Connor McGarty, cmcgarty - HW01: CONTINUOUS LOADING OF A RIBBON ON A SPOOL

File: cmcgarty_EE254_HW01_RIBBON_LOADING.m

Submission Date: Tuesday, January 28, 2020 - 1/28/20

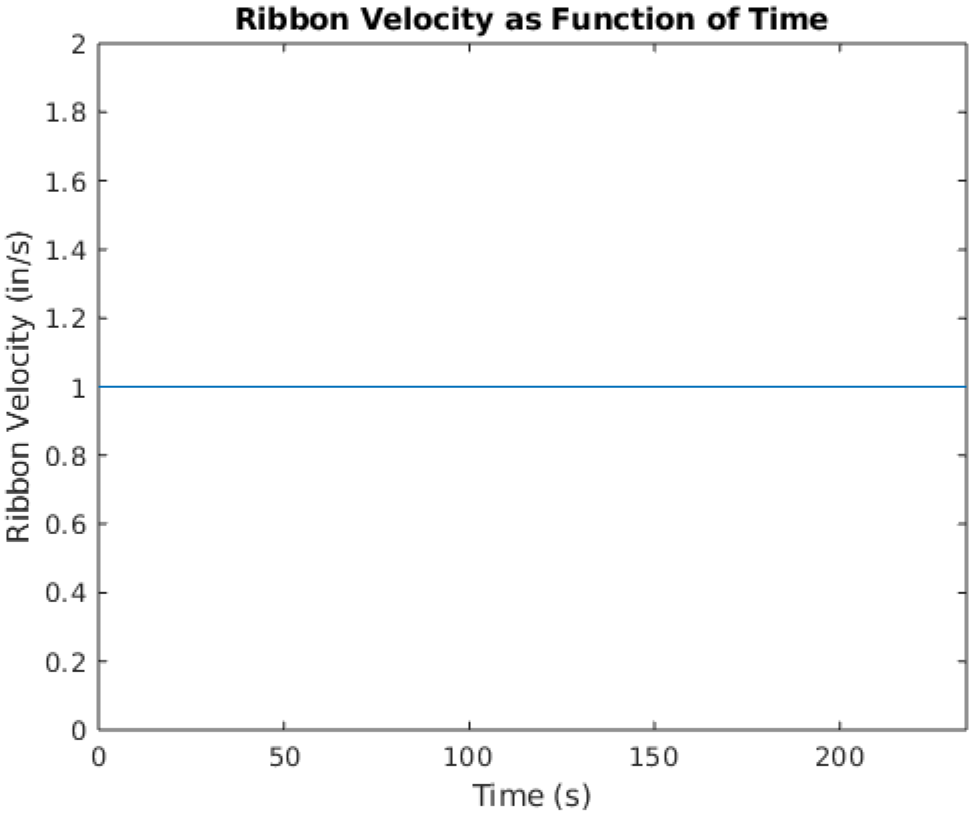
Problem: Calculate angular velocity of a spool loading a strip of ribbon such that the ribbon moves at a constant velocity. Plot velocity as a function of time. Plot omega as a function of time. Plot omega as a function of layer count.

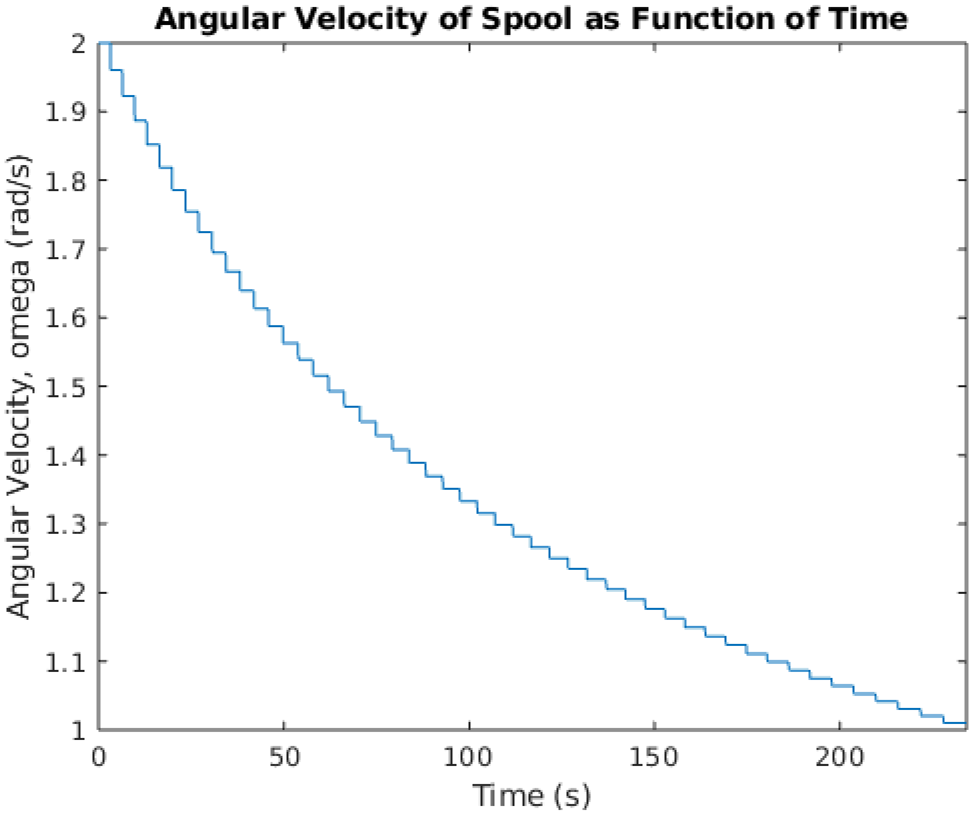
```
% INITIAL CONDITIONS
clc;clear;close all; % clean up
v_constant = 1; % in/s (constant)
r_min = .5; % in
r_max = 1; % in
thickness_material = .01; % in - thickness of the ribbon

% TIME PARAMETERS
t_init = 0; % s
t_delta = .1; % s
t_vector = []; % s

theta_init = 0; % radians
theta_time = [theta_init]; % radians

omega_init = v_constant / (r_min); % w(t=0), rad/s
omega_time = [omega_init]; % w(t), rad/s
```

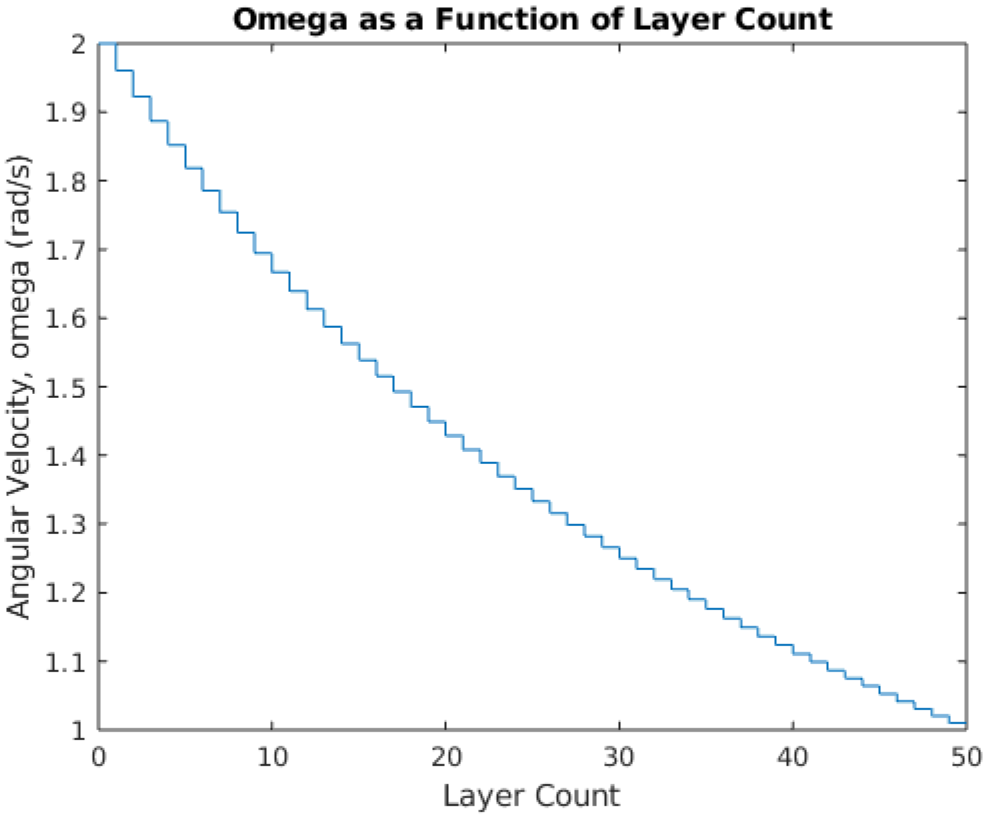
Solution

```
iteration = 1; % index variable
r_current = r_min;
t_current = t_init;
done = false; % while flag
omega_previous = omega_init;
layer_count = 0; % # of times ribbon has wrapped competely around
 spool
layer_time = [layer_count];

while (done == false)
    iteration = iteration + 1;
    t_current = t_current + t_delta; % increment time by time delta
    t_vector(iteration) = t_current;
    omega_current = v_constant / (r_current);
    omega_time(iteration) = omega_current; % add new data point to
 omega vector

    % calculate change in position/rotation of the feed (theta)
    theta_time(iteration) = theta_time(end) + omega_time(iteration) *
 t_delta;
```

```
    % increase radius by material thickness for every full revolution:
    if (theta_time(iteration) >= layer_count * (2 * pi) + (2 * pi))
       r_current = r_current + thickness_material; % inc. radius by
 material thickness
       layer_count = layer_count + 1;
    end

    if (r_current >= r_max) % if we have reached max radius we're "out
 of ribbon"
        done = true; % signal to stop while-loop
    end

    layer_time(iteration) = layer_count; % for ease of plotting later
end

% Plot velocity as function of time
v_vector = v_constant * ones(size(t_vector));
figure;
plot(t_vector, v_vector);
xlabel('Time (s)');
ylabel('Ribbon Velocity (in/s)');
title('Ribbon Velocity as Function of Time');
xlim([0,t_vector(end)]);

% Plot omega as function of time
figure;
plot(t_vector, omega_time);
xlabel('Time (s)');
ylabel('Angular Velocity, omega (rad/s)');
title('Angular Velocity of Spool as Function of Time');
xlim([0,t_vector(end)]);

% Plot omega as function of layer_count:
figure;
plot(layer_time, omega_time);
xlabel('Layer Count');
ylabel('Angular Velocity, omega (rad/s)');
title('Omega as a Function of Layer Count');
xlim([0,layer_count]);
```


Ribbon Velocity as Function of Time
Ribbon Velocity (in/s)
Time (s)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
50
100
150
200


Angular Velocity of Spool as Function of Time
Angular Velocity, omega (rad/s)
Time (s)
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
0
50
100
150
200



Published with MATLAB® R2019b