```
clear
close
clc

numProve=6;

for ii=1:numProve

    dati=readmatrix(ii+".xlsx");
    Tf(ii)=dati(end,2);
    Ti(ii)=dati(1,2)+1;
    Data{ii}=dati(:,2).*(dati(:,2)>dati(1,2)+1);

    kk=1;
    for jj=1:length(Data{ii})

        if(Data{ii}(jj)~=0)
            Data{ii}(kk)=Data{ii}(jj);
            kk = kk + 1;
        end

    end

end

Tc = 0.1;
tau=zeros(1,numProve);
min=zeros(1,numProve);

scelta=4;
```

```
%======= Costante di tempo per sistema primo ordine ==========

% Determino tau con 4 metodi differenti, poi ne faccio la media

% Determino tau col metodo grafico


%identifico il valore tra i dati aquisiti con minore differenza dal valore
%atteso al tempo tau

for ii = 1:numProve
    min(ii) = abs(Data{ii}(ii) -Tf(ii)-(Ti(ii) - Tf(ii))*0.368);
end

for ii = 1:numProve
    for time = 1:length(Data{ii}(:,1))
        if abs(Data{ii}(time,1) -Tf(ii)-(Ti(ii) - Tf(ii))*0.368)< min(ii)
           min(ii) = abs(Data{ii}(time) -Tf(ii)-(Ti(ii) - Tf(ii))*0.368);
           tau(ii) = time*Tc;
        end
    end
end
```

```
tau
```

```
tau = 1×6
   93.2000   98.0000   94.5000   98.6000   98.0000   99.4000
```

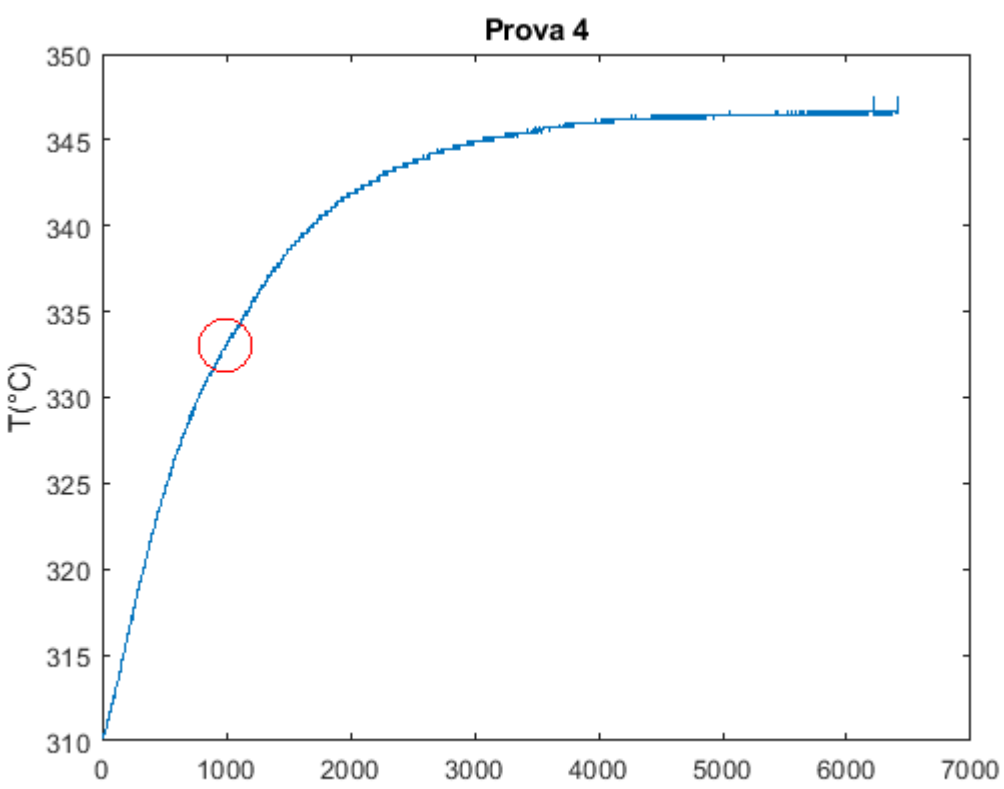
```
Tau1 = mean(tau)
```

```
Tau1 = 96.9500
```

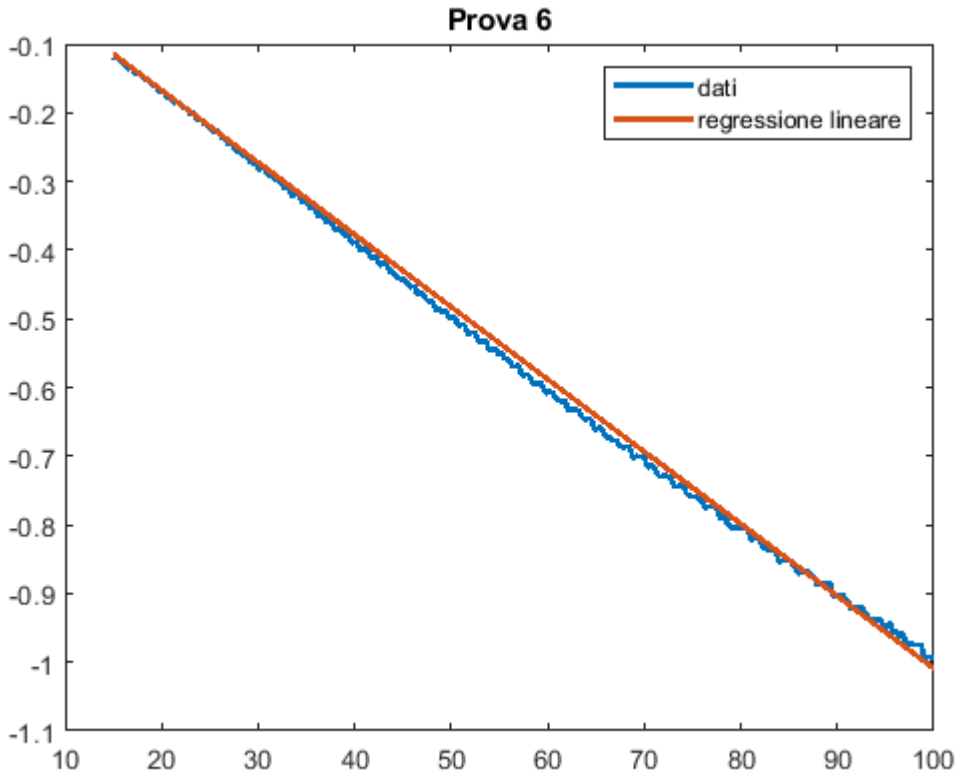
```
% Display del grafico
Ttau=zeros(1,numProve);
for ii = 1:numProve
    Ttau(ii) = Tf(ii)+(Ti(ii) - Tf(ii))*0.368;
end
Ttau
```

```
Ttau = 1×6
  328.7213  330.0972  329.5921  333.1004  331.9012  330.1113
```

```
figure;
plot(Data{scelta});
hold on;
title("Prova "+scelta);
ylabel("T(°C)")
plot(ceil(tau(scelta)/Tc),Data{scelta}(ceil(tau(scelta)/Tc),1),'Color',[1 0 0],"MarkerSize",20,
```



```
% secondo metodo
% linearizzo l'equazione e tramite il coefficiente valuto tau

a=zeros(2,numProve);   %coefficienti
%filtro
[B,A]=butter(4,0.3,"low");
for ii=1:numProve
    filtrato=filter(B,A,Data{ii});
    X{ii}=(150:1000)*Tc;
    Y{ii}=log((filtrato(150:1000)-Tf(ii))/(Ti(ii)-Tf(ii)));
    a(:,ii)=polyfit(X{ii},Y{ii},1);
    tau(ii)=-1/a(1,ii);
end

figure;
plot(X{scelta},Y{scelta},'LineWidth',2);
title("Prova "+ii);

hold on;
plot(X{ii},a(1,ii)*X{ii}+a(2,ii),'LineWidth',2);
legend("dati","regressione lineare")
```



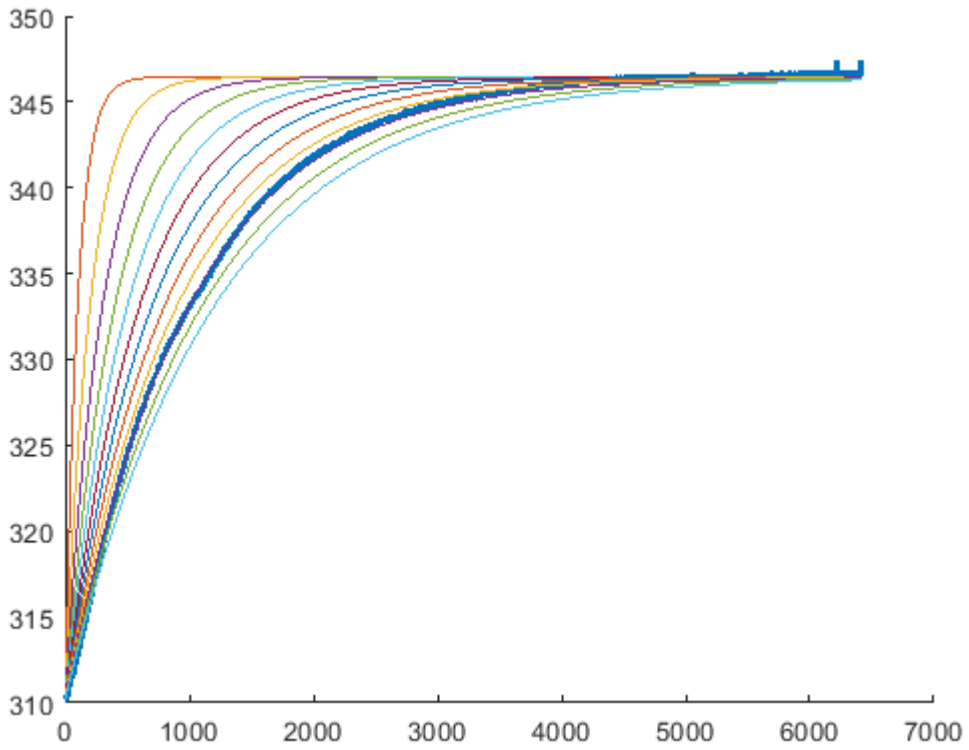

```
tau
```

```
tau = 1×6
   89.6640   92.0419   88.6419   95.7775   91.6249   94.9989
```

```
Tau2=mean(tau)
```

```
Tau2 = 92.1248
```

```
%terzo metodo
tot=0;
for ii = 1:numProve
    for time = 1:length(Data{ii}(:,1))
            min(ii)=min(ii)+power(Data{ii}(time) ...
                -Tf(ii)-(Ti(ii) - Tf(ii))*power(exp(1),-time*Tc/1),2);
    end
end


figure;

for ii = 1:numProve

    if ii==scelta
        hold on;
        plot(Data{ii},'LineWidth',2);
    end


    for tauVar=10:1:120

        tot=0;
        for time = 1:length(Data{ii}(:,1))
            tot=tot+power(Data{ii}(time) ...
                -Tf(ii)-(Ti(ii) - Tf(ii))*power(exp(1),-time*Tc/tauVar),2);

            if ii==scelta
                            y(time)=Tf(ii)+(Ti(ii) ...
                                - Tf(ii))*power(exp(1),-time*Tc/tauVar);
            end

        end

        if mod(tauVar,10)==0 && ii==scelta
            hold on;
            plot(y);
        end

        if tot< min(ii)
                min(ii) = tot;
                tau3(ii) = tauVar;
        end

    end

end
```




```
tau3
```

```
tau3 = 1×6
    96   104    99    99   100   102
```

```
Tau3 = mean(tau3)
```

```
Tau3 = 100
```

```
%quarto metodo

for ii=1:numProve
    for time=1:length(Data{ii})
        tauVar2(time)=time*Tc/log( abs( (Ti(ii)-Tf(ii)) / (Data{ii}(time)-Tf(ii)) ) );
    end
    tau4(ii)=mean(tauVar2);
end

tau4
```

```
tau4 = 1×6
   91.9827  114.5914   96.8996   80.0439   95.6320   92.7215
```

```
Tau4=mean(tau4)
```

```
Tau4 = 95.3119
```

```
%media delle medie


Tau1
```

```
Tau1 = 96.9500
```

```
Tau2
```

```
Tau2 = 92.1248
```

```
Tau3
```

```
Tau3 = 100
```

```
Tau4
```

```
Tau4 = 95.3119
```

```
TAUtot=(Tau1+Tau2+Tau3+Tau4)/4
```

```
TAUtot = 96.0967
```

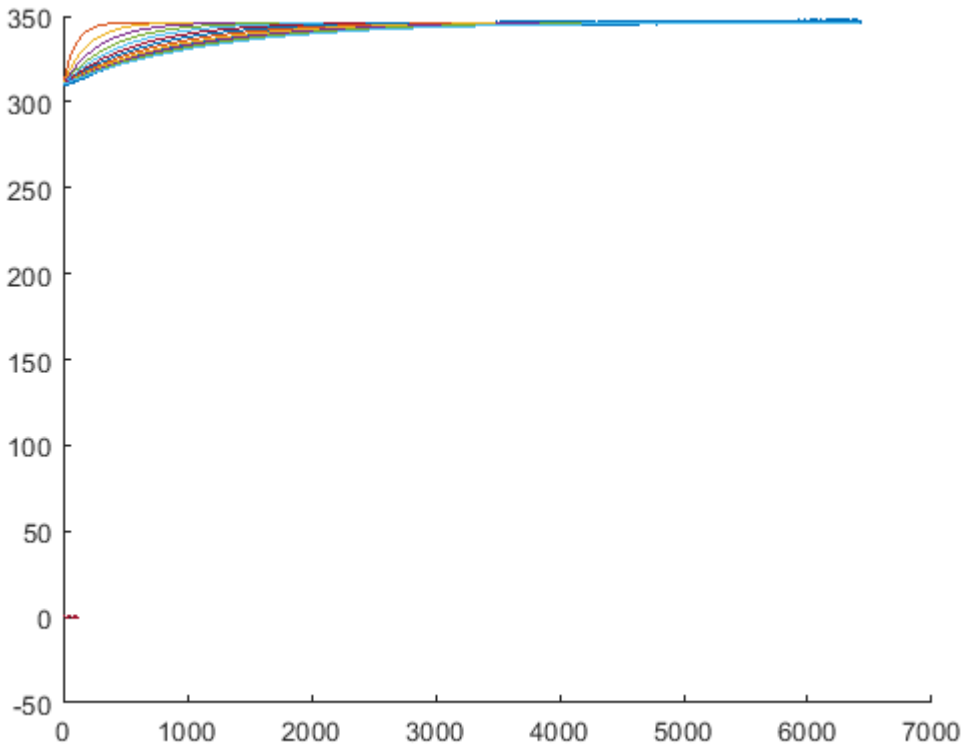
```
t7=0:127
```

```
t7 = 1×128
     0     1     2     3     4     5     6     7     8     9    10    11    12 ···
```

```
y=sin(0.15*t7)
```

```
y = 1×128
         0    0.1494    0.2955    0.4350    0.5646    0.6816    0.7833    0.8674 ···
```

```
plot(t7,y)
```


350
300
250
200
150
100
50
0
-50
0
1000
2000
3000
4000
5000
6000
7000