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# ECEN 4138 HW 1 Problem 4 Script

## Table of Contents

Housekeeping .....	1
Setup .....	1
Simulate .....	1
Analyze .....	1
EOM function .....	2

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## Housekeeping

```
clc; clear; close all;
```

## Setup

```
m = 1500; % kg
b = 70; % N-sec/m
K = 20000; % N-sec/m, vary for this problem

vr = 1; % m/s

tspan = 0:0.001:10;

titleText = sprintf("Car velocity vs. time, K = %.0f N/m/s", K);

disturbTime = tspan(end)/2;

const = [m; b; K; vr; disturbTime];

v0 = 0; % IC vector
```

## Simulate

```
[time, state] = ode45(@(t,state)cruiseEOM(t,state,const), tspan, v0);
```

## Analyze

```
v = state(:,1);

idx = find(time == disturbTime);
vrPlot = zeros(size(time));
vrPlot(idx:end) = vr;

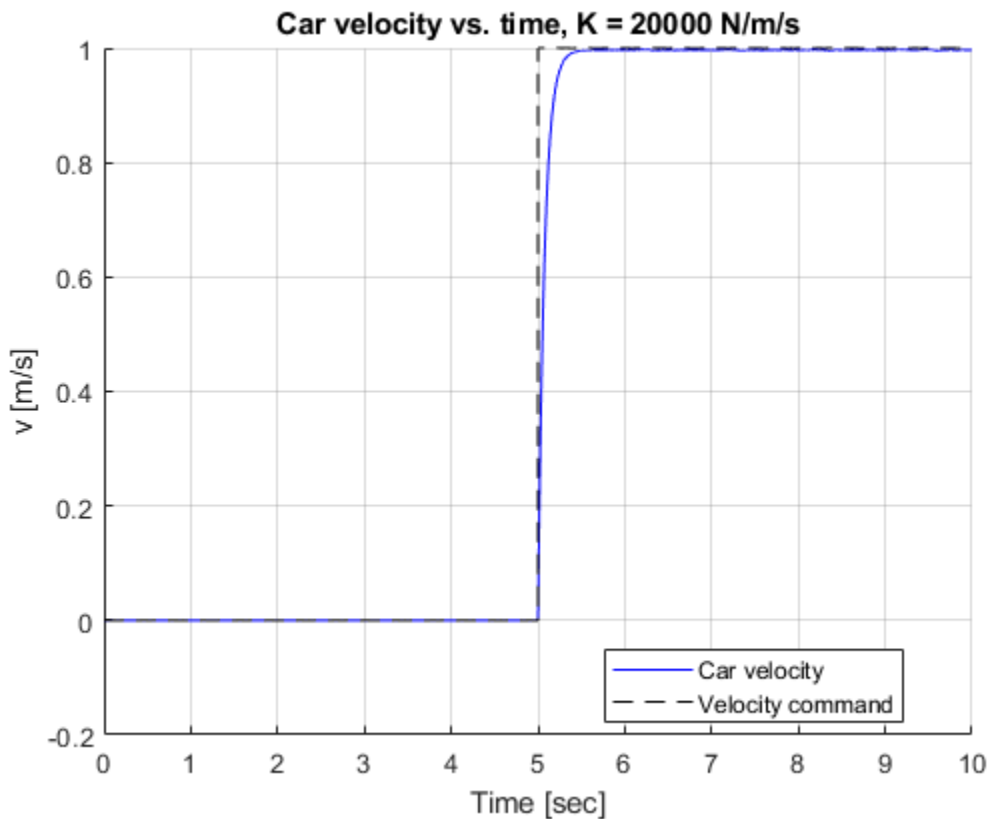
figure
hold on; grid on;
```

```

title(titleText)
plot(time, v, 'b-')
plot(time, vrPlot, 'k--')
xlabel("Time [sec]")
ylabel("v [m/s]")

legend("Car velocity", "Velocity command", 'Location', 'best')

```



## EOM function

```

function dX = cruiseEOM(t,X,const)
% EOM function for simulating a cruise control system with ode45
% Inputs:
%   t: time [sec]
%   X: state vector
%       v
%   const: vector of constants for simulation
%           [m; b; K; vr; disturbTime]
%
% Outputs:
%   dX: rate of change vector
%       [ vx; vy; ax; ay ]
%
% By: Ian Faber, 09/05/2023
%

```

```
v = X;

m = const(1);
b = const(2);
K = const(3);
vr = const(4);
disturbTime = const(5);

if t < disturbTime
    vr = 0;
end

a = (1/m)*(K*vr - (b+K)*v);

dX = a;

end
```

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