - 0.9048 z

  From input 2 to output:
      0.04877
```

```
  ----------------
  z^3 - 0.9512 z^2

Sample time: 1 seconds
Discrete-time transfer function.
```

```
Gz = ss(Gz)
```

```
Gz =

  A =
         x1      x2      x3      x4      x5
   x1  0.9048       0       0       0       0
   x2       1       0       0       0       0
   x3       0       0  0.9512       0       0
   x4       0       0       1       0       0
   x5       0       0       0       1       0

  B =
        u1    u2
   x1  0.25     0
   x2     0     0
   x3     0  0.25
   x4     0     0
   x5     0     0

  C =
         x1      x2      x3      x4      x5
   y1       0  0.3807       0       0  0.1951

  D =
       u1  u2
```