

Homework 1 Due:30/10/2022

Q1 A replica of the `step()` function of the Control system toolbox `[y,t]=step_response(Gs,method)` is to be coded. The function `step_response` accepts tf objects and the method to be used, converts the transfer function into state space representation,

$$\dot{x}(t) = Ax(t) + Bu(t) \quad y(t) = Cx(t) + Du(t)$$

since the step function is replicated, the input is going to be $u = 1$. Implement the function using,

- [05p] the Control system toolbox's `step` function (`method='default',color='k'`)
- [25p] the Mid point method (`method='midpoint',color='r'`)
- [25p] the Heun method (`method='heun',color='b'`)
- [25p] the 4th order Runge-kutta method (`method='rkutta4',color='m'`)
- [10p] combine the methods on a single plot using assigned colors and showing their names in the legend, this plot is generated internally and only the method chosen is returned. You may use `stepinfo` to determine the time vector and choose $h = 0.1$ so that the difference of the results becomes obvious.
- [10p] Which method performs the best and why? (add your response as a comment)

- Submit a single `*.m` file to NINOA. Other file types will not be accepted nor graded.
- The given main function is not going to be submitted, only the necessary implementation needs to be submitted.
- Your submission will be tested with a tester `main.m` file. Your code needs to run without error, or your grade will be zero.
- Each functionality will be tested and added to your grade.
- Late submissions will be deduced 10p for each day late.
- Cheating is not allowed, once cheating is detected all involved submissions will be graded zero.

```
%% UPLOAD ONLY THIS FILE
function [y,t]=step_response(Gs,method)

    %% default
    % default implementation goes here

    %% midpoint
    % midpoint implementation goes here

    %% heun
    % heun implementation goes here

    %% rkutta4
    % rkutta4 implementation goes here

    % plotting goes here

    % return of the result for given method method
end

%% Which method performs the best and why?
% response goes here

deliverables/step_response.m

%% DO NOT UPLOAD THIS FILE
clear;clc;

Gs=tf(1,[1 2*0.2*10 10^2]);

[y,t]=step_response(Gs,'midpoint');

deliverables/main.m
```