Estimation of model parameters

differential equation model : $\frac{dT(t)}{dt} = \frac{-k}{m \cdot c} \cdot T_0$

analitical solution : $dT(t) = T_0 \cdot e^{\frac{-k}{m \cdot c} \cdot t}$

Symbol	Importance	Value	Units	
T	temperature of water	vector T, T0 - unknown	°C	Var.
V	volume of the termos	0.75	liters	Parameters
ρ	density of water	0.961	kg/liter	
m	mass of water in a thermos	0.75*0.961	kg	
c	specific heat capacity of water	4211	J/(kg·K)	
k	heat exchange of thermos	unknow, need to estimate	W/(m^2·K)	

```
% estimation of model parameters T0 and k
x = lsqcurvefit(@(Z,t)Z(1)*exp((-Z(2))*t/(m*c)) ,[0 100], t, T)

% finding time when temperature would be 10 celcius
solve('10=96.5269*exp(-819.215510*t/(0.72075*4211))', t)
t = 8.399792860815757835321323159843 2

%finding T0 from repeating experiment
lsqcurvefit(@(T0,t)T0*exp((-k)*t/(m*c)), [0], [2 4 6], [33.06 20.91 11.91])
T0 = 58.1102
```

Figure 1: Output of model simulation.

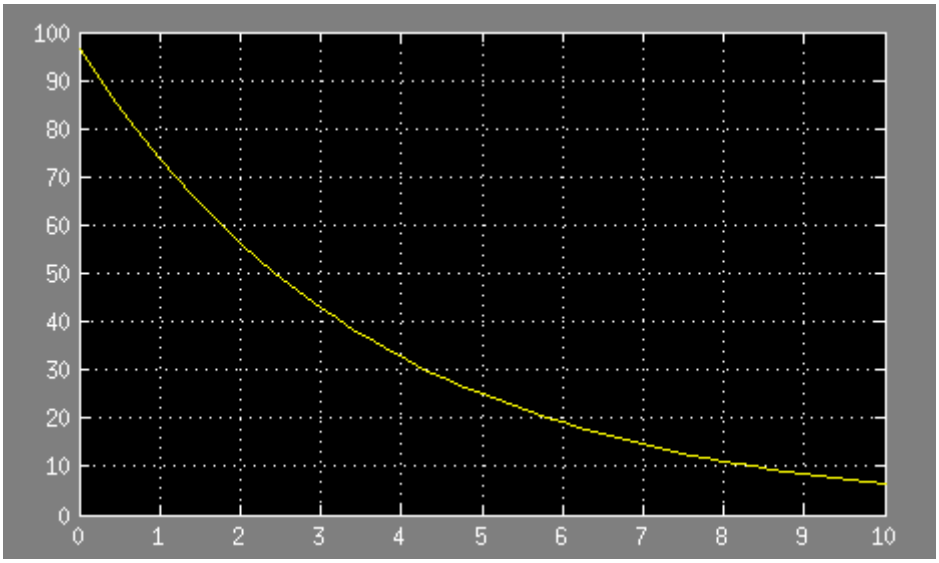

Figure 2: Approximation of measured values.

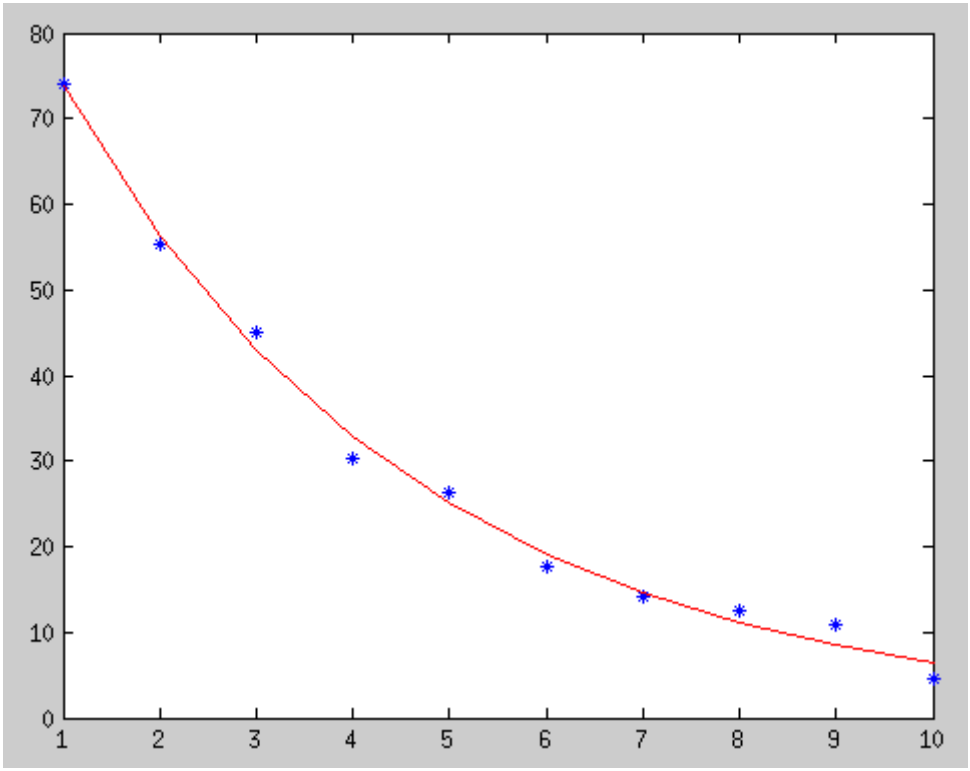

Figure 3: Mesh in the vicinity of minimum.