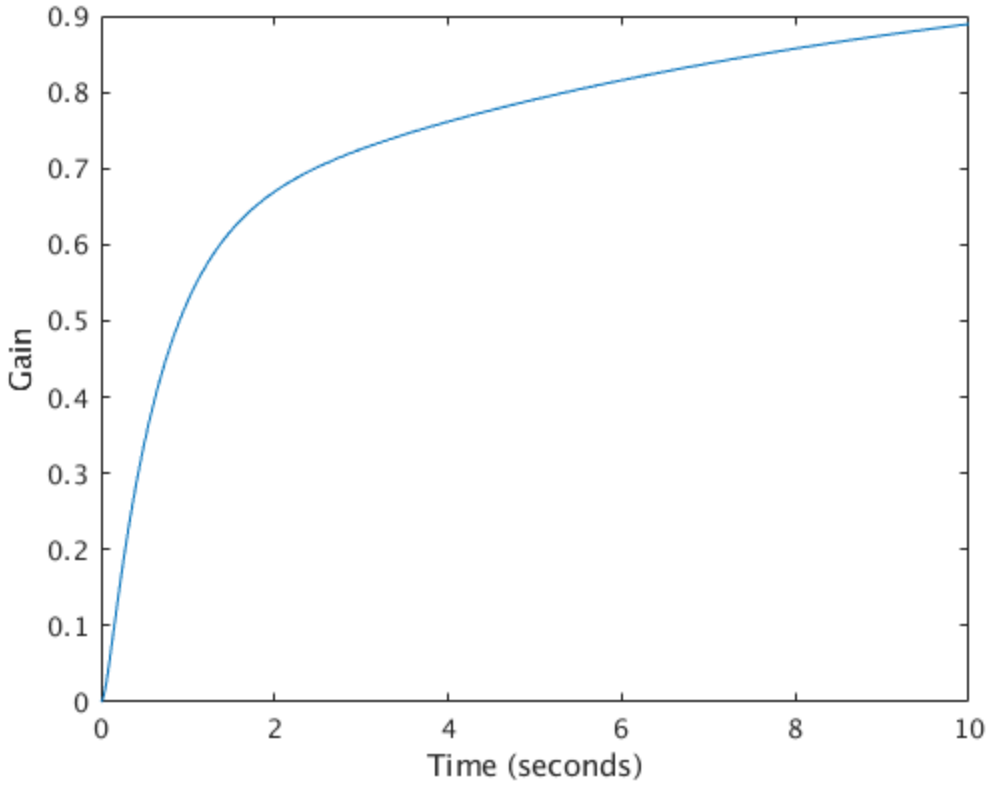
Table of Contents

Control Systems Homework 5 Problem 1

```
A1 = [-20, -2, 0, 0; 10, 0, -10, 0; 0, 5, -100, -5; 0, 0, 4, 0];
B1 = [2;0;0;0];
C1 = [0,1,0,0];
D1 = [0];
G1 = ss(A1,B1,C1,D1);
tf(G1)
zpk(G1)

t1 = 0:0.01:10;
y1 = step(G1,t1);
plot(t1, y1);
xlabel('Time (seconds)');
ylabel('Gain');
```

```
ans =

            20 s^2 + 2000 s + 400
  ---------------------------------------
  s^4 + 120 s^3 + 2090 s^2 + 3400 s + 400

Continuous-time transfer function.


ans =

           20 (s+99.8) (s+0.2004)
  -------------------------------------
  (s+99.3) (s+18.91) (s+1.67) (s+0.1276)

Continuous-time zero/pole/gain model.
```

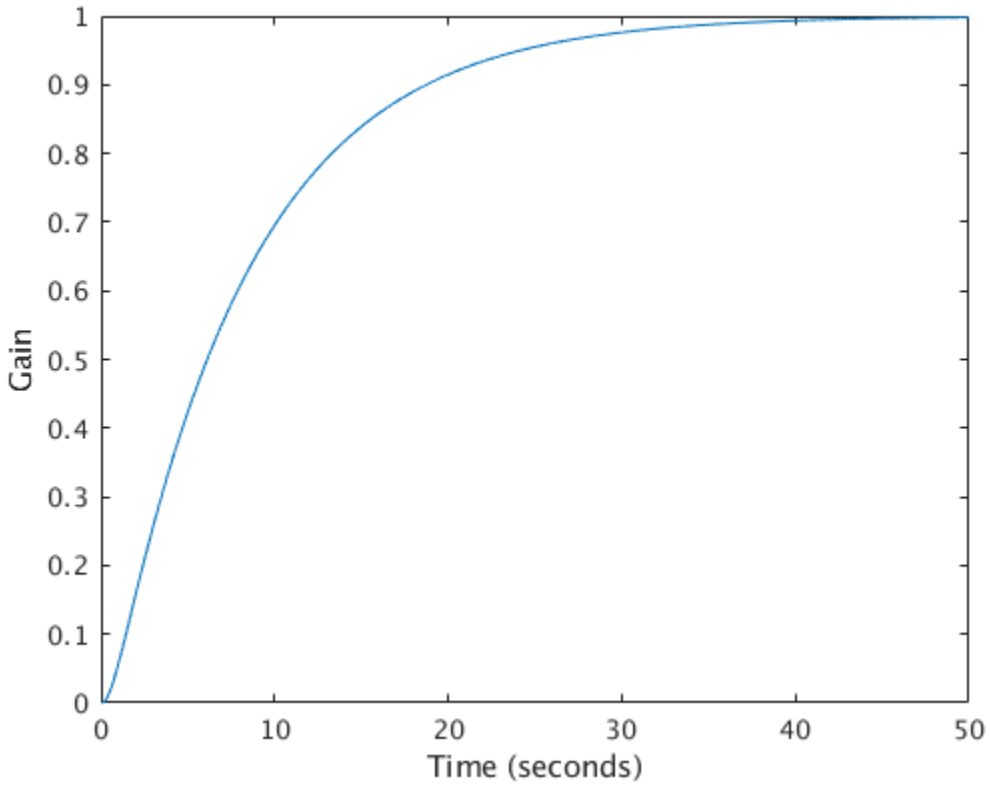


Control Systems Homework 5 Problem 2

```
A2 = [-20, -2, 0, 0; 10, 0, -10, 0; 0, 5, -100, -5; 0, 0, 4, 0];
B2 = [2;0;0;0];
C2 = [0,0,0,1];
D2 = [0];
G2 = ss(A2,B2,C2,D2);
tf(G2)
zpk(G2)

t2 = 0:0.01:50;
y2 = step(G2,t2);
figure;
plot(t2, abs(y2));
xlabel('Time (seconds)');
ylabel('Gain');
```

```
ans =

                    400
  -----------------------------------------
  s^4 + 120 s^3 + 2090 s^2 + 3400 s + 400

Continuous-time transfer function.
```

```
ans =

                  400
  ---------------------------------------
  (s+99.3) (s+18.91) (s+1.67) (s+0.1276)

Continuous-time zero/pole/gain model.
```

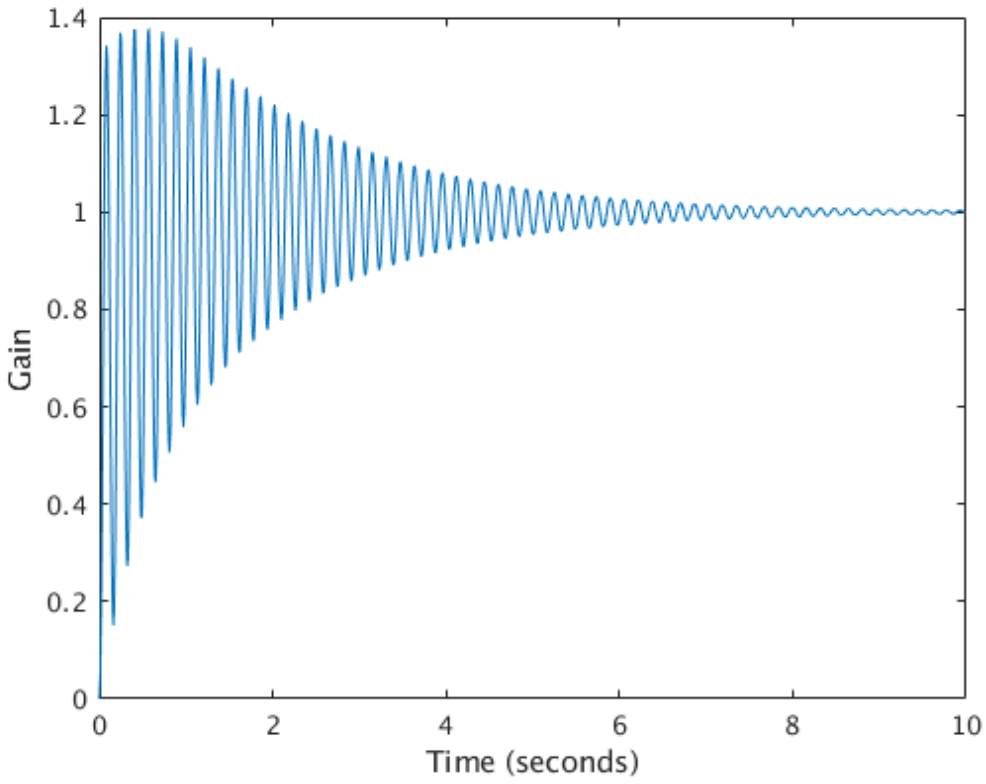


Control Systems Homework 5 Problem 3

```
A3 = [0, -10, 0, 0; 100, -0.2, -100, 0; 0, 5, 0, 5; 0, 0, -50,
 -83.33];
B3 = [10;0;0;0];
C3 = [0,1,0,0];
D3 = [0];
G3 = ss(A3,B3,C3,D3);
tf(G3)
zpk(G3)

t3 = 0:0.01:10;
y3 = step(G3,t3);
figure;
plot(t3, abs(y3));
xlabel('Time (seconds)');
```

```
ylabel('Gain');
```

```
ans =

            1000 s^2 + 83330 s + 2.5e05
  -----------------------------------------------
  s^4 + 83.53 s^3 + 1767 s^2 + 1.25e05 s + 2.5e05

Continuous-time transfer function.


ans =

          1000 (s+3.117) (s+80.21)
  ---------------------------------------
  (s+80.42) (s+2.053) (s^2 + 1.06s + 1514)

Continuous-time zero/pole/gain model.
```

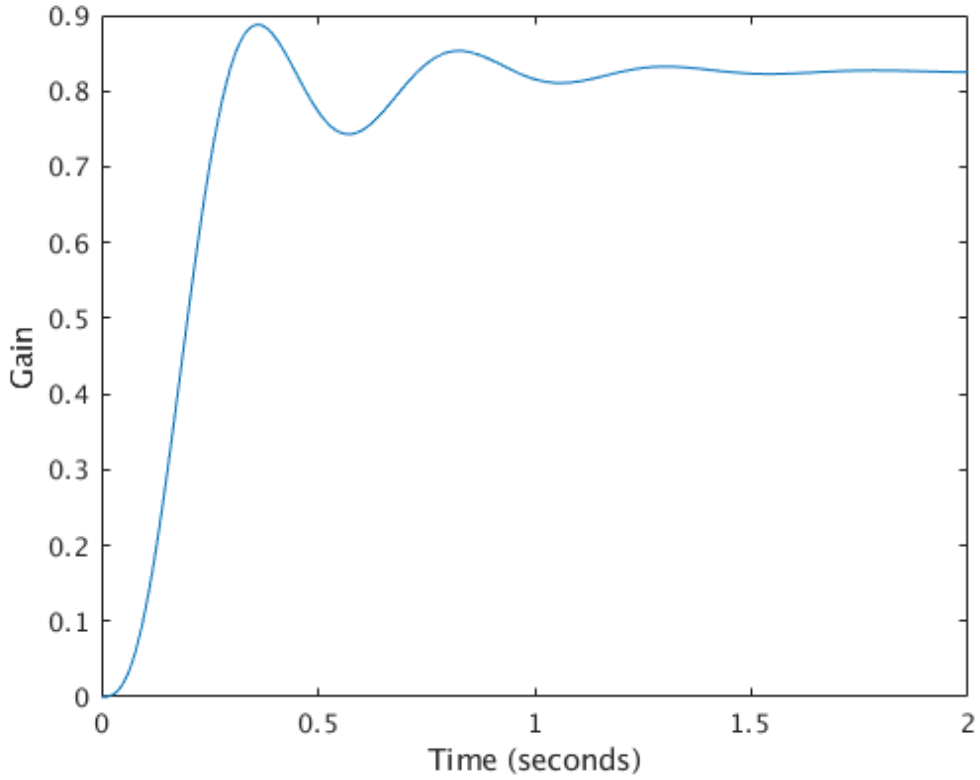


Control Systems Homework 5 Problem 4

```
C4 = 0.01; R41 = 10; R42 = 100;
A4 = [-1/(C4*R42), -1/(C4*R41), 0; 1/(C4*R41), -1/(C4*R42), -1/
(C4*R41); 0, 1/(C4*R41), -1/(C4*R42)-1/(C4*R41)];
```

```
B4 = [1/(C4*R41); 0; 0];
C4 = [0,0,1];
D4 = [0];
G4 = ss(A4,B4,C4,D4);
tf(G4)
zpk(G4)

t4 = 0:0.01:2;
y4 = step(G4,t4);
figure;
plot(t4, abs(y4));
xlabel('Time (seconds)');
ylabel('Gain');
```

```
ans =

             1000
  ---------------------------
  s^3 + 13 s^2 + 223 s + 1211

Continuous-time transfer function.


ans =

                1000
  --------------------------------
  (s+6.698) (s^2 + 6.302s + 180.8)

Continuous-time zero/pole/gain model.
```



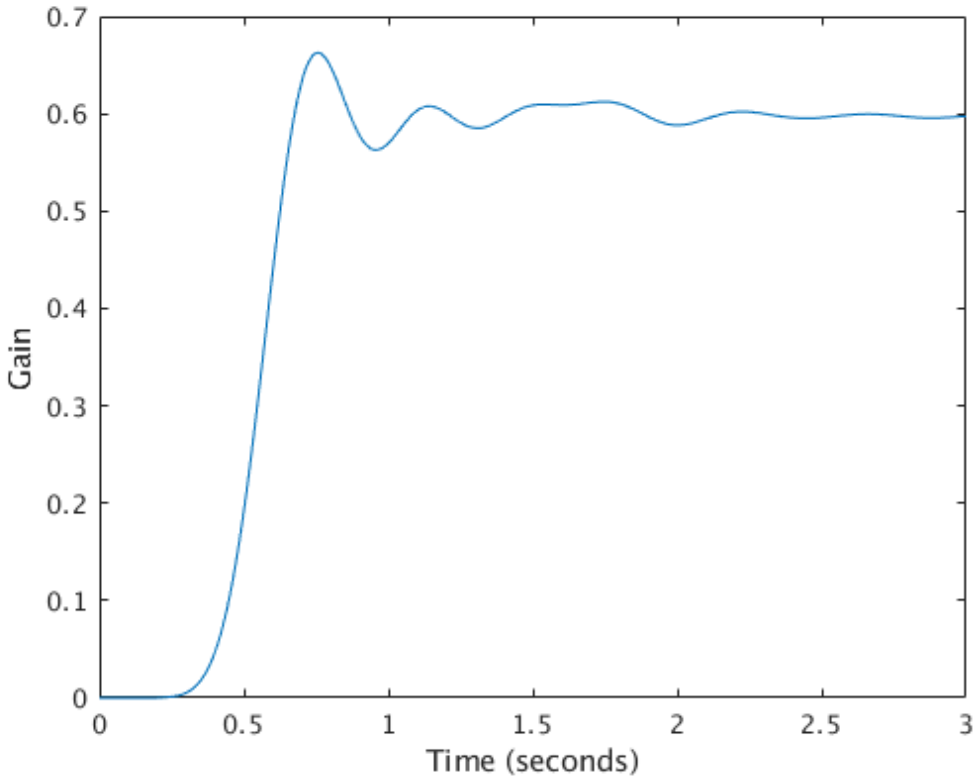
Control Systems Homework 5 Problem 5

```
C5 = 0.01; R51 = 10; R52 = 100;
A5 = [-1/(C5*R52), -1/(C5*R51), 0,  0,  0,  0,  0,  0,  0,  0;...
        1/(C5*R51), -1/(C5*R52), -1/(C5*R51),   0,  0,  0,  0   0,  0,
  0;...
        0, 1/(C5*R51), -1/(C5*R52), -1/(C5*R51),    0,  0,  0,  0,  0,
  0;...
        0,  0,   1/(C5*R51), -1/(C5*R52), -1/(C5*R51),  0,  0,  0,  0,
  0;...
        0,  0,  0,  1/(C5*R51), -1/(C5*R52), -1/(C5*R51), 0,  0,  0,
 0;...
        0,  0,  0,  0, 1/(C5*R51), -1/(C5*R52), -1/(C5*R51), 0,  0,
 0;...
        0,  0,  0,  0,  0,  1/(C5*R51), -1/(C5*R52), -1/(C5*R51),  0,
  0;...
        0,  0,  0,  0,  0,  0,  1/(C5*R51), -1/(C5*R52), -1/(C5*R51),
  0;...
        0,  0,  0,  0,  0,  0,  0,  1/(C5*R51), -1/(C5*R52), -1/
(C5*R51);...
        0,  0,  0,  0,  0,  0,  0,  0,  1/(C5*R51), -1/(C5*R52) - 1/
(C5*R51)];
B5 = [(1/(C5*R51)); 0; 0; 0; 0; 0; 0; 0; 0; 0];
C5 = [0,0,0,0,0,0,0,0,0,1];
D5 = [0];
G5 = ss(A5,B5,C5,D5);
```

```
tf(G5)
zpk(G5)

t5 = 0:0.01:3;
y5 = step(G5,t5);
figure;
plot(t5, abs(y5));
xlabel('Time (seconds)');
ylabel('Gain');
```

```
ans =

                                    1e10

  ------------------------------------------------------------------------

   s^10 + 20 s^9 + 1035 s^8 + 1.568e04 s^7 + 3.623e05 s^6 + 4e06 s^5

            + 5.004e07 s^4 + 3.669e08 s^3 + 2.335e09 s^2 + 8.752e09 s

                                                                        +
 1.674e10

Continuous-time transfer function.

ans =

                                   1e+10

  ------------------------------------------------------------------------

   (s^2 + 6.74s + 16.56) (s^2 + 4.863s + 62.3) (s^2 + 3.547s + 160.5)

                                (s^2 + 2.68s + 275.8) (s^2 + 2.17s +
 366.7)
```

```
Continuous-time zero/pole/gain model.
```



Published with MATLAB® R2018a