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% HW 3 Demo

clear all; close all; clc;

addpath("ME-0460_Kinematics\Functions")

syms d0 d1 d2 d3 real
syms th(t)
assume(th(t), 'real')

rb = [d3 0 0 1]';
w = [1 0 0]';
q = [d0 d1 0]';
v = -hat_PCM(w)*q;

xi = twistr_PCM(w,q); % Twist Function

Rab_0 = [0 1 0; 0 0 1; 1 0 0];
Pab_0 = [d0, d1+d2 0]';
gab_0 = [Rab_0, Pab_0; 0 0 0 1];

expt_HW3 = expt_PCM(xi, th(t));
% pretty(expt_HW3);
% latex(expt_HW3);

gab_th = simplify(expt_HW3*gab_0);

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ra_th = simplify(gab_th*rb);
Vra_th = diff(ra_th,th(t));

gab_th_d = diff(gab_th,t);
% latex(gab_th_d);
R = gab_th(1:3,1:3);
P = gab_th(1:3,4);
gab_th_inv = [R', -R'*P; 0 0 0 1];
gab_th_inv = simplify(gab_th_inv);

Vs_ab = unwedge_PCM(simplify(gab_th_d*gab_th_inv));

Vb_ab = simplify(adjoint_PCM(invHGT_PCM(hgt_PCM(R, P)))*Vs_ab);

%% Code HW3

syms theta real

gab_th = subs(gab_th, th(t), theta);

myFunHandle = matlabFunction(gab_th, "File", "HW3_p7_gab_th","Vars", [theta, d0, d1,
d2]);

myFunHandle(d0, d1, d2, th(t));

% tic

% myFunHandle(3.1, 2, 4, 0)

% toc

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disp("1")

disp(rb)

disp("2")

disp(xi)

disp("3")

disp(gab_0)

disp("4")

disp(expt_HW3)

disp("5")

disp(gab_th)

disp("6")

disp(ra_th)

disp("7")

disp(Vs_ab)

disp("8")

disp(Vra_th)

disp("9")

disp(Vb_ab)

1)

d3

0

0

1

2)

0

0

-d1

1

0

0

3)

[0, 1, 0, d0]

[0, 0, 1, d1 + d2]

[1, 0, 0, 0]

[0, 0, 0, 1]

4)

[1, 0, 0, 0]

[0, cos(th(t)), -sin(th(t)), -d1*(cos(th(t)) - 1)]

[0, sin(th(t)), cos(th(t)), -d1*sin(th(t))]

[0, 0, 0, 1]

5)

[0, 1, 0, d0]

[-sin(theta), 0, cos(theta), d1 + d2*cos(theta)]

[cos(theta), 0, sin(theta), d2*sin(theta)]

[0, 0, 0, 1]

6)

d0

d1 + d2*cos(th(t)) - d3*sin(th(t))

d3*cos(th(t)) + d2*sin(th(t))

1

7)

0

0

-d1*diff(th(t), t)

diff(th(t), t)

0

0

8)

0

- d3*cos(th(t)) - d2*sin(th(t))

d2*cos(th(t)) - d3*sin(th(t))

0

9)

d2*diff(th(t), t)

0

0

0

diff(th(t), t)

0

