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Homework #7 -- Prof. SUH

* The 1st order approximation:

A diagram of a function

Description automatically generated with medium confidenceA graph of a graph

Description automatically generated with medium confidence

* The 2nd order approximation:

A diagram of a graph

Description automatically generated with medium confidence

A graph of a graph

Description automatically generated with medium confidence

Implementation for the 1st order approximation:

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| clc, clearvars, close all  load('3dsim.mat');  N = size(ya,2);  T = 0.01;  qhat = zeros(4,N);  eulerhat = zeros(3,N);  qhat(:,1) = q(:,1);  eulerhat(:,1) = quaternion2euler(q(:,1));  for i = 2:N  wx = yg(1,i-1);  wy = yg(1,i-1);  wz = yg(1,i-1);  Omega = [ 0 , -wx, -wy, -wz ; wx , 0 , wz , -wy ; wy , -wz, 0, wx ; wz , wy , -wx , 0 ];  qhat(:,i) = (eye(4) + (1/2) \* Omega \* T) \* qhat(:,i-1);  qhat(:,i) = qhat(:,i) / norm(qhat(:,i));  qhat(:,i) = qhat(:,i) / norm(qhat(:,i));  eulerhat(:,i) = quaternion2euler(qhat(:,i));  end  plotsensor(eulerhat);  plotsensor(eulertrue - eulerhat);  sum(sum(abs(eulertrue - eulerhat))) %%37.9651 |

Implementation for the 2nd order approximation:

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| clc, clearvars, close all  load('3dsim.mat');  N = size(ya,2);  T = 0.01;  qhat = zeros(4,N);  eulerhat = zeros(3,N);  qhat(:,1) = q(:,1);  eulerhat(:,1) = quaternion2euler(q(:,1));  oldOmega = zeros(4,4);  for i = 2:N  wx = yg(1,i-1);  wy = yg(1,i-1);  wz = yg(1,i-1);  Omega = [ 0 , -wx, -wy, -wz ; wx , 0 , wz , -wy ; wy , -wz, 0, wx ; wz , wy , -wx , 0 ];  qhat(:,i) = (eye(4) + (1/2) \* Omega \* T) \* qhat(:,i-1);  qhat(:,i) = (eye(4) + (3/4) \* Omega \* T - (1/4) \* oldOmega \* T - (1/8) \* T^2 \* norm(yg(:,i-1))^2) \* qhat(:,i-1);  qhat(:,i) = qhat(:,i) / norm(qhat(:,i));  qhat(:,i) = qhat(:,i) / norm(qhat(:,i));  eulerhat(:,i) = quaternion2euler(qhat(:,i));  end  plotsensor(eulerhat);  plotsensor(eulertrue - eulerhat);  sum(sum(abs(eulertrue - eulerhat))) %%239.4734 |