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```
clear;
close all;
```

Task 1

```
i1 = [1 0 0]';
i2 = [0 1 0]';
i3 = [0 0 1]';

dRAi = @(t) (-100*sin(t) + 300*sin(2*t))*i1 + ...
    (100*cos(t) - 300*cos(2*t))*i2 + 5*cos(t)*i3;

distance = integral(@(t) norm(dRAi(t)),0, 2*pi, 'ArrayValued', true)
```

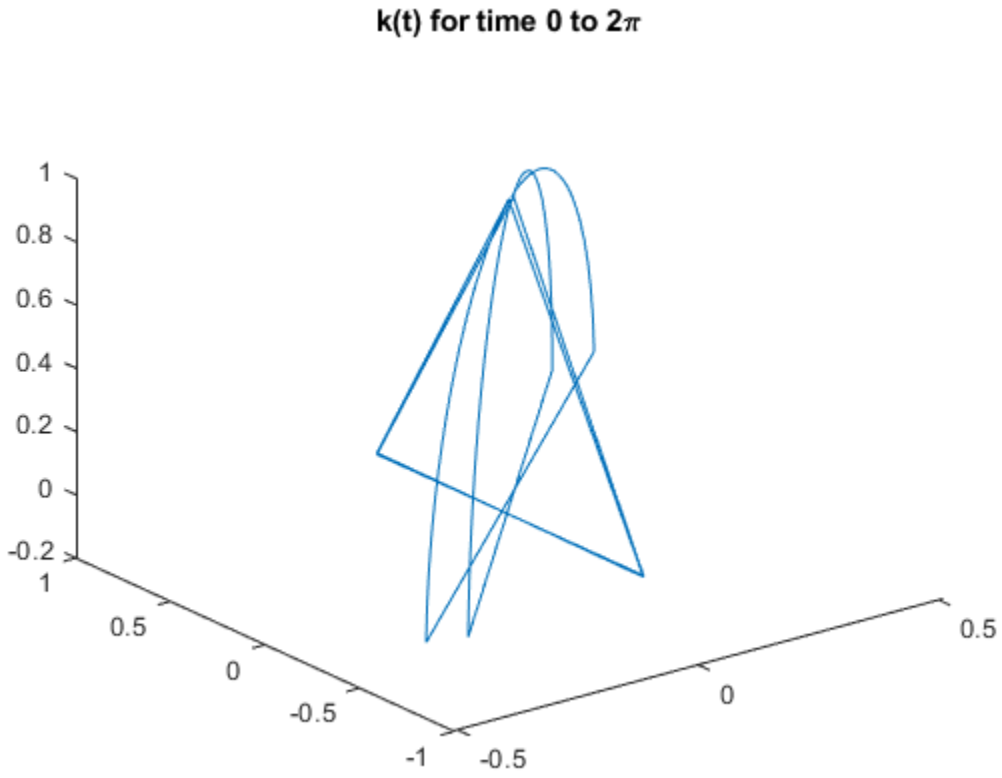
```
distance =

   1.9378e+03
```

Task 2/3

```
RAi = @(t)(100*cos(t) - 150*cos(2*t))*i1 + ...
    (100*sin(t) - 150*sin(2*t))*i2 + 5*sin(t)*i3;

dRAi = @(t) (-100*sin(t) + 300*sin(2*t))*i1 + ...
    (100*cos(t) - 300*cos(2*t))*i2 + 5*cos(t)*i3;

ddRAi = @(t) -(100*cos(t) - 600*cos(2*t))*i1 + ...
    -(100*sin(t) - 600*sin(2*t))*i2 - 5*sin(t)*i3;

T = @(t) dRAi(t)/norm(dRAi(t));
N = @(t) cross(dRAi(t), cross(ddRAi(t), dRAi(t)))/...
    (norm(dRAi(t)*norm(cross(ddRAi(t), dRAi(t)))));
B = @(t) cross(T(t),N(t));

R = @(t) [T(t), N(t), B(t)];

steps = 10000;
time = linspace(0,2*pi, steps);

k = zeros(3,steps);
r = zeros(3,steps);
tau = zeros(3,steps);
```

```
n = zeros(3,steps);
b = zeros(3,steps);
for i = 1:steps
    [V,D] = eig(R(time(i)));
    k(:,i) = V(:,3); %Eigen vector corresponding to value 1

%     tau(:,i) = T(time(i));
%     n(:,i) = N(time(i));
%     b(:,i) = B(time(i));
end

figure(1);
plot3(k(1,:), k(2,:), k(3,:)); %Plotting the rotaion axis over time
title("k(t) for time 0 to 2\pi")
% plot3(tau(1,:), tau(2,:), tau(3,:));
% plot3(n(1,:), n(2,:), n(3,:));
% plot3(b(1,:), b(2,:), b(3,:));
```

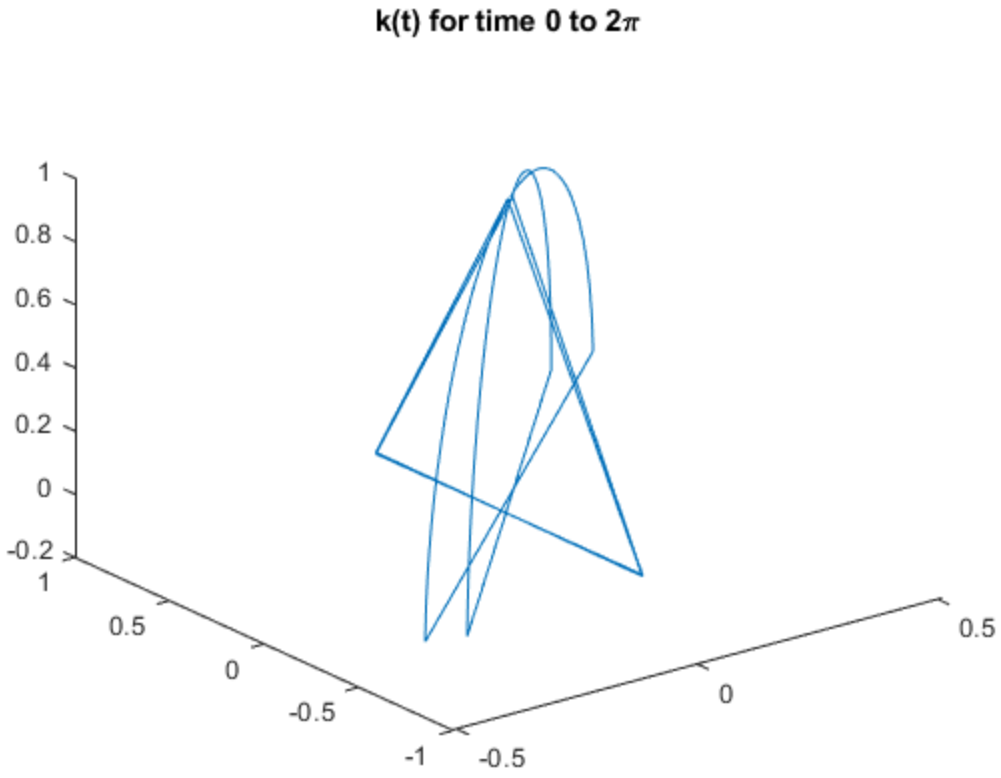
Warning: Imaginary parts of complex X, Y, and/or Z arguments ignored

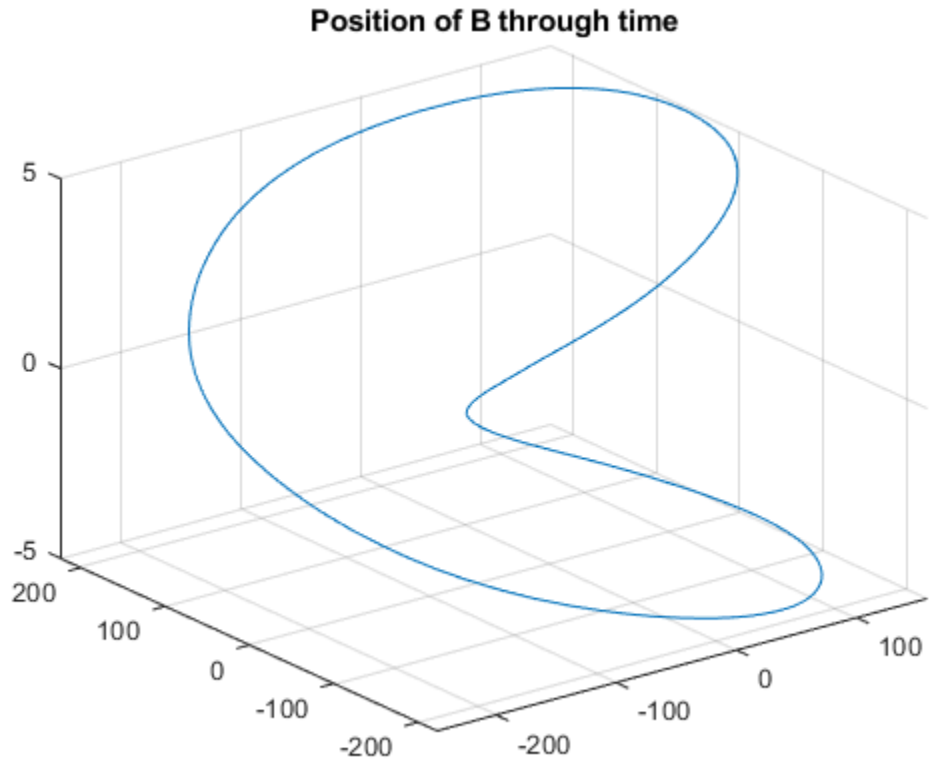


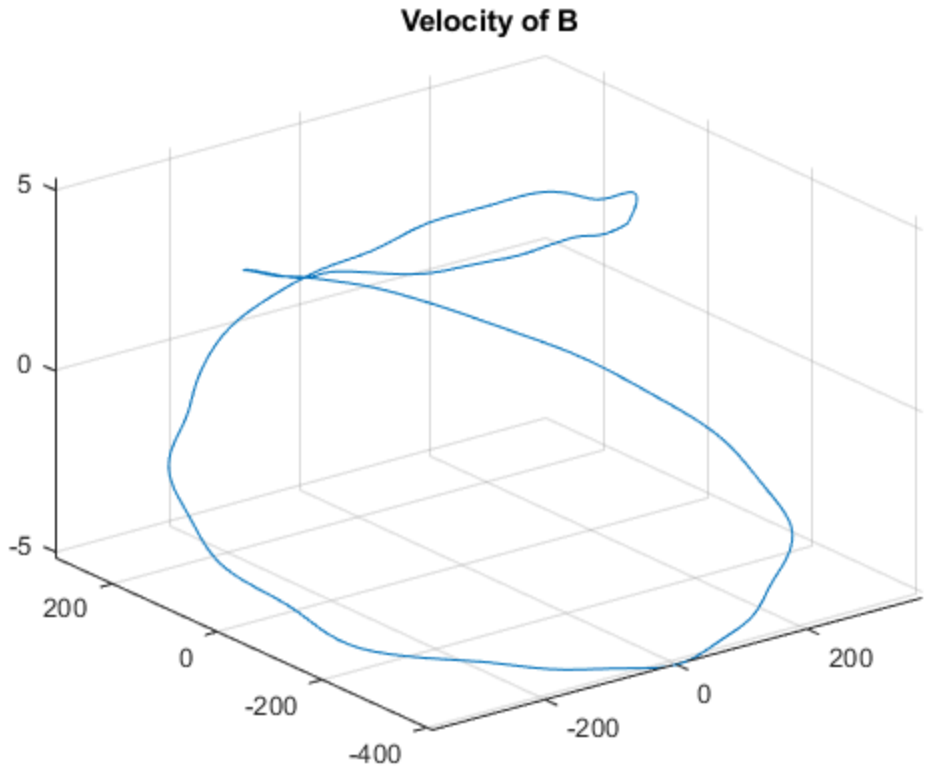
Task 5

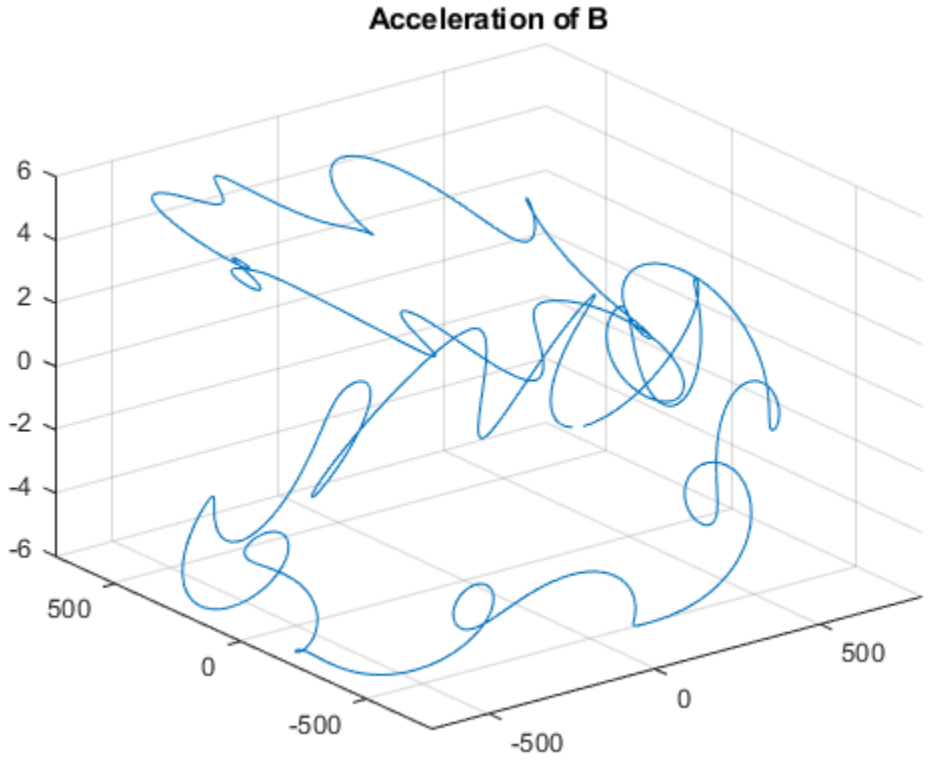
```
syms t

Omega = 10;
AB = 1;
```

```
RA = [100*cos(t) - 150*cos(2*t); 100*sin(t)-150*sin(2*t);5*sin(t)];
dRA = diff(RA,t);
ddRA = diff(dRA);

T = dRA/norm(dRA);
N = cross(dRA, cross(ddRA, dRA))/...
    (norm(dRA*norm(cross(ddRA, dRA))));
B = cross(T,N);
R = [T,N,B];

delta = dot(cross(dRA, ddRA),ddRA)/norm(cross(dRA, ddRA))^2;
kappa = norm(cross(dRA,ddRA)) / norm(dRA)^3;

w = -norm(dRA)*[delta; 0; kappa];
w_dot = diff(w,t);

psi = pi/3*sin(Omega*t);

rB = AB*cos(psi)*T + AB*sin(psi)*N;
drB = diff(rB,t);
ddrB = diff(drB,t);

RB = RA + rB;
dRB = dRA + cross(w,rB) + R.*drB.';
ddRB = ddRA + cross(w_dot,rB) + cross(w,cross(w,rB)) + ...
    ddrB + 2*cross(w,rB);


figure(2);
fplot3(RB(1),RB(2),RB(3),[0,2*pi]);
title("Position of B through time");

figure(3);
fplot3(dRB(1),dRB(2),dRB(3),[0,2*pi]);
title("Velocity of B");

figure(4);
fplot3(ddRB(1),ddRB(2),ddRB(3),[0,2*pi])
title("Acceleration of B");
```


k(t) for time 0 to 2π
1
0.8
0.6
0.4
0.2
0
-0.2
1
0.5
0
-0.5
-1
-0.5
0
0.5


Position of B through time
5
0
-5
200
100
0
-100
-200
-200
-100
0
100


Velocity of B
5
0
-5
200
0
-200
-400
-200
0
200


Acceleration of B
6
4
2
0
-2
-4
-6
500
0
-500
-500
0
500

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