% Automobile Cruise control
% Pole placement regulator design
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m = 1000;             % mass of vehicle
Cd = 50;              % friction (drag) coefficient at 20 m/s
A = -Cd/m;
B = 1/m;
C = 1;
D = 0;
sys_o = ss(A,B,C,D);
eig(A)                      % eigenvalue (pole) of open loop system
p = -0.3;                   % desired pole position
K = place(A,B,p)           % gain matrix
ko = K;
sys_c = ss(A-B*K,B*K,C,D)   % closed-loop system
r = ones(200,1)*20;         % reference (20 m/s step input)
t = linspace(0,50,200);
[y] = lsim(sys_c,r,t',10);

% Type 0 plant, augment with
% an integrator to get a type 1 servo

aa = [A 0; -C 0];
bb = [B; 0];
cc = [1 0];
sys_ci = ss(aa,bb,cc,0);
p1 = -0.5 + 0.8i;           % desired closed loop poles
p2 = -0.5 - 0.8i;
K = place(aa,bb,[p1 p2])

% Closed-loop regulator with
% integrator added simulation

acl = [A-B*K(1) -B*K(2);-C 0];
bcl = [0; 1];
sys_ci_c = ss(acl,bcl,cc,0);
[y] = lsim(sys_ci_c,r,t',[10;0]);

ans =
  -0.0500

K =
   250

a =
  x1   -0.3

b =
  u1   0.25

c =
  x1   y1   1

d =
  u1   y1   0

Continuous-time model.
K =
  950.0000 -890.0000
Automobile Cruise Control
Type 1 Servo for a Plant without an Integrator
Use with cruise 3 m
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Automobile Cruise Control
Type 1 Servo for
a Plant without an integrator
Discrete time implementation \( f_c = 5 \text{Hz} \)
Use with cruise3.m
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