
ECEN 4138 HW 2 Problem 1 Script

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Housekeeping

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

Setup

```
M = 1; % kg
m = 1; % kg
b1 = 0.1; % N/m/s
b2 = [0, 0.1, 1]; % N/m/s, to turn off air drag b2 = 0
k = 1; % N/m
```

```
tspan = 0:0.001:50; % sec
```

```
u = 1; % N, input force
```

```
x0 = [0; 0; 0; 0]; % x; y; vx; vy
```

Simulate

```
for ii = 1:length(b2)

    titleTextX = sprintf("Flexible system x response with b_2 = %.3f",
        b2(ii));
    titleTextY = sprintf("Flexible system y response with b_2 = %.3f",
        b2(ii));
    titleTextVx = sprintf("Flexible system v_x response with b_2 = %.3f",
        b2(ii));
    titleTextVy = sprintf("Flexible system v_y response with b_2 = %.3f",
        b2(ii));

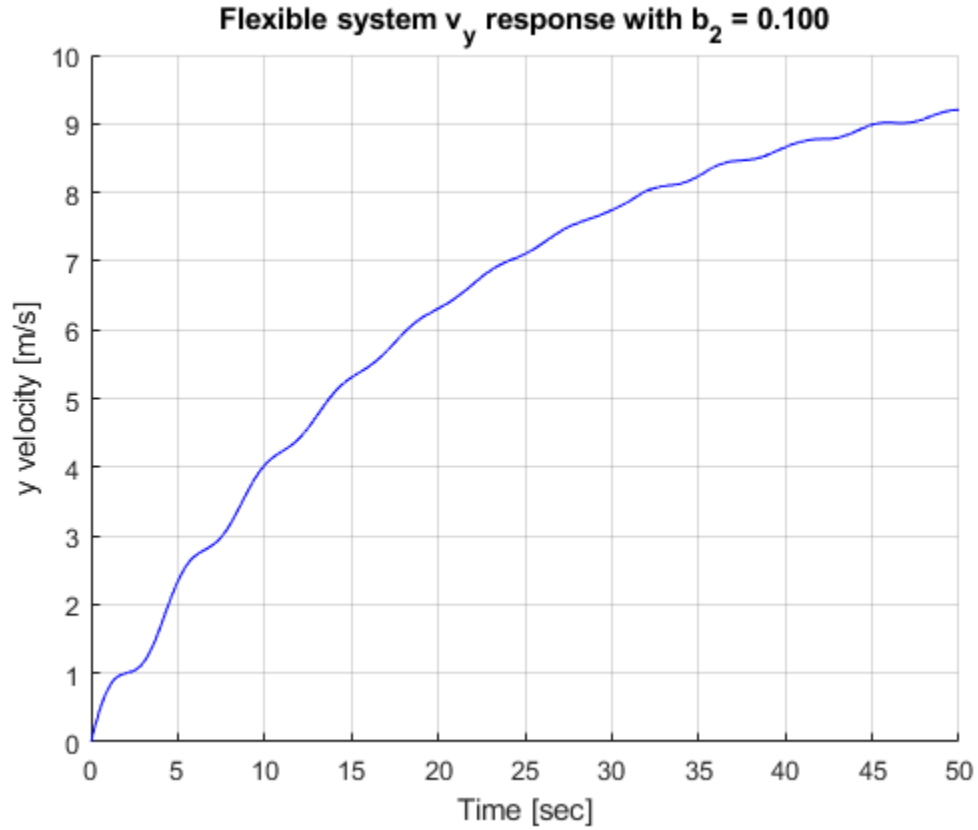
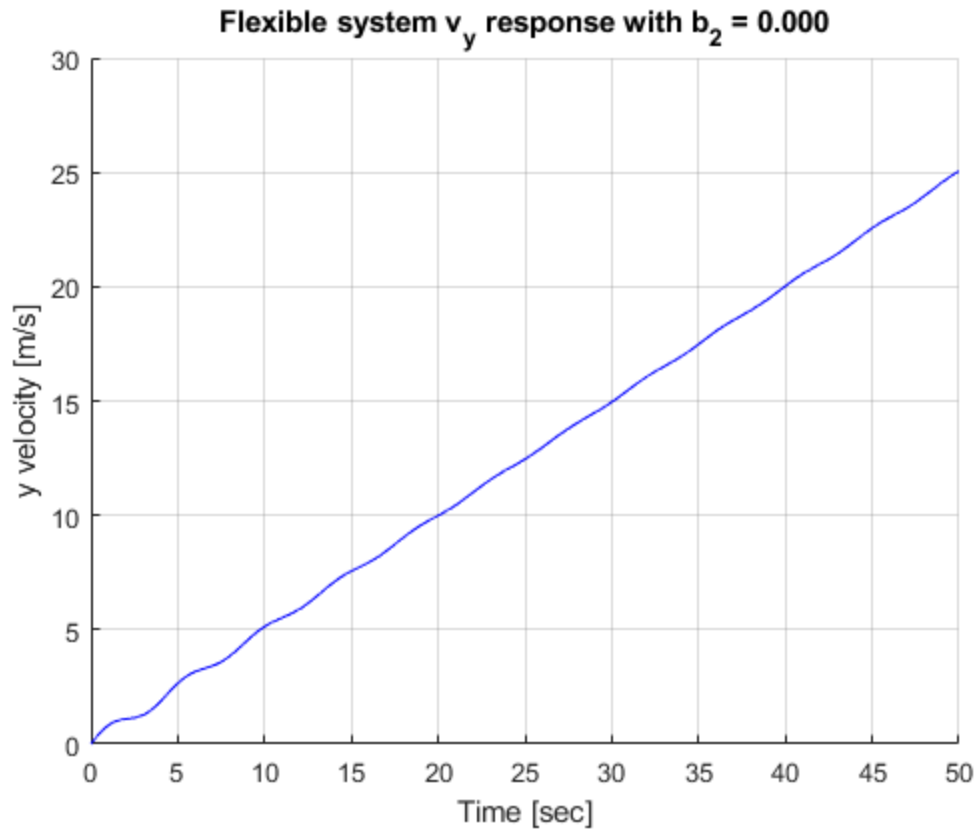
    const = [M; m; b1; b2(ii); k; u];

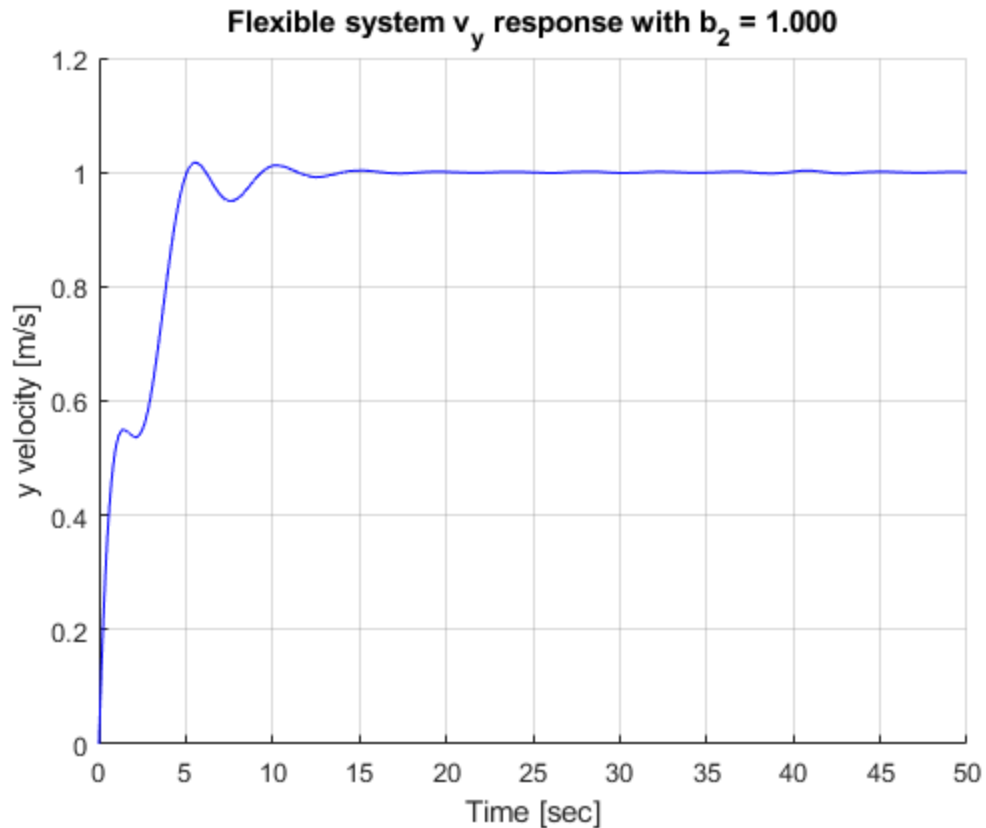
    [time, state] = ode45(@(time, state)flexEOM(time, state, const), tspan,
        x0);
```

Analyze

```
x = state(:,1);
y = state(:,2);
vx = state(:,3);
vy = state(:,4);

% figure
% hold on; grid on;
% title(titleTextX)
% plot(time, x, 'b-')
% xlabel("Time [sec]")
% ylabel("x position [m]")
%
% figure
% hold on; grid on;
% title(titleTextY)
% plot(time, y, 'b-')
% xlabel("Time [sec]")
% ylabel("y position [m]")
%
% figure
% hold on; grid on;
% title(titleTextVx)
% plot(time, vx, 'b-')
% xlabel("Time [sec]")
% ylabel("x velocity [m/s]")
%
figure
hold on; grid on;
title(titleTextVy)
plot(time, vy, 'b-')
xlabel("Time [sec]")
ylabel("y velocity [m/s]")
```





end

EOM function

```
function dX = flexEOM(t, X, const)
% EOM function for simulating a simplified 1-D flexible system with ode45
% Inputs:
%   t: time [sec]
%   X: state vector
%       [ x; y; vx; vy ]
%   const: vector of constants for simulation
%       [M; m; b1; b2; k; u] -> If not simulating air drag, b2 = 0
%
% Outputs:
%   dX: rate of change vector
%       [ vx; vy; ax; ay ]
%
% By: Ian Faber, 09/11/2023
%

M = const(1);
m = const(2);
b1 = const(3);
b2 = const(4);
k = const(5);
u = const(6);
```

```
x = X(1);
y = X(2);
vx = X(3);
vy = X(4);

%     if t > 30
%         u = 0;
%     end

ax = (1/m)*(b1*vy + k*y - b1*vx - k*x);
ay = (1/M)*(u + b1*vx + k*x - (b1+b2)*vy - k*y );

dX = [vx; vy; ax; ay];

end
```

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