

Assignment - I

CHRISTOPHER OHARA (31459079)

cao36@njit.edu

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DC Servomotor - DCS1

NB: Input is a step-function with an ending value of one.

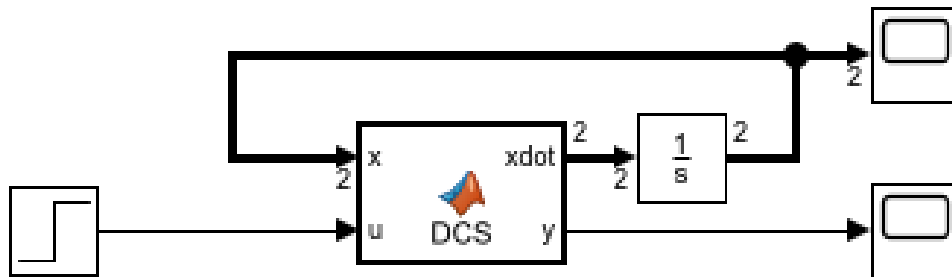


Figure 1: DCS Simulink Model

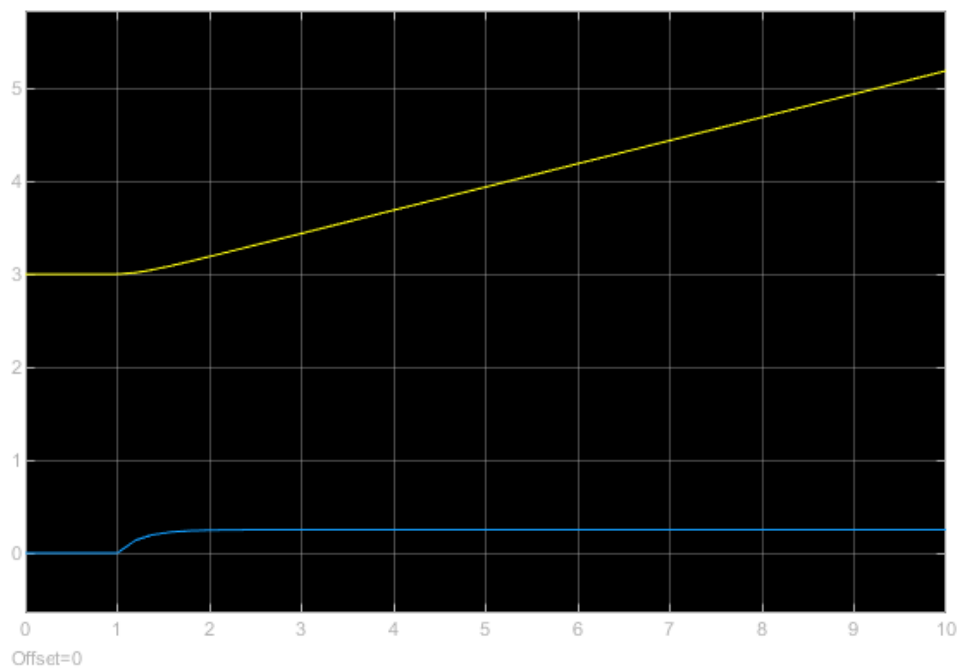
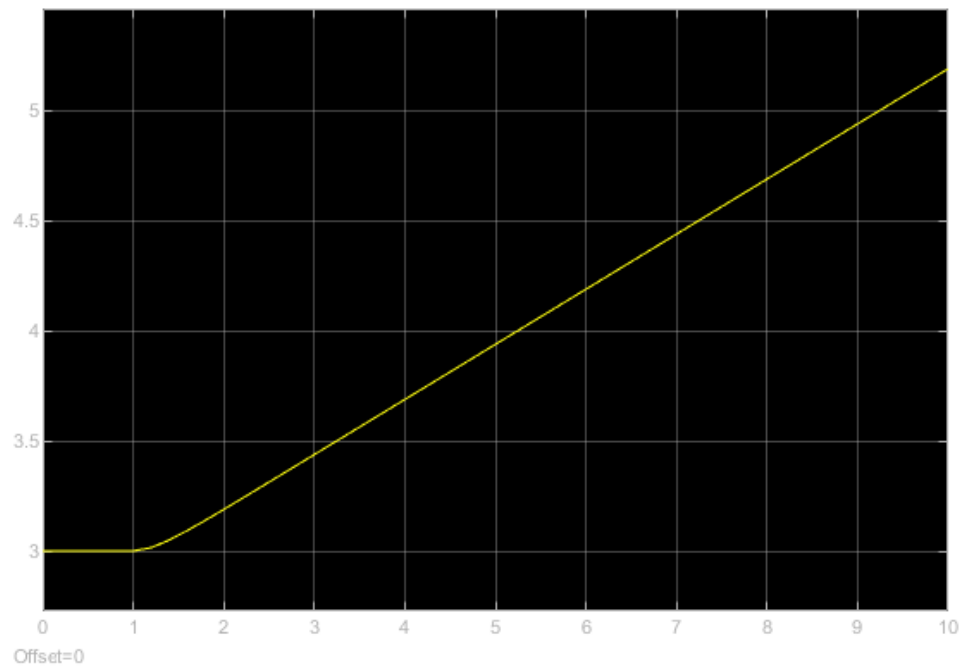


Figure 2: DCS Scope - Output of xdot

Figure 3: DCS Scope - Output of y

Listing 1: DCS

```
1 function [xdot, y] = DCS(x, u)
2 a = 4;
3 b = 1;
4 xdot1 = x(2);
5 xdot2 = -a*x(2)+u;
6 xdot = [xdot1; xdot2];
7 y = x(1);
```

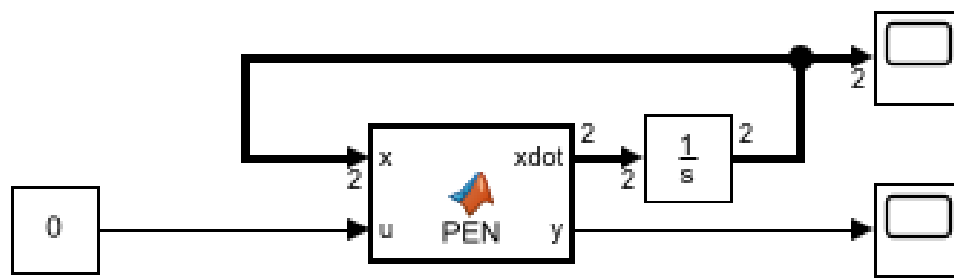
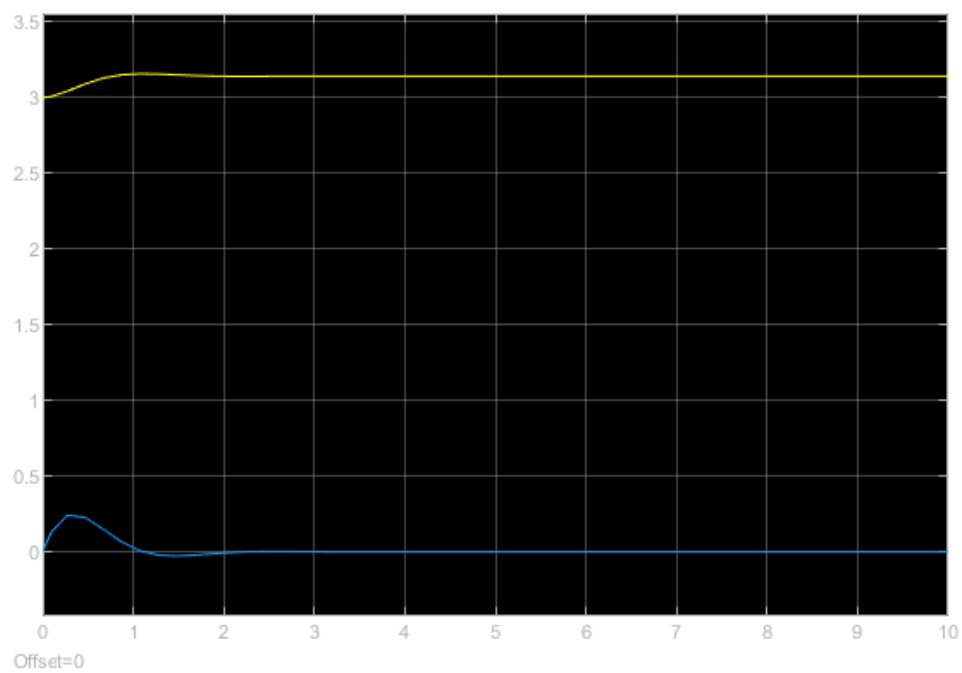
Motor-Driven Pendulum - PEN1

Figure 4: PEN Simulink Model

Figure 5: PEN Scope - Output of \dot{x}

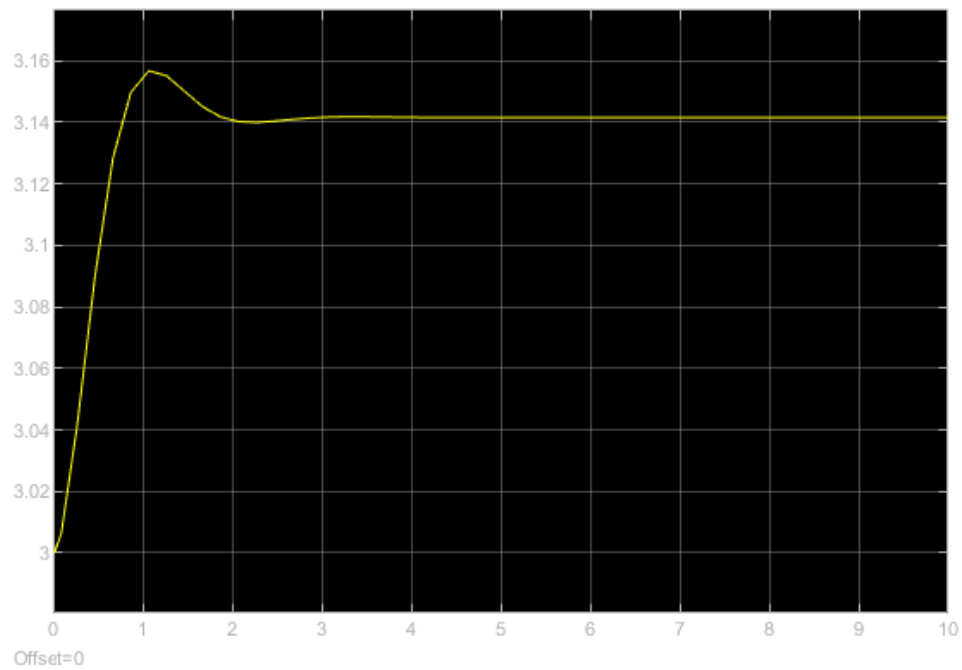


Figure 6: PEN Scope - Output of y

Listing 2: PEN

```
1 function [xdot, y] = PEN(x, u)
2 a = 4;
3 b = 1;
4 gol = 12;
5 xdot1 = x(2);
6 xdot2 = gol*sin(x(1))-a*x(2)+b*u;
7 xdot = [xdot1; xdot2];
8 y = x(1);
```

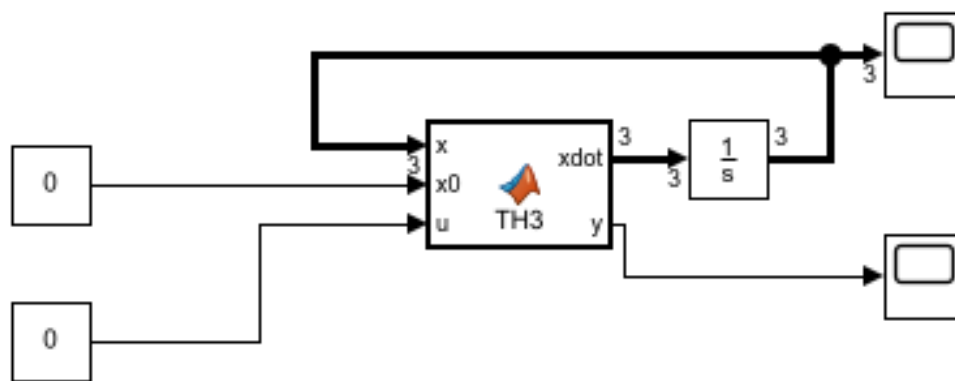
Third-Order Heat Conduction - TH31

Figure 7: PEN Simulink Model

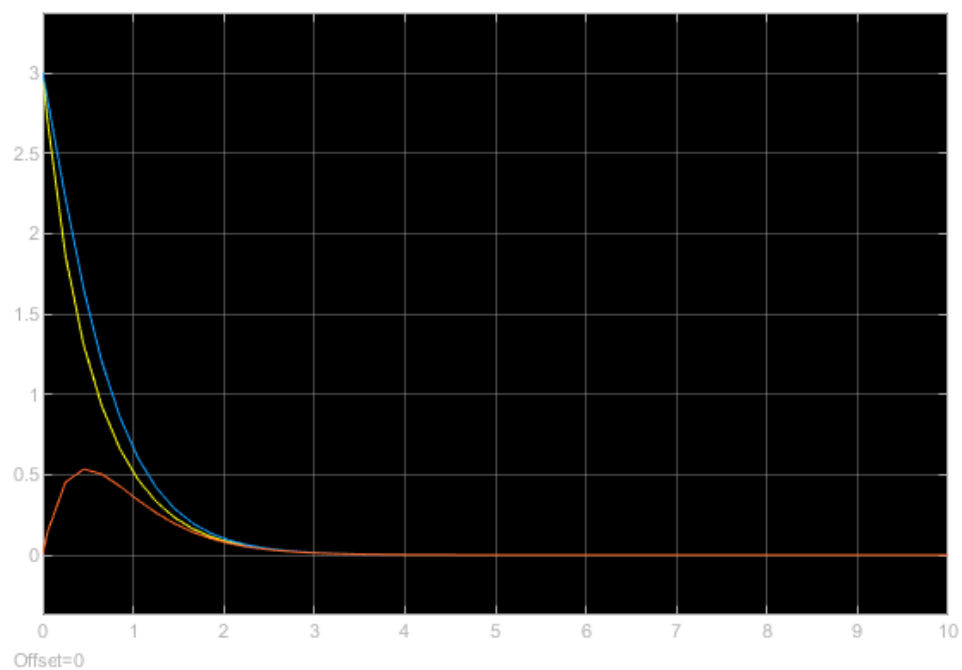


Figure 8: PEN Scope - Output of xdot

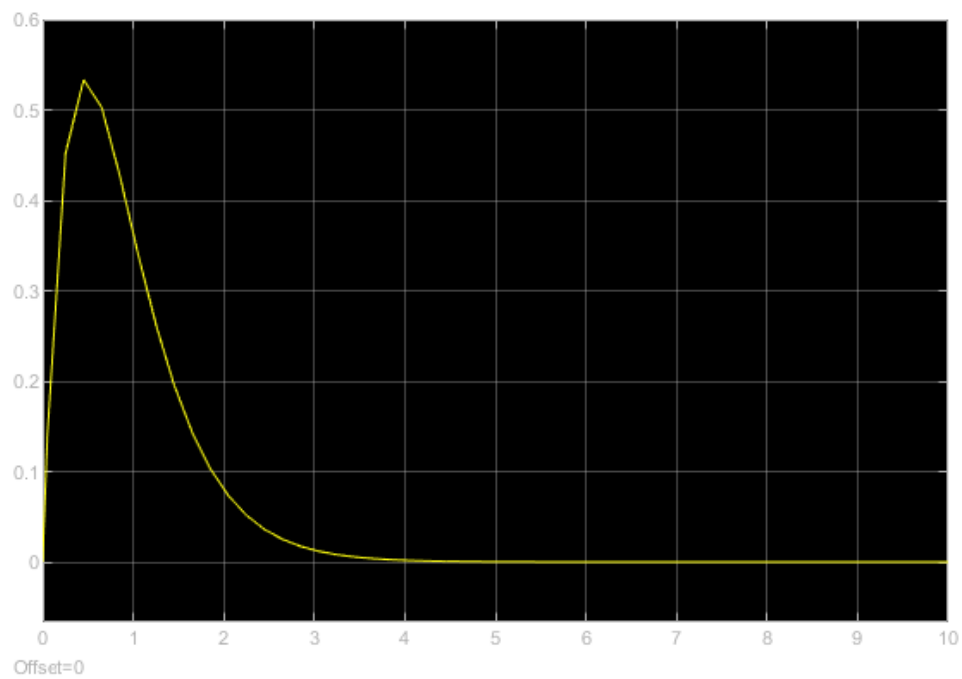


Figure 9: PEN Scope - Output of y

Listing 3: TH3

```
1 function [xdot, y] = TH3(x, x0, u)
2 xdot1 = -3*x(1) + x(2) + u;
3 xdot2 = x(1) - 2*x(2) - x(3);
4 xdot3 = x(2) - 3*x(3) + x0;
5 xdot = [xdot1 ; xdot2 ; xdot3];
6 y = x(3);
```

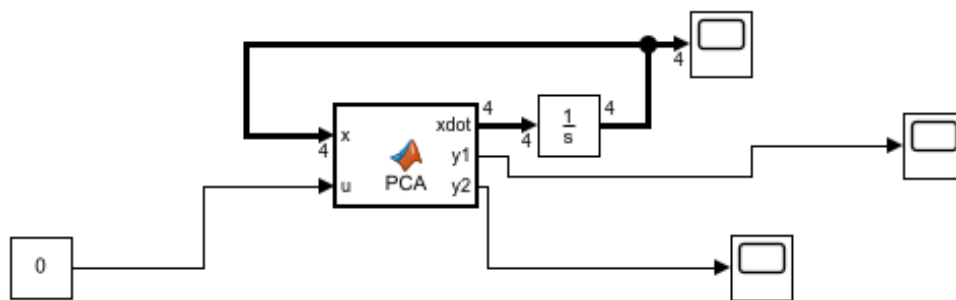
Pendulum on Cart - PCA1

Figure 10: PCA Simulink Model

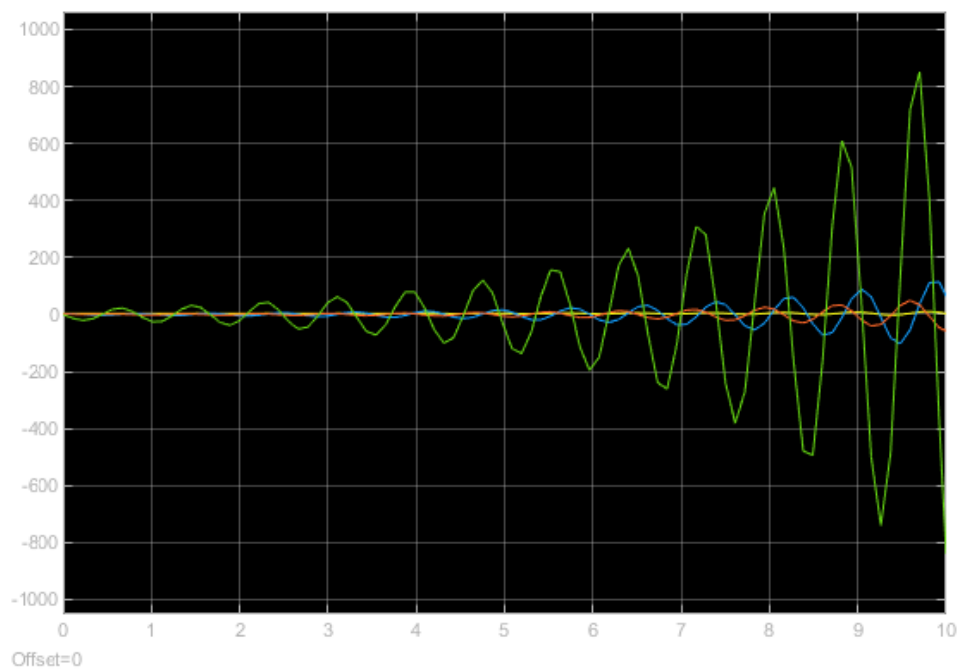


Figure 11: PCA Scope - Output of xdot

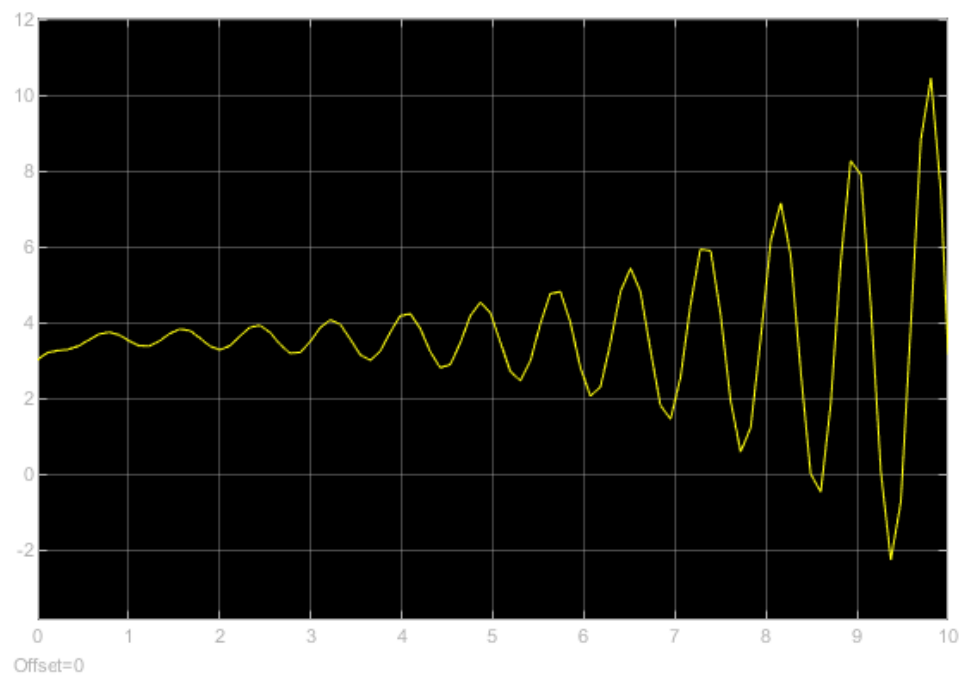


Figure 12: PCA Scope - Output of y1

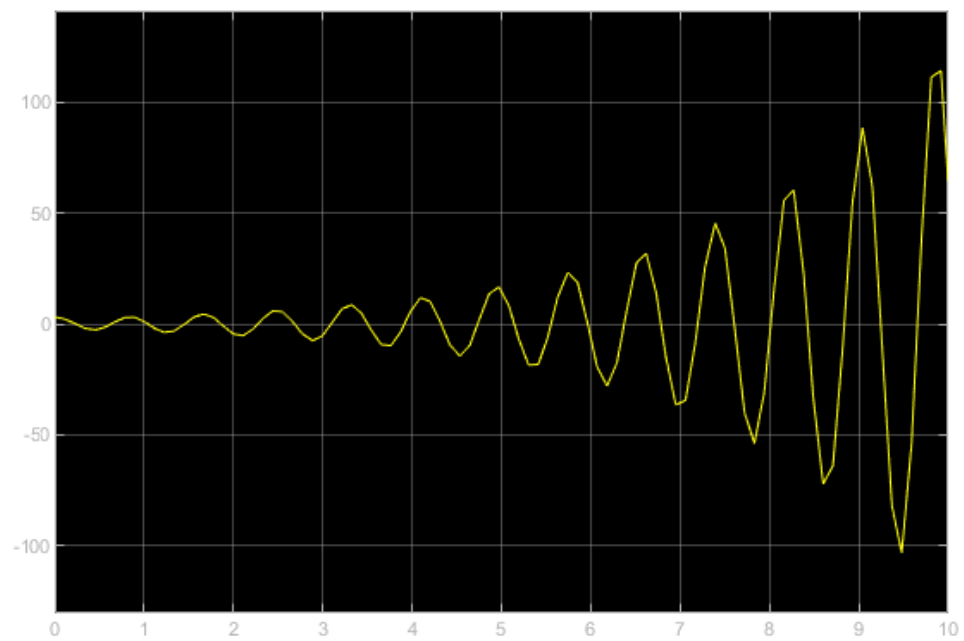


Figure 13: PCA Scope - Output of y2

Listing 4: PCA

```
1 function [xdot, y1, y2] = PCA(x, u)
2 a = 4;
3 b = 1;
4 M = 1;
5 m = 0.4;
6 g = 9.81;
7 L = 0.25*M;
8 xdot1 = x(3);
9 xdot2 = x(4);
10 xdot3 = -a*x(3) - ((m*g)/M)*x(2) + b*u;
11 xdot4 = (a/L)*x(3) - (M+m)*(g/(M*L))*x(2) - (b/L)*u;
12 xdot = [xdot1; xdot2; xdot3; xdot4];
13 y1 = x(1);
14 y2 = x(2);
```

References

- [1] B. Friedland, Observer-Based Control System Design Lecture Notes for ECE660.
- [2] B. Friedland, Control System Design: An Introduction to State Space Methods, McGraw-Hill, 1985. ISBN:0070224412 (Reprinted by Dover Publications May 2005, ISBN: 0-486-44278-0.)