

My ODE system is the follow:

```
> with(plots):EQS := diff(x[1](t), t) = 0.3437232353e-3
-0.4291176471e-4*x[1](t)-2.075*10^7*x[1](t)*exp
(-8384.652394/x[2](t)), diff(x[2](t), t) = 0.1261605882e-1
-0.3782659473e-3*x[2](t)+5.756601267*10^8*x[1](t)*exp
(-8384.652394/x[2](t))+(85951/256299174)*x[3](t), diff(x[3]
(t), t) = (85951/418300000)*x[2](t)-(85951/418300000)*x[3](t)
+(1/100)*min(0.8e-1, max(0.678e-2, 2.981921956*10^5*
(-5.643726732*10^6*(0.3505977e-1-0.4377e-2*xc[1](t)-2.11650*
10^9*xc[1](t)*exp(-8384.652394/xc[2](t))))*exp(-8384.652394/xc
[2](t))-1.522318716*10^(-17)*(3.233485456*10^6-96949.24985*xc
[2](t)+1.475412150*10^17*xc[1](t)*exp(-8384.652394/xc[2](t))
+85951.*xc[3](t))*(-96949.24985+1.237081802*10^21*xc[1](t)*
exp(-8384.652394/xc[2](t))/xc[2](t)^2)-0.4177577812e-5*xc[2]
(t)-0.1607863365e-5*xc[3](t)+0.2036583788e-2-2.878300634*
10^6*xc[1](t)*exp(-8384.652394/xc[2](t)))/(294.-1.*xc[3](t))
)*(294-x[3](t)), diff(xc[1](t), t) = 0.3437232353e-3
-0.4291176471e-4*xc[1](t)-2.075*10^7*xc[1](t)*exp
(-8384.652394/xc[2](t))+(2.445670127*10^(-24)*(8.060360632*
10^8*xc[2](t)^2-1.028509810*10^25*xc[1](t)*exp
(-8384.652394/xc[2](t)))/(xc[2](t)^2*exp(-8384.652394/xc[2]
(t)))+3.474272244*10^(-15)/exp(-8384.652394/xc[2](t)))*(x[2]
(t)-xc[2](t))-2.912779322*10^(-14)*(x[3](t)-xc[3](t))/exp
(-8384.652394/xc[2](t)), diff(xc[2](t), t) = 0.1261605882e-1
-0.3378265947e-2*xc[2](t)+5.756601267*10^8*xc[1](t)*exp
(-8384.652394/xc[2](t))+(85951/256299174)*xc[3](t)
+0.3000000000e-2*x[2](t), diff(xc[3](t), t) =
(85951/418300000)*xc[2](t)-0.5020547693e-1*xc[3](t)+(1/100)*
min(0.8e-1, max(0.678e-2, 2.981921956*10^5*(-5.643726732*
10^6*(0.3505977e-1-0.4377e-2*xc[1](t)-2.11650*10^9*xc[1](t)*
exp(-8384.652394/xc[2](t))))*exp(-8384.652394/xc[2](t))
-1.522318716*10^(-17)*(3.233485456*10^6-96949.24985*xc[2](t)
+1.475412150*10^17*xc[1](t)*exp(-8384.652394/xc[2](t))+85951.
*xc[3](t))*(-96949.24985+1.237081802*10^21*xc[1](t)*exp
(-8384.652394/xc[2](t))/xc[2](t)^2)-0.4177577812e-5*xc[2](t)
-0.1607863365e-5*xc[3](t)+0.2036583788e-2-2.878300634*10^6*xc
[1](t)*exp(-8384.652394/xc[2](t)))/(294.-1.*xc[3](t)))*(294-
xc[3](t))+0.5000000000e-1*x[3](t):
```

> TR\_EQ\_80 := 328.5763254: CA\_EQ\_80 := 1.602: TJ\_EQ\_80 :=  
310.2526970:EQS[1];#EQUATION 1

$$\frac{d}{dt} x_1(t) = 0.0003437232353 - 0.00004291176471 x_1(t) - 2.075000000 \cdot 10^7 x_1(t) e^{-\frac{8384.652394}{x_2(t)}} \quad (1)$$

> EQS[2];#EQUATION 2

$$\frac{d}{dt} x_2(t) = 0.01261605882 - 0.0003782659473 x_2(t) + 5.756601267 \cdot 10^8 x_1(t) e^{-\frac{8384.652394}{x_2(t)}} + \frac{85951}{256299174} x_3(t) \quad (2)$$

> EQS[3];#EQUATION 3

$$\frac{d}{dt} x_3(t) = \frac{85951}{418300000} x_2(t) - \frac{85951}{418300000} x_3(t) + \frac{1}{100} \min \left( 0.08, \max \left( 0.00678, \frac{1}{294. - 1. x_{c_3}(t)} \left( 2.981921956 \cdot 10^5 \left( -5.643726732 \cdot 10^6 \left( 0.03505977 - 0.004377 x_{c_1}(t) - 2.116500000 \cdot 10^9 x_{c_1}(t) e^{-\frac{8384.652394}{x_{c_2}(t)}} \right) e^{-\frac{8384.652394}{x_{c_2}(t)}} - 1.522318716 \cdot 10^{17} \left( 3.233485456 \cdot 10^6 - 96949.24985 x_{c_2}(t) + 1.475412150 \cdot 10^{17} x_{c_1}(t) e^{-\frac{8384.652394}{x_{c_2}(t)}} + 85951. x_{c_3}(t) \right) \right) \left( -96949.24985 + \frac{1.237081802 \cdot 10^{21} x_{c_1}(t) e^{-\frac{8384.652394}{x_{c_2}(t)}}}{x_{c_2}(t)^2} \right) - 0.000004177577812 x_{c_2}(t) \right) \right) \right) \quad (3)$$

$$- 0.000001607863365 x_{C_3}(t) + 0.002036583788$$

$$- 2.878300634 \cdot 10^6 x_{C_1}(t) e^{-\frac{8384.652394}{x_{C_2}(t)}} \left. \right) \left. \right) \left. \right) (294 - x_3(t))$$

> EQS[4]; #EQUATION 4

$$\frac{d}{dt} x_{C_1}(t) = 0.0003437232353 - 0.00004291176471 x_{C_1}(t) \quad (4)$$

$$- 2.075000000 \cdot 10^7 x_{C_1}(t) e^{-\frac{8384.652394}{x_{C_2}(t)}} + \left( \frac{1}{x_{C_2}(t)^2 e^{-\frac{8384.652394}{x_{C_2}(t)}}} \left( 2.445670127 \cdot 10^{-24} \left( 8.060360632 \cdot 10^8 x_{C_2}(t)^2 - 1.028509810 \cdot 10^{25} x_{C_1}(t) e^{-\frac{8384.652394}{x_{C_2}(t)}} \right) + \frac{3.474272244 \cdot 10^{-15}}{e^{-\frac{8384.652394}{x_{C_2}(t)}}} \right) (x_2(t) - x_{C_2}(t)) - \frac{2.912779322 \cdot 10^{-14} (x_3(t) - x_{C_3}(t))}{e^{-\frac{8384.652394}{x_{C_2}(t)}}} \right)$$

> EQS[5]; #EQUATION 5

$$\frac{d}{dt} x_{C_2}(t) = 0.01261605882 - 0.003378265947 x_{C_2}(t) \quad (5)$$

$$+ 5.756601267 \cdot 10^8 x_{C_1}(t) e^{-\frac{8384.652394}{x_{C_2}(t)}} + \frac{85951}{256299174} x_{C_3}(t) + 0.003000000000 x_2(t)$$

> EQS[6]; #EQUATION 6

$$\frac{d}{dt} x_{C_3}(t) = \frac{85951}{418300000} x_{C_2}(t) - 0.05020547693 x_{C_3}(t) + \frac{1}{100} \min \left( 0.08, \quad (6)$$

$$\max \left( 0.00678, \frac{1}{294 - 1 \cdot x_{C_3}(t)} \left( 2.981921956 \cdot 10^5 \left( \right. \right. \right)$$

$$\begin{aligned}
& -5.643726732 \cdot 10^6 \left( 0.03505977 - 0.004377 x_{C_1}(t) \right. \\
& \left. - 2.116500000 \cdot 10^9 x_{C_1}(t) e^{-\frac{8384.652394}{x_{C_2}(t)}} \right) e^{-\frac{8384.652394}{x_{C_2}(t)}} \\
& - 1.522318716 \cdot 10^{-17} \left( 3.233485456 \cdot 10^6 - 96949.24985 x_{C_2}(t) \right. \\
& \left. + 1.475412150 \cdot 10^{17} x_{C_1}(t) e^{-\frac{8384.652394}{x_{C_2}(t)}} + 85951 \cdot x_{C_3}(t) \right) \left( -96949.24985 \right. \\
& \left. + \frac{1.237081802 \cdot 10^{21} x_{C_1}(t) e^{-\frac{8384.652394}{x_{C_2}(t)}}}{x_{C_2}(t)^2} \right) - 0.000004177577812 x_{C_2}(t) \\
& - 0.000001607863365 x_{C_3}(t) + 0.002036583788 \\
& - 2.878300634 \cdot 10^6 x_{C_1}(t) e^{-\frac{8384.652394}{x_{C_2}(t)}} \left. \left. \left. \left. \right) \right) \right) \right) (294 - x_{C_3}(t)) \\
& + 0.05000000000 x_{C_3}(t)
\end{aligned}$$

```

> Cond_iniz:=
  x[1](0)=0,

  x[2](0)=294,

  x[3](0)=294,

  xc[1](0)=CA_EQ_80,

  xc[2](0)=TR_EQ_80,

  xc[3](0)=TJ_EQ_80;#INITIAL VALUE

```

$Cond\_iniz := x_1(0) = 0, x_2(0) = 294, x_3(0) = 294, x_{c1}(0) = 1.602, x_{c2}(0) = 328.5763254, x_{c3}(0) = 310.2526970$

(7)

```

> tempo:=80000:
  soluzione:=dsolve(
    {seq(EQS[i],i=1..6),Cond_iniz},
    {x[1](t),
     x[2](t),
     x[3](t),
     xc[1](t),
     xc[2](t),
     xc[3](t)},
    type=numeric,

    method = rkf45,

    maxfun=50000,

    abserr=Float(1,-10),

    relerr=Float(1,-10),

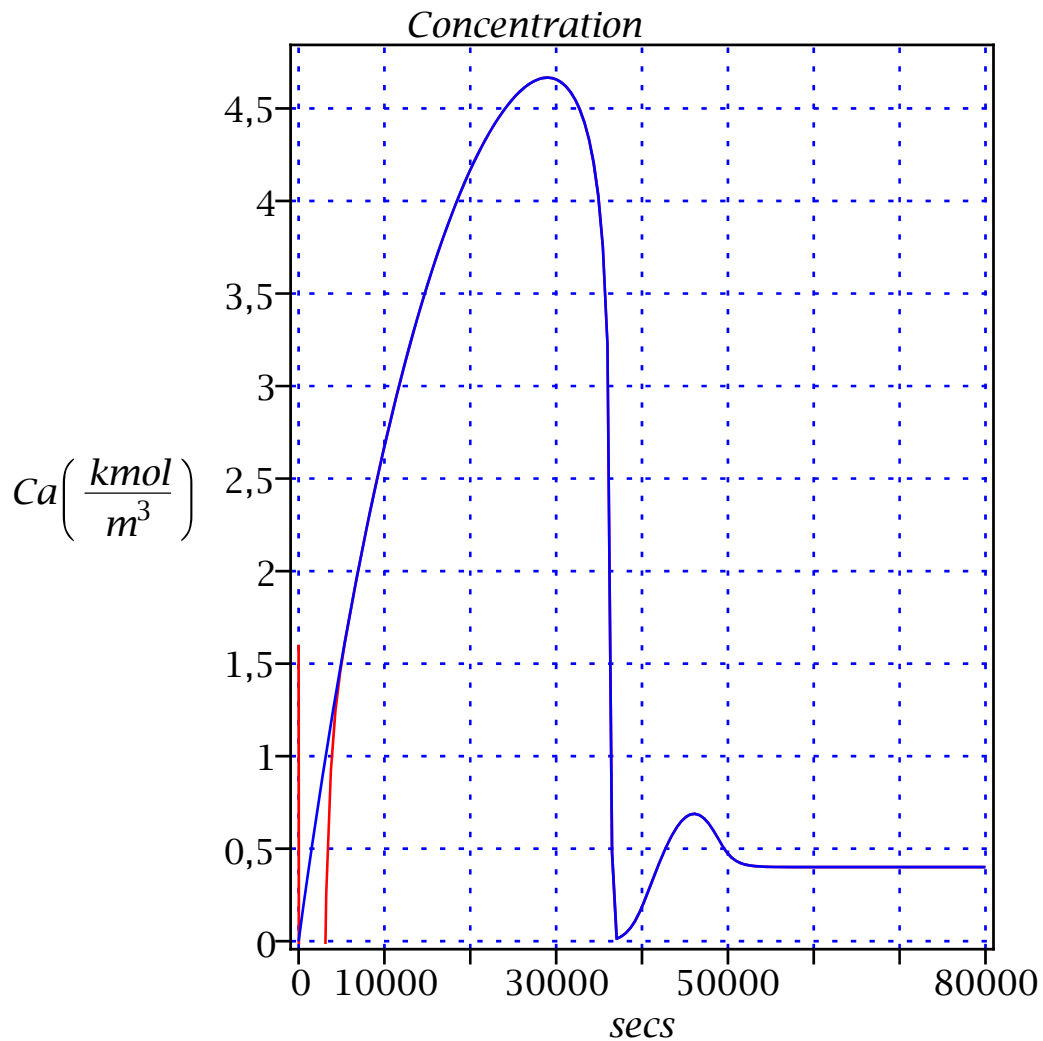
    output=listprocedure):

```

```

> ics1:=odeplot(soluzione,
[t,x[1](t)],
0..tempo,
numpoints=150,
color = blue):
ics1cap:=odeplot(soluzione,
[t,xc[1](t)],
0..tempo, numpoints=150):
display({ics1,ics1cap},
axes = boxed,
labels=[secs, Ca(kmol/m^3)],
title = `Concentration`,
view=[0..tempo, 0..4.8],
axis = [gridlines = [10, linestyle=dot,thickness=1,color =
blue]]);

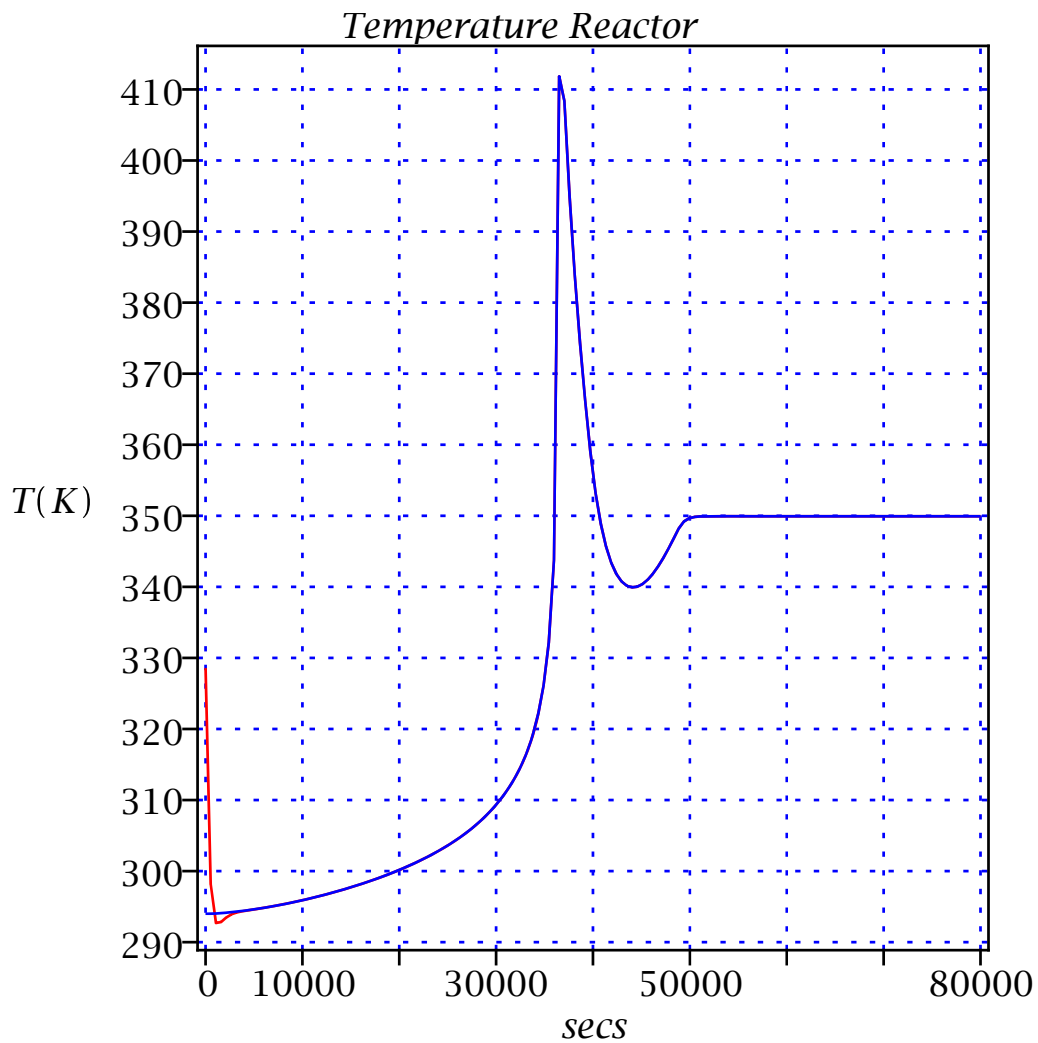
```



```

> ics2:=odeplot(soluzione,
  [t,x[2](t)],
  0..tempo,
  numpoints=150,
  color = blue):
ics2cap:=odeplot(soluzione,
  [t,xc[2](t)],
  0..tempo,
  numpoints=150):
display({ics2cap,ics2},
  axes = boxed,
  labels=[secs, T (K)],
  title = `Temperature Reactor`,
  view=[0..tempo, 290..415],
  axis = [gridlines = [10, linestyle=dot,thickness=1,color =
  blue]]);

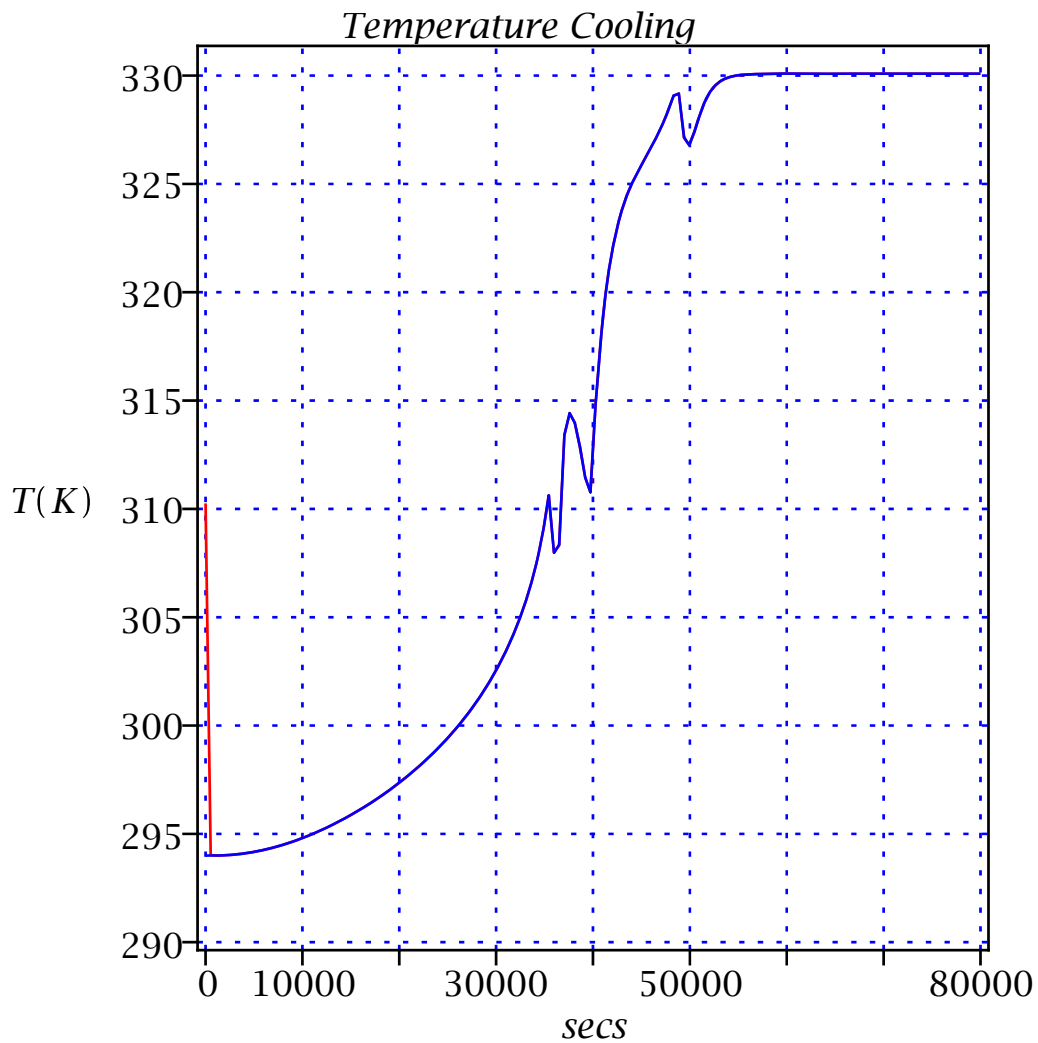
```



```

> ics3:=odeplot(soluzione,
  [t,x[3](t)],
  0..tempo,
  numpoints=150,
  color = blue):
ics3cap:=odeplot(soluzione,
  [t,xc[3](t)],
  0..tempo,
  numpoints=150):
display({ics3,ics3cap},
  axes = boxed,
  labels=[secs, T (K)],
  title = `Temperature Cooling`,
  view=[0..tempo, 290..331],
  axis = [gridlines = [10, linestyle=dot,thickness=1,color =
  blue]]);

```





**The problem is that i want graphics this function:**

```
> EQ7 := min(0.8e-1, max(0.678e-2, 2.981921956*10^5*
(-5.643726732*10^6*(0.3505977e-1-0.4377e-2*xc[1](t))-2.11650*
10^9*xc[1](t)*exp(-8384.652394/xc[2](t)))*exp(-8384.652394/xc
[2](t))-1.522318716*10^(-17)*(3.233485456*10^6-96949.24985*xc
[2](t)+1.475412150*10^17*xc[1](t)*exp(-8384.652394/xc[2](t))
+85951.*xc[3](t))*(-96949.24985+1.237081802*10^21*xc[1](t)*
exp(-8384.652394/xc[2](t))/xc[2](t)^2)-0.4177577812e-5*xc[2]
(t)-0.1607863365e-5*xc[3](t)+0.1908377658e-2-2.878300634*
10^6*xc[1](t)*exp(-8384.652394/xc[2](t)))/(294.-1.*xc[3](t))
):u=EQ7;
```

$$u = \min \left( 0.08, \max \left( 0.00678, \frac{1}{294. - 1. x_{c_3}(t)} \left( 2.981921956 \cdot 10^5 \right. \right. \right. \right. \quad (8)$$

$$\left. \left. \left. \left. -5.643726732 \cdot 10^6 \left( 0.03505977 - 0.004377 x_{c_1}(t) \right. \right. \right. \right. \right.$$

$$\left. \left. \left. \left. -2.116500000 \cdot 10^9 x_{c_1}(t) e^{-\frac{8384.652394}{x_{c_2}(t)}} \right) e^{-\frac{8384.652394}{x_{c_2}(t)}} \right. \right. \right.$$

$$\left. \left. \left. \left. -1.522318716 \cdot 10^{-17} \left( 3.233485456 \cdot 10^6 - 96949.24985 x_{c_2}(t) \right. \right. \right. \right.$$

$$\left. \left. \left. \left. + 1.475412150 \cdot 10^{17} x_{c_1}(t) e^{-\frac{8384.652394}{x_{c_2}(t)}} + 85951. x_{c_3}(t) \right) \right) \left( -96949.24985 \right. \right.$$

$$\left. \left. \left. \left. + \frac{1.237081802 \cdot 10^{21} x_{c_1}(t) e^{-\frac{8384.652394}{x_{c_2}(t)}}}{x_{c_2}(t)^2} \right) \right) - 0.000004177577812 x_{c_2}(t) \right.$$

$$\left. \left. \left. \left. - 0.000001607863365 x_{c_3}(t) + 0.001908377658 \right. \right. \right. \right.$$

$$\left. \left. \left. \left. - 2.878300634 \cdot 10^6 x_{c_1}(t) e^{-\frac{8384.652394}{x_{c_2}(t)}} \right) \right) \right) \right)$$

**with  $x_{c_1}(t), x_{c_2}(t), x_{c_3}(t)$  present in SOLUZIONE**

