Homework10 solution

1.(70%)

function out = controller(u,P)

% process inputs**(30%)**

xd = u(1:3);

xd\_1dot = u(4:6);

xd\_2dot = u(7:9);

b1d = u(10:12);

% current state

x = u(13:15);

v = u(16:18);

R = renormalization(reshape(u(19:27),3,3));

Omega = u(28:30);

% calculate errors, eq 17-18

ex = x - xd;

ev = v - xd\_1dot;

% inertial frame 3-axis

e3 = [0; 0; 1];

% thrust magnitude control**(10%)**

A = -P.kx\*ex - P.kv\*ev - P.mass\*P.gravity\*e3 + P.mass\*xd\_2dot;

f = dot(-A, R\*e3);

% desired R and omega**(20%)**

b3c = -A/norm(A);

C = cross(b3c, b1d);

b1c = -(1/norm(C))\*cross(b3c, C);

b2c = C/norm(C);

Rc = [b1c b2c b3c];

Omegac = [0; 0; 0];

% inertia matrix

J = diag([P.Jxx P.Jyy P.Jzz]);

% error

eR = (1/2)\*vee(Rc.'\*R - R.'\*Rc);

eOmega = Omega - R.'\*Rc\*Omegac;

% moment vector control**(10%)**

M = -P.kR\*eR - P.kOmega\*eOmega + cross(Omega, J\*Omega);

% calculate SO(3) error function, Psi

Psi = (1/2)\*trace(eye(3) - Rc.'\*R);

out = [f;M;eR;eOmega;Psi];

end

2.(30%)Plot position error