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EÐL207G Verk 4

```
err = 0.01;
```

3.1

```
innraVid = 53; %ohm
```

3.2

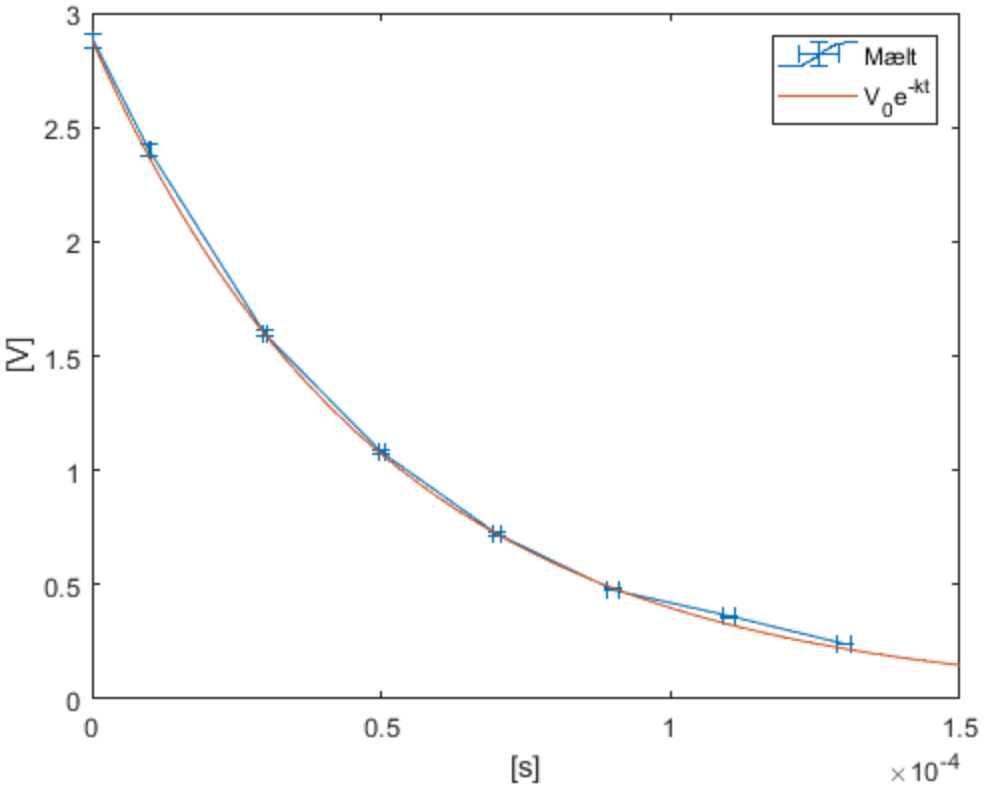
1-3

```
v_r = 0.6047; %volt
```

4

```
R = 5e3;
C = 10e-9;

v_r = [2.88 2.4 1.6 1.08 0.72 0.48 0.36 0.24];
t = [0 10 30 50 70 90 110 130]*1e-6;
k = 1/((R+innraVid)*C)
slope = polyfit(v_r, t, 1);
slope = slope(1)
v_rerror = v_r.*err;
terrror = t.*err;

kMes = (log(v_r(1))-log(v_r)).*t.^-1
kMesErr = 1./(t.*v_r).*v_rerror+(log(v_r(1))-log(v_r))./t.^2.*terrror
tau = 1./kMes
figure(1)
errorbar(t,v_r,v_rerror,v_rerror,terrror,terrror); hold on;
x = linspace(0, 150e-6, 100);
mdl = v_r(1)*exp(-k.*x);
plot(x,mdl)
```

```
hold off;

xlabel('[s]')
ylabel('[V]')
legend('Mælt', 'V_0e^{-kt}')

k =
   1.9790e+04
slope =
  -4.5142e-05
kMes =
  Columns 1 through 6
          NaN   1.8232e+04   1.9593e+04   1.9617e+04   1.9804e+04   1.9908e+04
  Columns 7 through 8
   1.8904e+04   1.9115e+04
kMesErr =
  Columns 1 through 6
          NaN   1.1823e+03   5.2926e+02   3.9617e+02   3.4090e+02   3.1020e+02
  Columns 7 through 8
   2.7995e+02   2.6807e+02
tau =
  Columns 1 through 6
          NaN   5.4848e-05   5.1039e-05   5.0977e-05   5.0494e-05   5.0230e-05
  Columns 7 through 8
   5.2899e-05   5.2316e-05
```



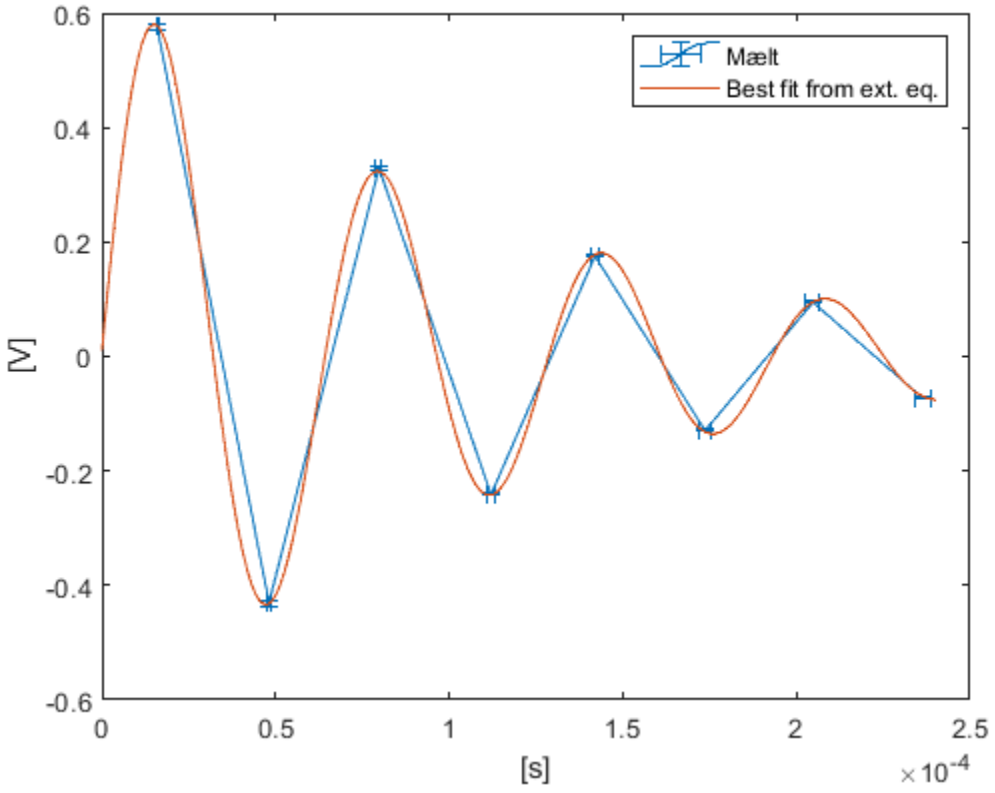
3.3

1

```
R = 110;
L = 10e-3;

t = [16 48 79.5 112 142 173.5 204.5 236.5]*1e-6;
v_r = [0.576 -0.432 0.328 -0.24 0.176 -0.128 0.096 -0.072];
terror = t.*err;
v_rerror = v_r.*err;

figure(2);

errorbar(t,v_r, v_rerror,v_rerror,terror,terror);

t_mdl = linspace(0,2.4e-4,1e5);
b = R/(2*L)

R = 110;
omega_0 = ((1/(L*C))^0.5)
omega_e = (omega_0^2-b^2)^0.5


syms A l;
eq1 = A*exp(-l*t(1))*sin(omega_0*t(1)) == v_r(1);
eq2 = A*exp(-l*t(7))*sin(omega_0*t(7)) == v_r(7);
Andl = solve([eq1 eq2], [A l]);
lambda = double(Andl.l)
A = double(Andl.A)

f2 = @(p) p(1) * sin(p(2) * t - p(3)) .* exp(-p(4) * t);
f2_mdl = @(p) p(1) * sin(p(2) * t_mdl - p(3)) .* exp(-p(4) * t_mdl);

f3 = @(p) p(1) .* sin(p(2) .* t - p(3)) .* exp(-p(4) .* t) + p(5) .*
 cos(p(6) .* t - p(7)) .* exp(p(8) .* t) + p(9);
f3_mdl = @(p) p(1) .* sin(p(2) .* t_mdl - p(3)) .* exp(-p(4) .* t_mdl) +
 p(5) .* cos(p(6) .* t_mdl - p(7)) .* exp(p(8) .* t_mdl) + p(9);

p20 = [A omega_0 0   lambda]
p30 = [A omega_0 0 lambda  0 0 0 0 0 ]
p = fminsearch(@(p) norm(f2(p) - v_r), p20)

hold on;
plot(t_mdl, f2_mdl(p));
hold off;

xlabel('[s]')
ylabel('[V]')
legend('Mælt', 'Best fit from ext. eq.')
```

b =

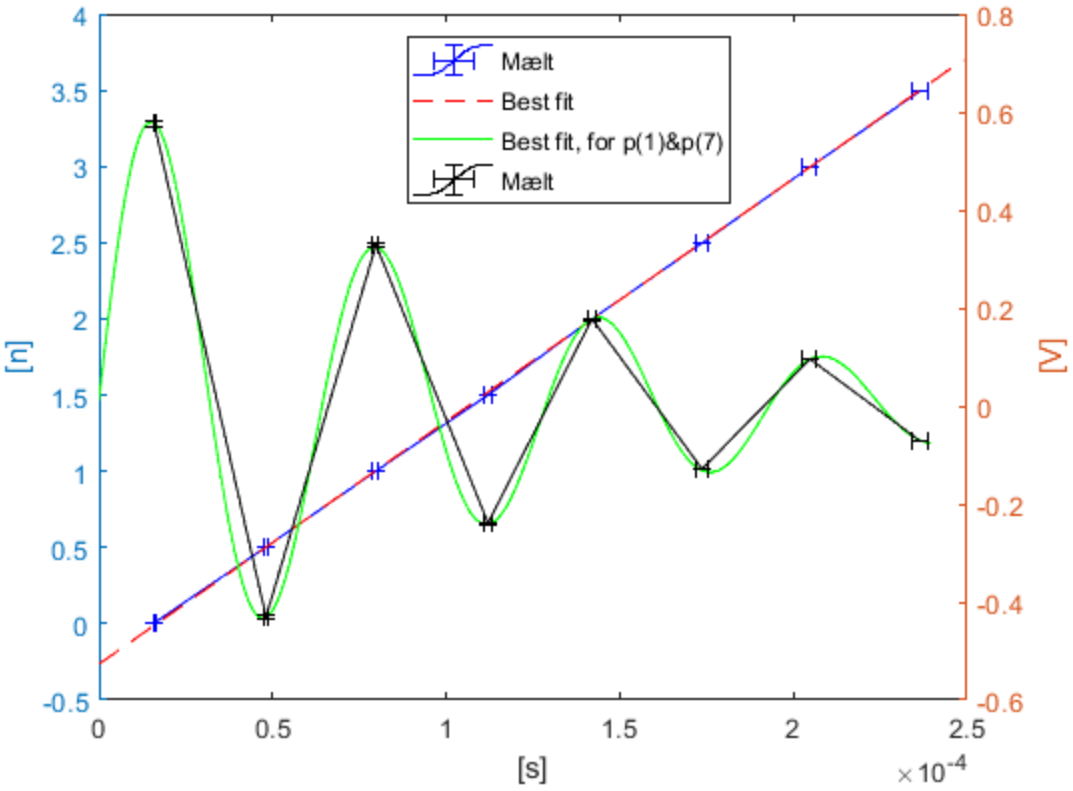
```
        5500
omega_0 =
      100000
omega_e =
   9.9849e+04
lambda =
   9.5053e+03
A =
   6.7090e-01
p20 =
   6.7090e-01   1.0000e+05            0   9.5053e+03
p30 =
  Columns 1 through 6
   6.7090e-01   1.0000e+05            0   9.5053e+03            0            0
  Columns 7 through 9
            0            0            0
p =
   6.6687e-01   9.7579e+04  -1.6271e-02   9.0503e+03
```



2

```
n = 0:0.5:3.5;
x0 = linspace(0, 2.49e-4);
y0 = polyval(polyfit(t,n,1), x0);
fig3 = figure(3);
yyaxis left
```

```
errorbar(t,n,zeros(1,8),zeros(1,8),terror,terror,'b-','LineWidth',0.1);
hold on;
plot(x0,y0,'r--', 'LineWidth', 0.1)
yyaxis right
plot(t_mdl, f2_mdl(p),'g-','LineWidth',0.1);
errorbar(t,v_r, v_rerror,v_rerror,terror,terror,'k-','LineWidth',0.1);

hold off;

yyaxis left
xlabel('[s]')
ylabel('[n]')

gca.YColor = 'k';

legend('Mælt', 'Best fit', 'Best fit, for p(1)&p(7)', 'Mælt', 'Position',[0.5
 0.7 0.1 0.2])
yyaxis right

gca.YColor = 'b';

ylabel('[V]')

n = 1:0.5:4.5;
mesOmega_e = 2*pi./t.*(n+1/4)

mesOmega_e =
  Columns 1 through 6
   4.9087e+05   2.2907e+05   1.7783e+05   1.5427e+05   1.4381e+05   1.3580e+05
  Columns 7 through 8
   1.3058e+05   1.2620e+05
```



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