# Practice 1

**Desire a contrller (PD) for the MAV to rotate in different angles ignoring the location of the body.**

Matlab result:

In order to get the inertia and thrust contrains to the MAV, we could find the parameters of Crazyflie 2.1, According to the <https://www.bitcraze.io/products/crazyflie-2-1/> .

Crazyflie 2.X

* Takeoff weight: 27g
* Size (WxHxD): 92x92x29mm (motor-to-motor and including motor mount feet)
* Max recommended payload weight: 15 g

DC -RPM-force

https://www.bitcraze.io/documentation/repository/crazyflie-firmware/master/functional-areas/pwm-to-thrust/

Now, we could know that , , to simplify I also set Max ,

Thrust (in gram) = 1.0942e-07\*rpm² – 2.1059e-04\*rpm + 0.15417.







Dynamics:







Controller:



where,

图表

描述已自动生成

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function PDforRotation()

clc;

clear all; close all;

x0 = [0;0;0;0;0;0]; % x0 is the intial state of the system

tspan=[0; 0.1]; % simulation time

[t,x] = ode45(@sys\_dynamics,tspan,x0);

% plot the simulation data

figure;

% subplot(1,2,1);plot(t,x(:,1)); legend('\phi');title('Rotate around X axis when kp=400 kd=4');

% subplot(1,2,2);plot(t,x(:,4)); legend('\phi^{o}');

% subplot(1,2,1);plot(t,x(:,2)); legend('\theta');title('Rotate around Y axis when kp=400 kd=4');

% subplot(1,2,2);plot(t,x(:,5)); legend('\theta^{o}');

subplot(1,2,1);plot(t,x(:,3)); legend('\psi');title('Rotate around Z axis when kp=400 kd=4');

subplot(1,2,2);plot(t,x(:,6)); legend('\psi^{o}');

% figure; plot(t,x(:,1),t,x(:,2),t,mod(x(:,3),pi\*2)); legend('\phi','\theta','\psi'); title('angle');

% figure(2); plot(t,x(:,4),t,x(:,5),t,x(:,6)); legend('\phi^{.}','d\theta^{.}','d\psi^{.}'); title('angular velocity');

end

function dx=sys\_dynamics(t,x)

I=[5.5\*10^(-7) 0 0;0 5.5\*10^(-7) 0;0 0 11\*10^(-7)];

dx=zeros(6,1);

dx(1)=x(4);

dx(2)=x(5);

dx(3)=x(6);

dx(4:6)=I\(controller(x)-cross(x(4:6),I\*x(4:6)));

end

function u=controller(inputX)

desirex=[0;0;1;0;0;0];

deltax=inputX-desirex;

u=zeros(3,1);

% kpx=400;

% kdx=4;

% u(1)=-kpx\*deltax(1)-kdx\*deltax(4);

% if abs(u(1))>0.56

% u(1)=u(1)\*0.56/abs(u(1));

% end

% kpy=400;

% kdy=4;

% u(2)=-kpy\*deltax(2)-kdy\*deltax(5);

% if abs(u(2))>0.56

% u(2)=u(2)\*0.56/abs(u(2));

% end

kpz=400;

kdz=4;

u(3)=-kpz\*deltax(3)-kdz\*deltax(6);

if abs(u(3))>0.56

u(3)=u(3)\*0.56/abs(u(3));

end

end