

# Trajectory generation

## Contents

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- [Link1](#)
- [Implement the adaptive control with ODE function](#)
- [Plotting the result:](#)
- [Implement the robust control with ODE function](#)
- [Plotting the result:](#)
- [Summary](#)

## Link1

---

```
t0=0;
tf=20;
q1_0=0;
q1_f=15;
v1_0=5;
v1_f=0;
t = linspace(t0,tf,100);
c = ones(size(t));
M = [ 1 t0 t0^2 t0^3;
0 1 2*t0 3*t0^2;
1 tf tf^2 tf^3;
0 1 2*tf 3*tf^2];
b = [q1_0; v1_0; q1_f; v1_f];
a1 = inv(M)*b;
%a1=[0 0 0 0]
```

```
qd1 = a1(1).*c + a1(2).*t +a1(3).*t.^2 + a1(4).*t.^3;
vd1 = a1(2).*c +2*a1(3).*t +3*a1(4).*t.^2;
ad1 = 2*a1(3).*c + 6*a1(4).*t;
```

```
%Initial estimate for phi and system values
I=8;
mgd=5;
fv=2.5;
alpha=[0;0;mgd;fv;I];
```

## Implement the adaptive control with ODE function

---

```
options = odeset('RelTol',1e-4,'AbsTol',[1e-4, 1e-4, 1e-4, 1e-4, 1e-4]);
[T,X] = ode45(@(t,x) ode1linkTracking_adaptive(t,x,a1'),[0 tf],alpha,options);
```

## Plotting the result:

---

```
figure('Name','Theta under Adaptive control');
```

```

plot(T, X(:,1), 'r-');
xlabel('t')
ylabel('theta')
hold on
plot(t, qd1);
hold on;
legend('actual', 'desired')

figure('Name', 'ddTheta under Adaptive control');

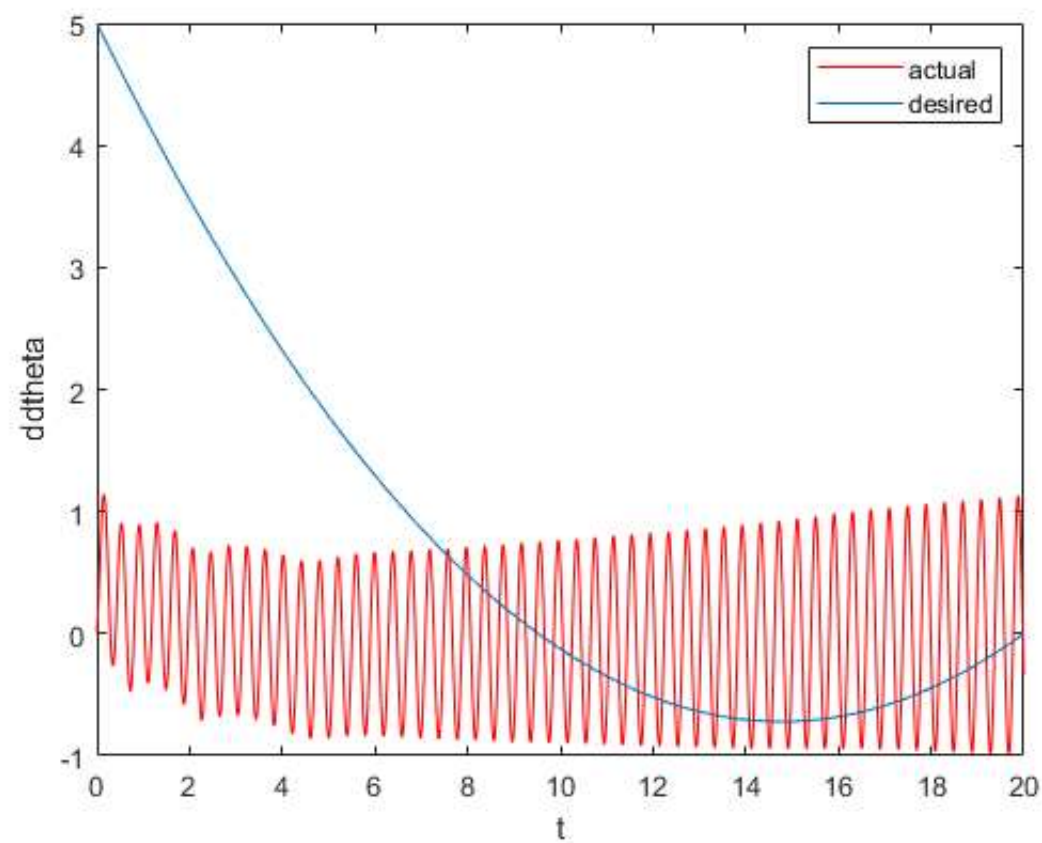
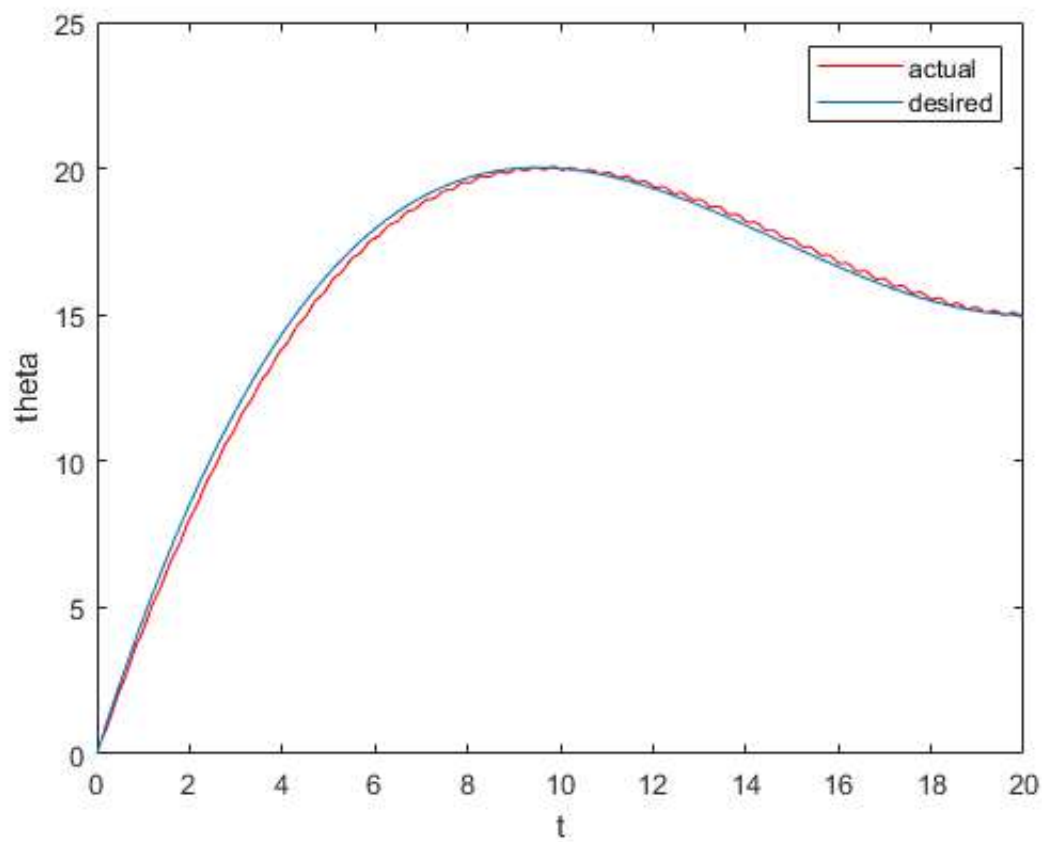
plot(T, X(:,2), 'r-');
xlabel('t')
ylabel('ddtheta')
hold on
plot(t, vd1);
hold on;
legend('actual', 'desired')

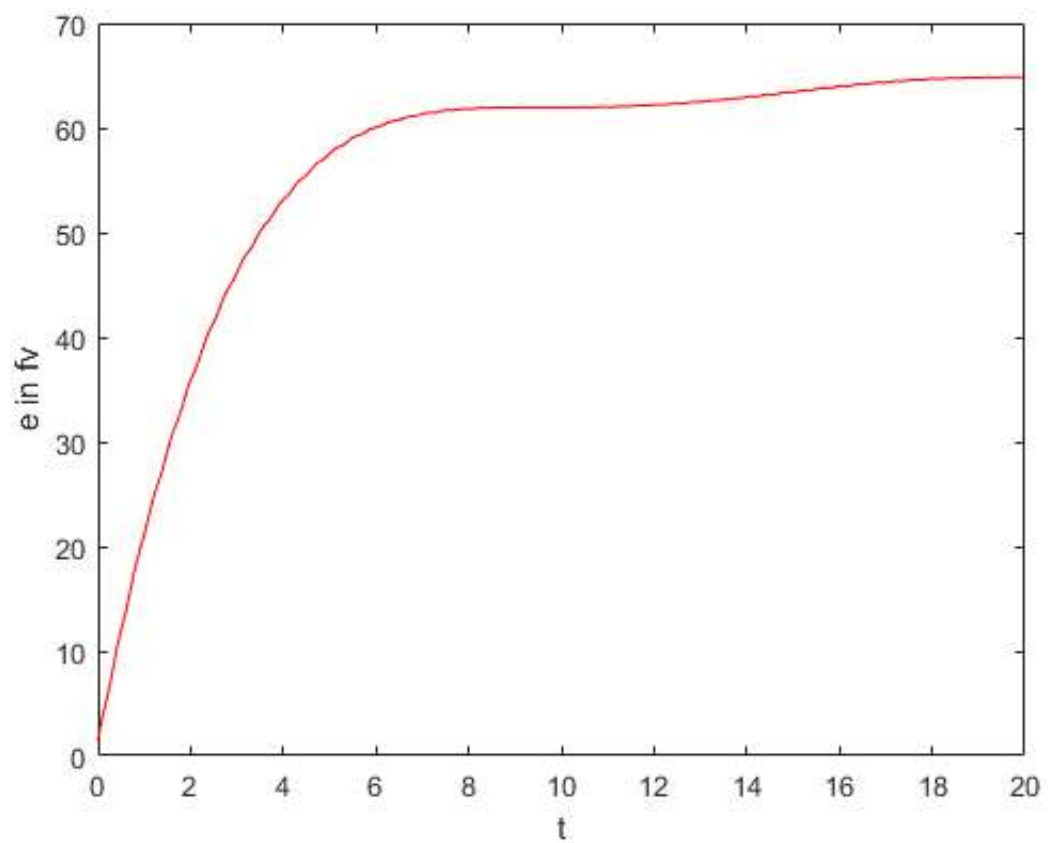
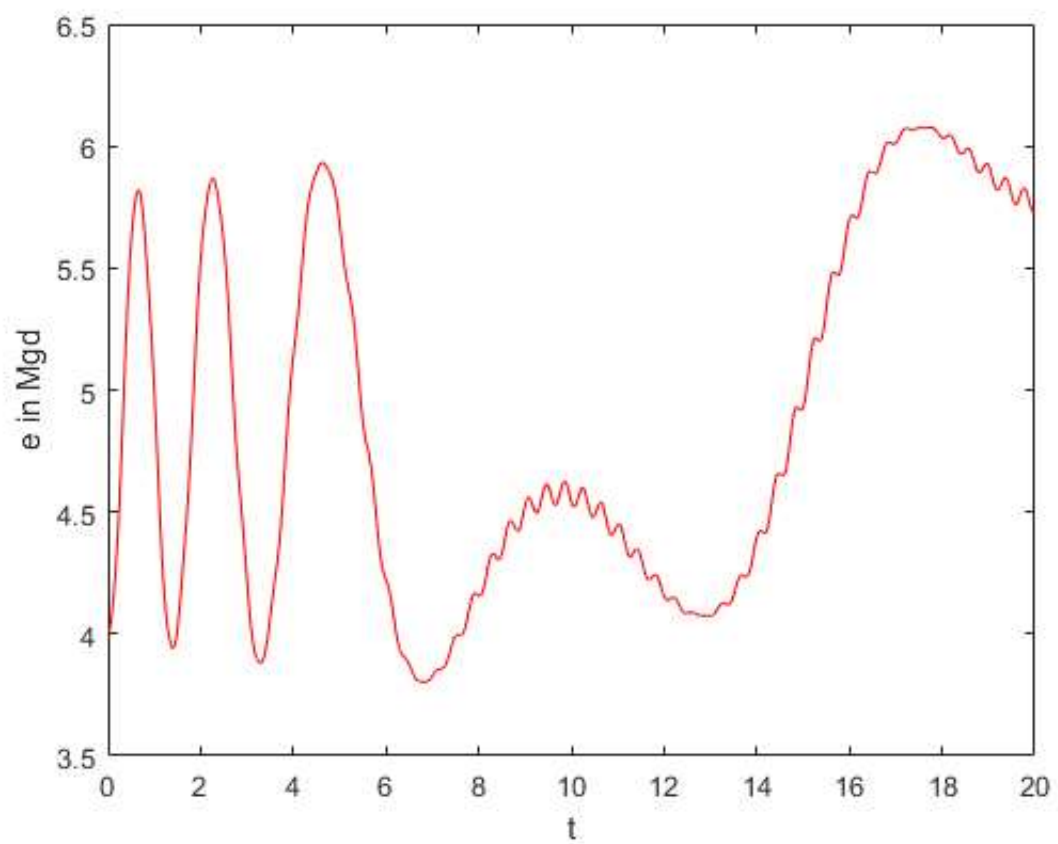
figure('Name', 'Error in Mgd over time for adaptive control');
plot(T, (X(:,3)-1), 'r-');
xlabel('t')
ylabel('e in Mgd')
hold on

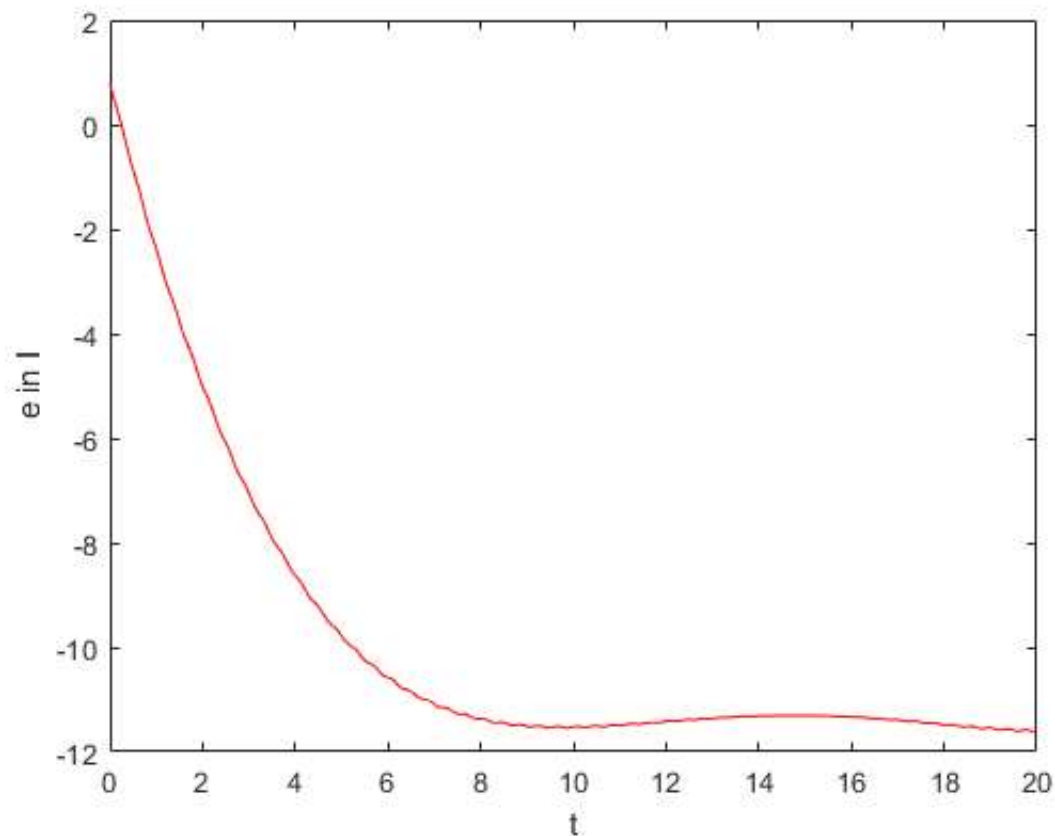
figure('Name', 'Error in fv over time for adaptive control');
plot(T, (X(:,4)-1), 'r-');
xlabel('t')
ylabel('e in fv')
hold on

figure('Name', 'Error in I over time for adaptive control');
plot(T, (X(:,5)-7.2), 'r-');
    xlabel('t')
ylabel('e in I')
hold on

```







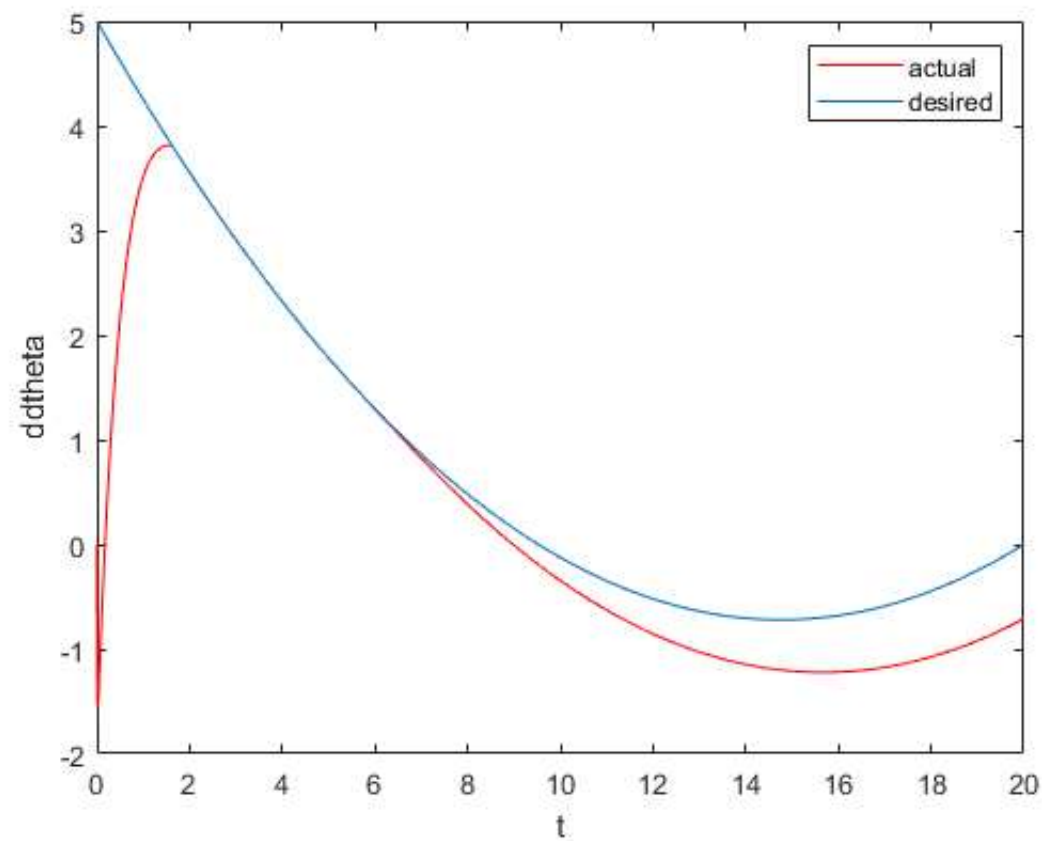
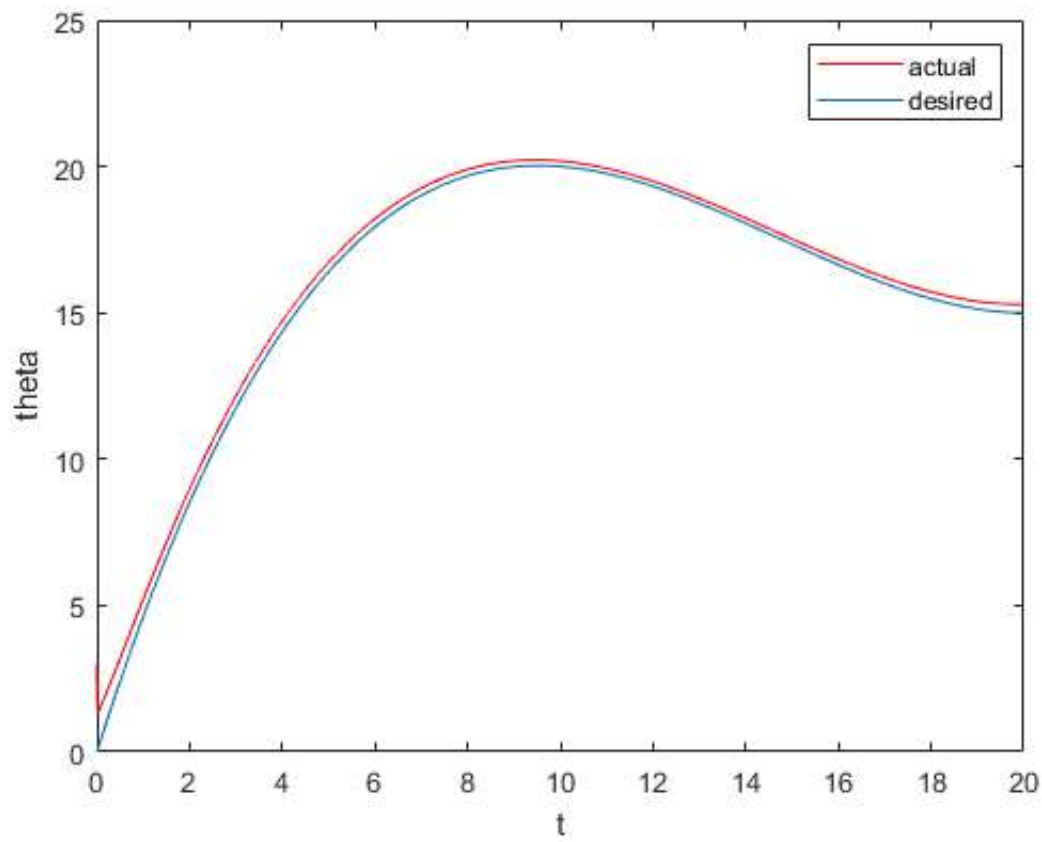
## Implement the robust control with ODE function

```
alpha=[3;0];
options = odeset('RelTol',1e-4,'AbsTol',[1e-4, 1e-4]);
[T,X4] = ode45(@(t,x) odellinkTracking_robust(t,x,a1'),[0 tf],alpha,options);
```

## Plotting the result:

```
figure('Name','Theta under robust control');
plot(T, X4(:,1),'r-');
xlabel('t')
ylabel('theta')
hold on
plot(t,qd1);
hold on;
legend('actual', 'desired')

figure('Name','dTheta under robust control');
plot(T, X4(:,2),'r-');
xlabel('t')
ylabel('ddtheta')
hold on
plot(t,vd1);
hold on;
legend('actual', 'desired')
```



## Summary

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1.From the plot, the adaptive controller trajectory tracking looks little jittery when compared to robust control trajectory.  
2.But when the initial starting positions are different then the adaptive is not able to cope up with the actual trajectory and has a lot of oscillation whereas the robust is able to follow the trajectory better than adaptive. 3.The parameters in the adaptive control are to be tuned regularly whereas in the robust which are less. 4. In adaptive control, the velocity and the acccleration profile has more oscillations whereas in robust it is less.