
Table of Contents

Main function for stiffness ID use data 0721	1
Initialize the system	1
Update location of 3 chambers P1, P2, P3	2
Read txt file or mat file	2
Symbolic EOM	3
system ID sets	3

Main function for stiffness ID use data 0721

```
clear all
close all
clc
```

Initialize the system

```
par_set=[];
%flag for EOM deriviation
par_set.EOM=0;
%flag for plot
par_set.flag_plot_rawData = 0;
%flag for read txt file or mat file 1: txt 0: mat
par_set.flag_read_exp = 1;
%flag for plotting moving constant layer
par_set.flag_plot_movingCC =0;
%flag for plotting fwd kinematic results
par_set.plot_fwdKinematic =0;
% p1 < p2,3
par_set.trial_4_25psi=[];
par_set.trial_3_25psi=[];
par_set.trial_2_25psi=[];
par_set.trial_1_25psi=[];
par_set.trial_0_25psi=[];
% p1 > p2,3
par_set.trial_25_0psi=[];
par_set.trial_25_1psi=[];
par_set.trial_25_2psi=[];
par_set.trial_25_3psi=[];
par_set.trial_25_4psi=[];

% Geometric para.
par_set.trianlge_length=70*1e-03;% fabric triangle edge length
par_set.L=0.19;%actuator length
par_set.n=4;% # of joints for augmented rigid arm
par_set.m0=0.35;%kg segment weight
par_set.g=9.8;%% gravity constant
par_set.a0=15*1e-03;%% 1/2 of pillow width
par_set.r_f=sqrt(3)/6*par_set.trianlge_length+par_set.a0; % we assume
the force are evenly spread on a circlce with radius of r_f
```

Update location of 3 chambers P1, P2, P3

```
par_set.pl_angle=-150;%deg p1 position w/ the base frame
% update force position of p1 p2 and p3
for i =1:3
    par_set.r_p{i}=[par_set.r_f*cosd(par_set.pl_angle
+120*(i-1)),par_set.r_f*sind(par_set.pl_angle+120*(i-1)),0].';
%     par_set.f_p{i}=588.31*par_set.pm_MPa(:,i+1);
end
fprintf('System initialization done \n')
```

System initialization done

Read txt file or mat file

```
if par_set.flag_read_exp==1

    par_set.trial_0_25psi=func_high_level_exp(par_set.trial_0_25psi,2);

    par_set.trial_4_25psi=func_high_level_exp(par_set.trial_4_25psi,10);

    par_set.trial_3_25psi=func_high_level_exp(par_set.trial_3_25psi,9);

    par_set.trial_2_25psi=func_high_level_exp(par_set.trial_2_25psi,8);

    par_set.trial_1_25psi=func_high_level_exp(par_set.trial_1_25psi,7);


    par_set.trial_25_0psi=func_high_level_exp(par_set.trial_25_0psi,1);

    par_set.trial_25_4psi=func_high_level_exp(par_set.trial_25_4psi,6);

    par_set.trial_25_3psi=func_high_level_exp(par_set.trial_25_3psi,5);

    par_set.trial_25_2psi=func_high_level_exp(par_set.trial_25_2psi,4);

    par_set.trial_25_1psi=func_high_level_exp(par_set.trial_25_1psi,3);


    save('raw_id_data.mat','par_set');
    fprintf('Saved \n' );
else
    fprintf('Loading... \n' );
    load('raw_id_data.mat');
    fprintf('Data loaded \n' );
end

Loading exp. data 2 ...
Loading exp. data 10 ...
Loading exp. data 9 ...
Loading exp. data 8 ...
Loading exp. data 7 ...
```

```
Loading exp. data 1 ...
Loading exp. data 6 ...
Loading exp. data 5 ...
Loading exp. data 4 ...
Loading exp. data 3 ...
Saved
```

Symbolic EOM

```
if par_set.EOM==1
par_set=func_EOM_baseFrame(par_set);
end
```

system ID sets

```
func_plot_pressure_3chambers(par_set.trial_25_0psi)

par_set.trial_0_25psi=func_sysID(par_set.trial_0_25psi,par_set);
par_set.trial_1_25psi=func_sysID(par_set.trial_1_25psi,par_set);
par_set.trial_2_25psi=func_sysID(par_set.trial_2_25psi,par_set);
par_set.trial_3_25psi=func_sysID(par_set.trial_3_25psi,par_set);
par_set.trial_4_25psi=func_sysID(par_set.trial_4_25psi,par_set);
%
par_set.trial_25_0psi=func_sysID(par_set.trial_25_0psi,par_set);
par_set.trial_25_1psi=func_sysID(par_set.trial_25_1psi,par_set);
par_set.trial_25_2psi=func_sysID(par_set.trial_25_2psi,par_set);
par_set.trial_25_3psi=func_sysID(par_set.trial_25_3psi,par_set);
par_set.trial_25_4psi=func_sysID(par_set.trial_25_4psi,par_set);

Dividing training set and validation set
Estimated [alpha,k,d] is [0.0399,0.2335,0.0346]
Dividing training set and validation set
Estimated [alpha,k,d] is [0.1254,0.2591,0.0284]
Dividing training set and validation set
Estimated [alpha,k,d] is [1.3797,0.3749,0.3716]
Dividing training set and validation set
Estimated [alpha,k,d] is [2.2944,0.5144,0.5829]
Dividing training set and validation set
Estimated [alpha,k,d] is [2.4905,0.5908,0.6789]
Dividing training set and validation set
Estimated [alpha,k,d] is [1.6867,0.1104,0.0722]
Dividing training set and validation set
Estimated [alpha,k,d] is [2.5513,0.1067,0.0371]
Dividing training set and validation set
Estimated [alpha,k,d] is [3.1562,0.1932,0.1439]
Dividing training set and validation set
Estimated [alpha,k,d] is [2.3934,0.2381,0.1823]
Dividing training set and validation set
Estimated [alpha,k,d] is [1.6164,0.2628,0.1984]

figure
xx_posi=[0,1,2,3,4]';
```

```

xx_neg=[-0,-1,-2,-3,-4]';
alpha_neg=[par_set.trial_25_0psi.trainSet.pi_set(1);
            par_set.trial_25_1psi.trainSet.pi_set(1);
            par_set.trial_25_2psi.trainSet.pi_set(1);
            par_set.trial_25_3psi.trainSet.pi_set(1);
            par_set.trial_25_4psi.trainSet.pi_set(1)];
alpha_posi=[par_set.trial_0_25psi.trainSet.pi_set(1);
            par_set.trial_1_25psi.trainSet.pi_set(1);
            par_set.trial_2_25psi.trainSet.pi_set(1);
            par_set.trial_3_25psi.trainSet.pi_set(1);
            par_set.trial_4_25psi.trainSet.pi_set(1)];

k_neg=[par_set.trial_25_0psi.trainSet.pi_set(2);
        par_set.trial_25_1psi.trainSet.pi_set(2);
        par_set.trial_25_2psi.trainSet.pi_set(2);
        par_set.trial_25_3psi.trainSet.pi_set(2);
        par_set.trial_25_4psi.trainSet.pi_set(2)];
k_posi=[par_set.trial_0_25psi.trainSet.pi_set(2);
        par_set.trial_1_25psi.trainSet.pi_set(2);
        par_set.trial_2_25psi.trainSet.pi_set(2);
        par_set.trial_3_25psi.trainSet.pi_set(2);
        par_set.trial_4_25psi.trainSet.pi_set(2)];

b_neg=[par_set.trial_25_0psi.trainSet.pi_set(3);
        par_set.trial_25_1psi.trainSet.pi_set(3);
        par_set.trial_25_2psi.trainSet.pi_set(3);
        par_set.trial_25_3psi.trainSet.pi_set(3);
        par_set.trial_25_4psi.trainSet.pi_set(3)];
b_posi=[par_set.trial_0_25psi.trainSet.pi_set(3);
        par_set.trial_1_25psi.trainSet.pi_set(3);
        par_set.trial_2_25psi.trainSet.pi_set(3);
        par_set.trial_3_25psi.trainSet.pi_set(3);
        par_set.trial_4_25psi.trainSet.pi_set(3)];

subplot(3,1,1)
scatter(-xx_neg,alpha_neg)
title('p_1\in[0,25]psi, p_{2,3}\in[1-5]psi')
ylabel('\alpha')
hold on
ylim([-1,5])
xlim([0,4])

subplot(3,1,2)
scatter(-xx_neg,k_neg)
ylabel('k')
hold on
ylim([0,1])
xlim([0,4])

subplot(3,1,3)
scatter(-xx_neg,b_neg)
ylabel('b')
xlabel('p_{2,3} pd')
hold on

```

```

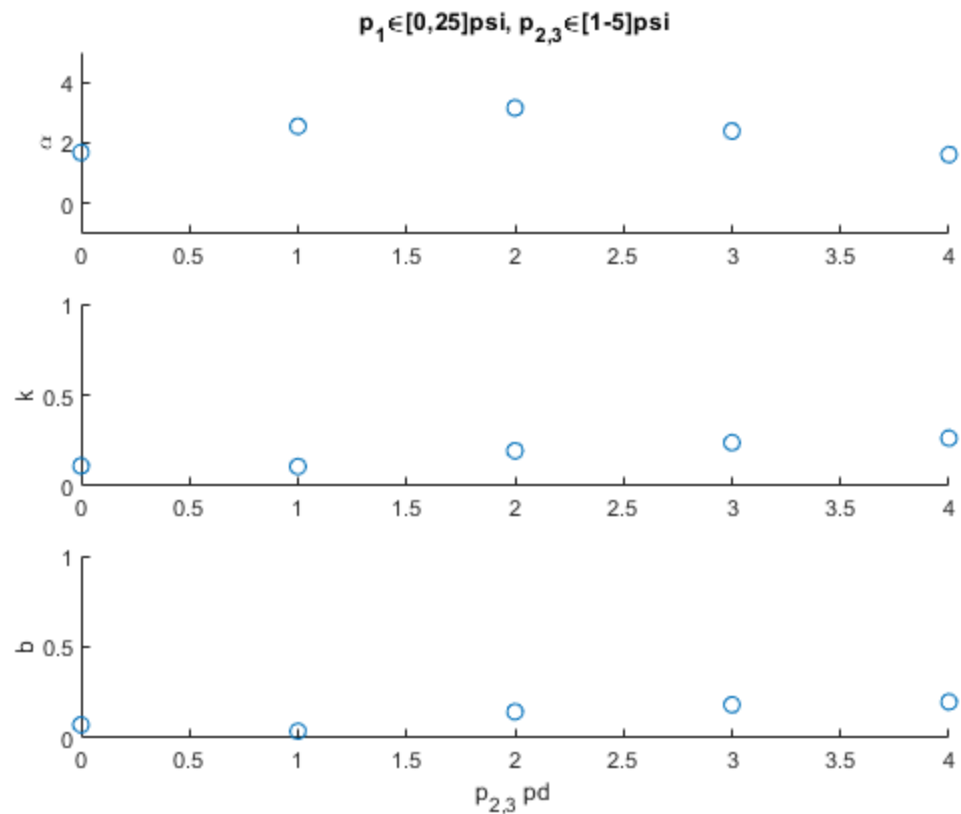
ylim([0,1])
xlim([0,4])

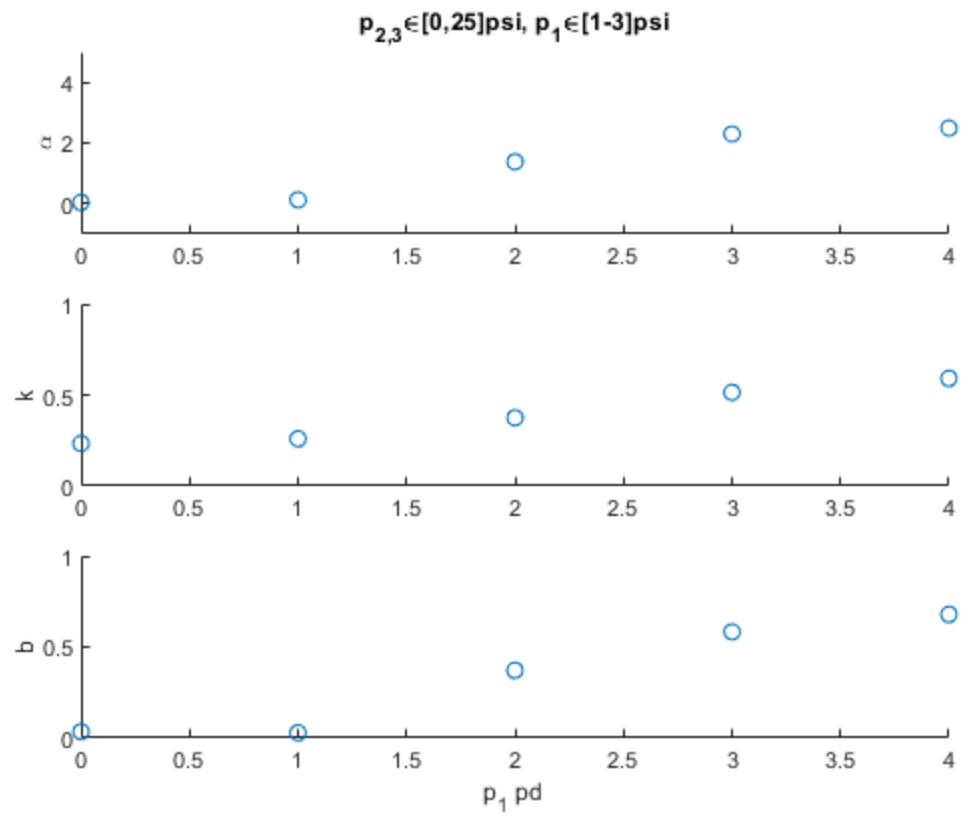
figure
subplot(3,1,1)
scatter(xx_posi,alpha_posi)
title('p_{2,3}\in[0,25]psi, p_1\in[1-3]psi')
ylabel('\alpha')
hold on
ylim([-1,5])
xlim([0,4])

subplot(3,1,2)
scatter(xx_posi,k_posi)
ylabel('k')
hold on
ylim([0,1])
xlim([0,4])

subplot(3,1,3)
scatter(xx_posi,b_posi)
ylabel('b')
xlabel('p_1 pd')
hold on
ylim([0,1])
xlim([0,4])

```





Published with MATLAB® R2018b