Contents


```
clear all; clc; close all;
% hold on;
```

Parameters

```
% Set frame of view (time)
t_end = .25; % s

% Inertia Value of motor
J_m = 5*10^(-7); % kgm^2

% Stall Torque
t_s = 0.17 * 9.81 / 100; % Nm
% No load speed
w_nl = 8200 * (2*pi) / 60; % rads / s
```

Numerical Solution

```
% Set frame of view (time)
tspan = [0, t_end];
y0 = [0, 0];

% Numerical solution defiition
[t, y] = ode45(@(t,y) odefcn(t, y, J_m, t_s, w_nl), tspan, y0);

% Set correct units
ts = t(:) .* 1000; % ms
y(:,2) = y(:,2) ./ (2*pi) * 60; % rpm


% plot(ts, y(:,2))
```

Closed-Form Solution

```
% Set frame of view (time)
t = linspace(0, t_end, t_end*100);

% Closed-form Solution
w = velocityProfile(J_m, t_s, w_nl); % Change inertia here

% Set correct units
ts = t(:) .* 1000;

% plot(ts, w(t))
```

Plot

```
% title("Numerical Solution vs Closed-Form Solution")
% xlabel("Time (ms)");
% ylabel("RPM");
% legend("Numerical Sol", "Closed-form", "Location", "southeast");
```

Functions

```
function dydt = odefcn(t, y, J, t_s, w_nl)
    % Return numerical solution to be used with ODE45
    dydt = zeros(2,1);
    dydt(1) = y(2);
    dydt(2) = (t_s / J) * (1 - y(2)/w_nl);
end

function w = velocityProfile(J, t_s, w_nl)
    % Return velocity profile of motor with J inertia, t_s stall torque,
    % and w_nl no load speed
    tr = w_nl * J / t_s;
    w = @(t) w_nl * (1 - exp(-t/tr)) / (2*pi) * 60;
end
```

Published with MATLAB® R2021b