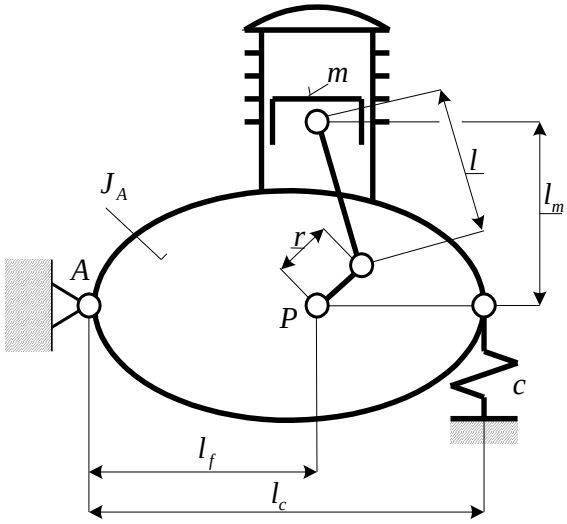
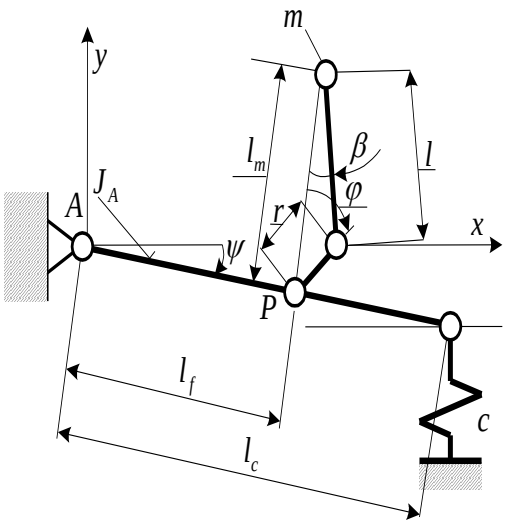
GÉPEK DINAMIKÁJA 8.gyak.hét – 1. Feladat

(kidolgozta: Dr. Nagy Zoltán egyetemi adjunktus)

8.gyak.hét – 1. feladat: RUGALMASAN ÁGYAZOTT EGYHENGERES MOTOR REZGÉSEI
Megoldás: ANALÓG MODELL



Egyhengeres motor rugalmasan megtámasztva



Egyhengeres motor kinematikai vázlata

Mozgásegyenlet: $\underbrace{\left[J_{Az} + m\left(l_f^2 + l^2 + \frac{r^2}{2}\right)\right]}_{J_{red}}\ddot{\psi} + \frac{l_c^2\psi}{c} = -m l_f r \Omega^2 \cos\Omega t$,

$$\ddot{y}_P = -\frac{l_c^2}{c\,J_{red}}\,y_P - \frac{m l_f^2 r}{J_{red}}\,\Omega^2 \cos\Omega t\,.$$

α^2

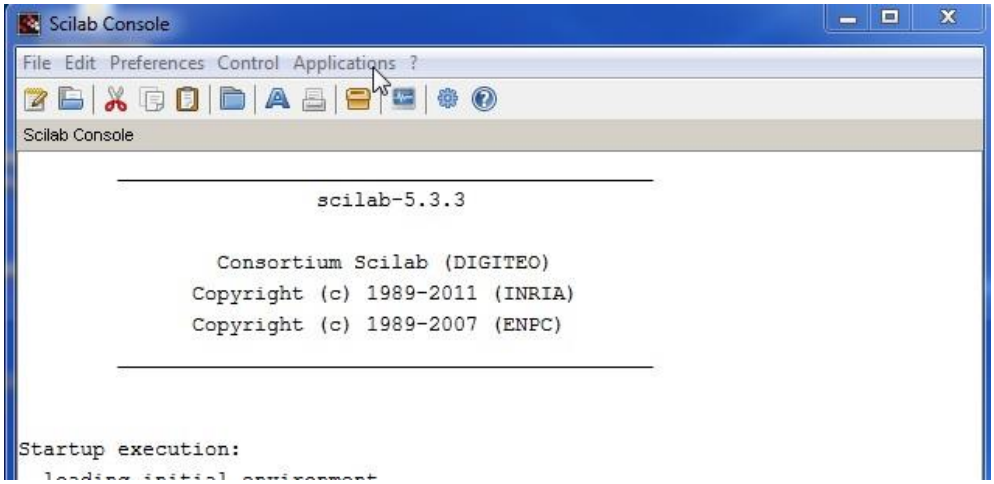
Csillapítást is figyelembe véve: $\ddot{y}_P = -2\alpha\zeta\,\dot{y}_P - \alpha^2 y_P - \frac{m l_f^2 r}{J_{red}}\,\Omega^2 \cos\Omega t\,.$

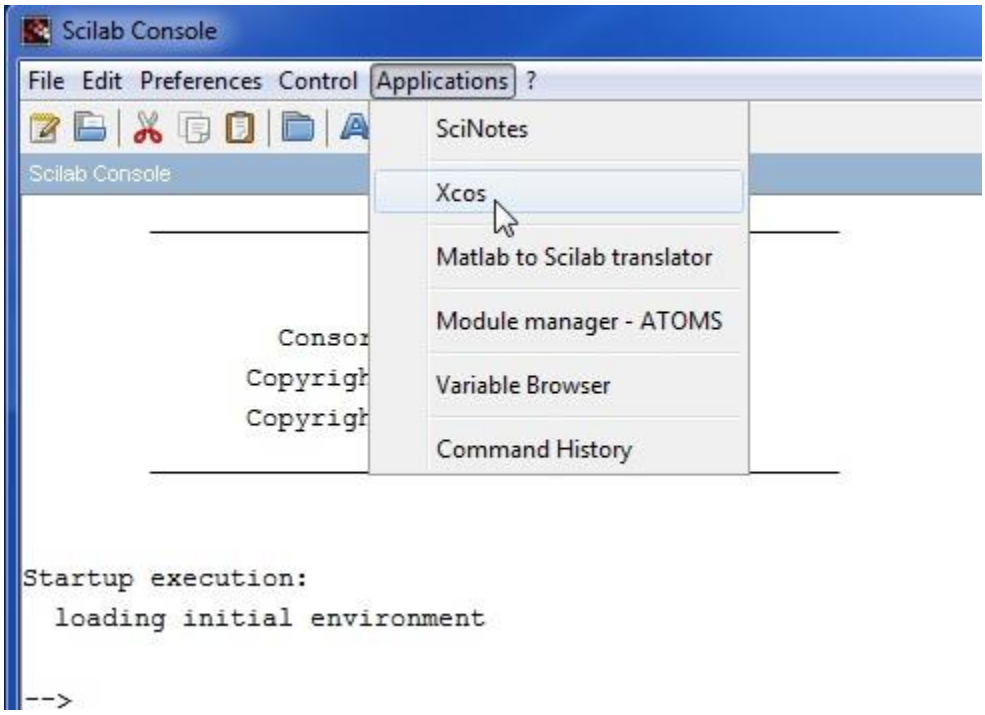
($\zeta = 0{,}1$ deformációból származó anyagcsillapítás)

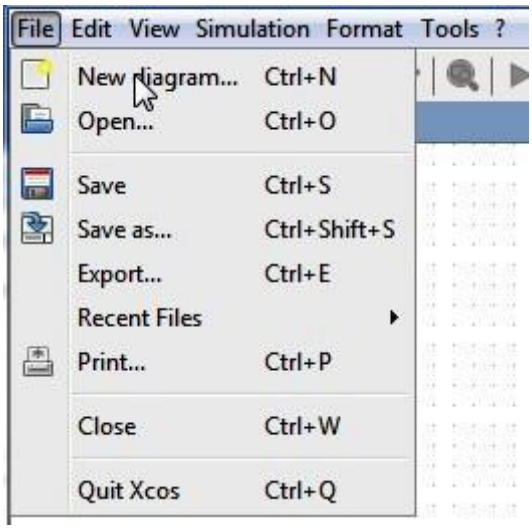
Az egyhengeres motor alapjárati fordulatszáma $n_{\min} = 1000\ ford/min$, maximális fordulatszáma pedig $n_{\max} = 5000\ ford/min$. Határozza meg a motor felfüggesztését biztosító rugó $c\left(m/N\right)$ rugóállandóját úgy, hogy a motor főtengelyének $\left(P\ pont\right)$ függőleges irányú kitérése $\pm\,1\ mm$ nagyságú sávban maradjon mindkét fordulatszám esetén!

A konkrét adatok és az előzetes elméleti számítások után két lehetőség adódik: $c_1 = 0{,}00281\ N/m$ (lágyabb rugó) és $c_2 = 0{,}000102\ N/m$ (keményebb rugó).

Határozza meg melyik rugó beépítése esetén teljesíthető az előírt feltétel!


Scilab Console
File Edit Preferences Control Applications ?
Scilab Console
scilab-5.3.3
Consortium Scilab (DIGITEO)
Copyright (c) 1989-2011 (INRIA)
Copyright (c) 1989-2007 (ENPC)
Startup execution:


Scilab Console
File Edit Preferences Control Applications ?
Scilab Console
SciNotes
Xcos
Matlab to Scilab translator
Module manager - ATOMS
Variable Browser
Command History
Startup execution:
loading initial environment
-->


File Edit View Simulation Format Tools ?
New diagram... Ctrl+N
Open... Ctrl+O
Save Ctrl+S
Save as... Ctrl+Shift+S
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Recent Files
Print... Ctrl+P
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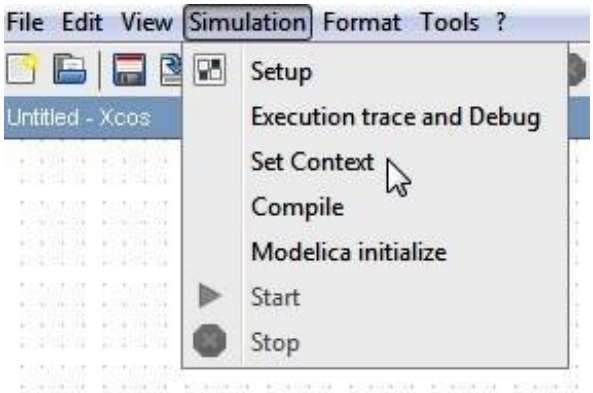
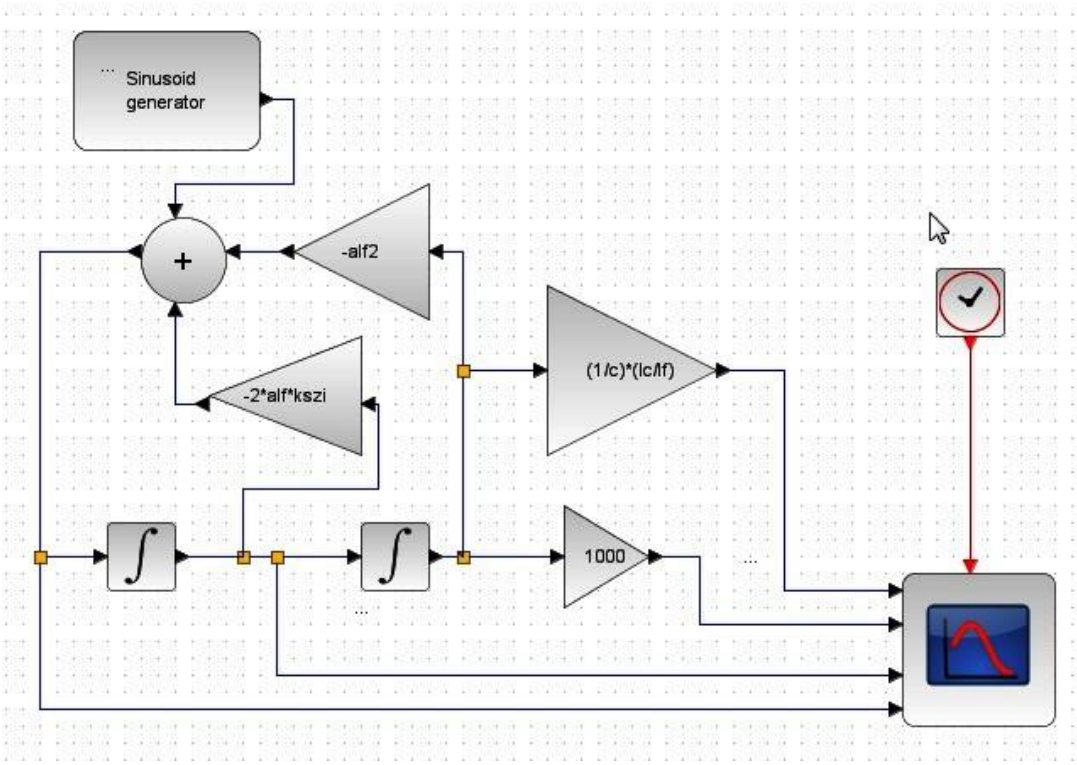
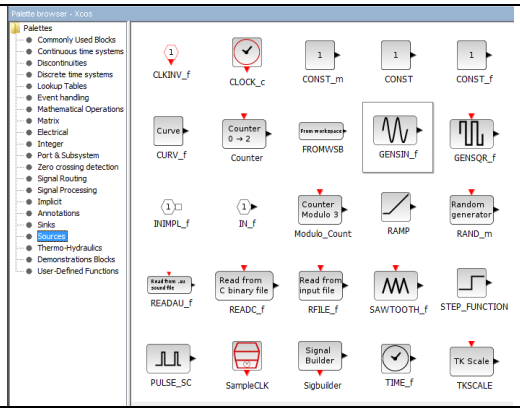
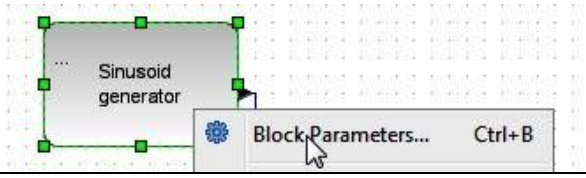

File Edit View Simulation Format Tools ?
Untitled - Xcos
Setup
Execution trace and Debug
Set Context
Compile
Modelica initialize
Start
Stop

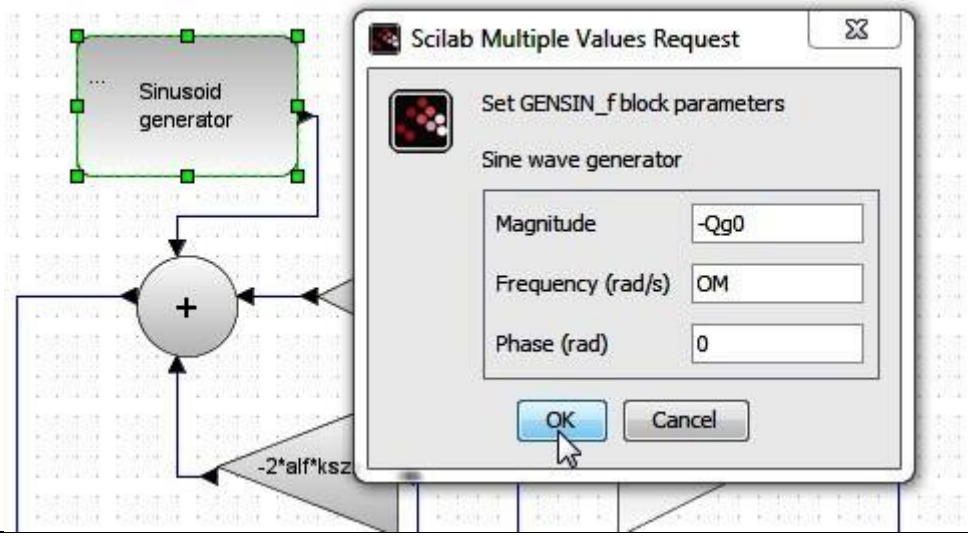
Set Context
You may enter here scilab instructions to define symbolic parameters used in block definitions usin
These instructions are evaluated once confirmed.(i.e. you click on OK, by Eval and every time dia
// GEOMETRIAI ADATOK
lc=0.35; lf=0.19; r=0.03; l=0.12; // (m)
// TÖMEG ADATOK
m=0.5; // (kg)
// TEHETETLENSÉGINYOMATÉK ADATOK
JAZ=0.52;
Jred=JAZ+m*(lf^2+l^2+r^2/2); // (kgm^2)
// Lehr-féle csillapítási tényező
ksi=0.1;
// FORDULATSZÁMOK
// ALAPJÁRATI FORDULATSZÁM: nmin
n_min=1000; // (ford/min)
om_min=(2*%pi*n_min)/60; // (rad/s)
// MAXIMÁLIS FORDULATSZÁM: nmax
n_max=5000; // (ford/min)
om_max=(2*%pi*n_max)/60; // (rad/s)
// Fordulatszám választás
//OM=om_min;
OM=om_max;
// RUGÓÁLLANDÓK
c1=0.00281; // (m/N), lágyabb rugó
c2=0.000112; // (m/N), keményebb rugó
// RUGÓÁLLANDÓ VÁLASZTÁS
c=c1;
// A csillapítatlan rezgés saját körfrekvencia négyzete
alf2=lc^2/(c*Jred); // (rad^2/s^2)
// A csillapítatlan rezgés saját körfrekvenciája
alf=sqrt(alf2); // (rad/s)
// GERJESZTÉS AMPLITÚDÓJA
Qg0=(m*lf^2*r*OM^2)/Jred; // (N)
Ok

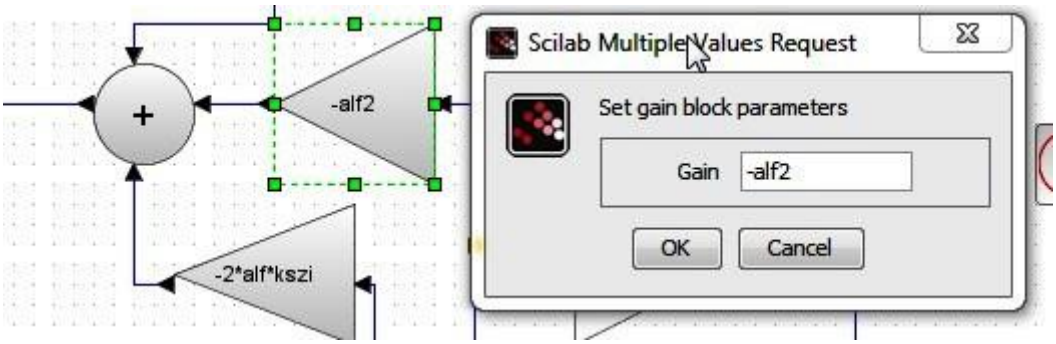
Az analóg modell megrajzolása és az egyes műveleti erősítők bemenő adatrendszerének megadása:

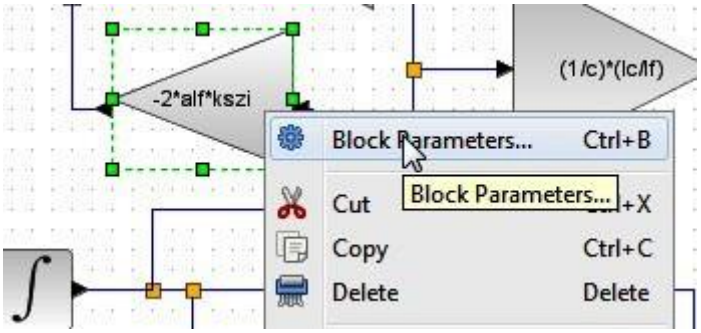









-alf2
-2*alf*kszi
Scilab Multiple Values Request
Set gain block parameters
Gain
-alf2
OK
Cancel


-2*alf*kszi
(1/c)*(lc/lf)
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Block Parameters...
Cut
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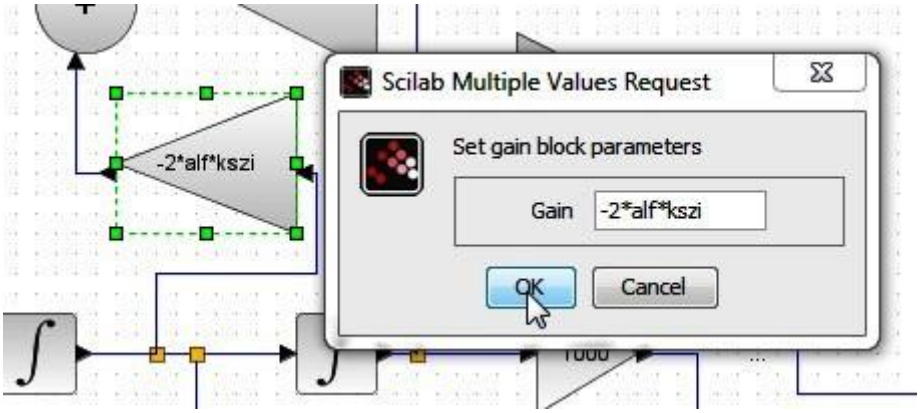
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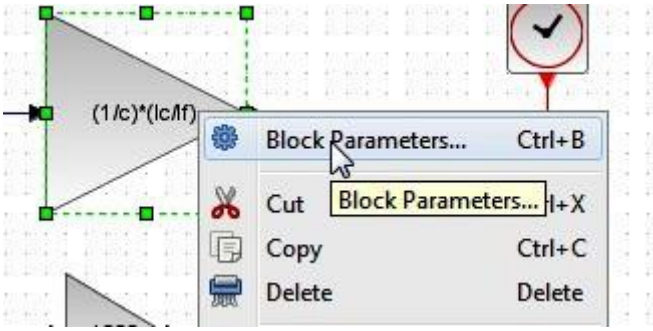
Scilab Multiple Values Request
Set gain block parameters
Gain
-2*alf*kszi
OK
Cancel


(1/c)*(lc/lf)
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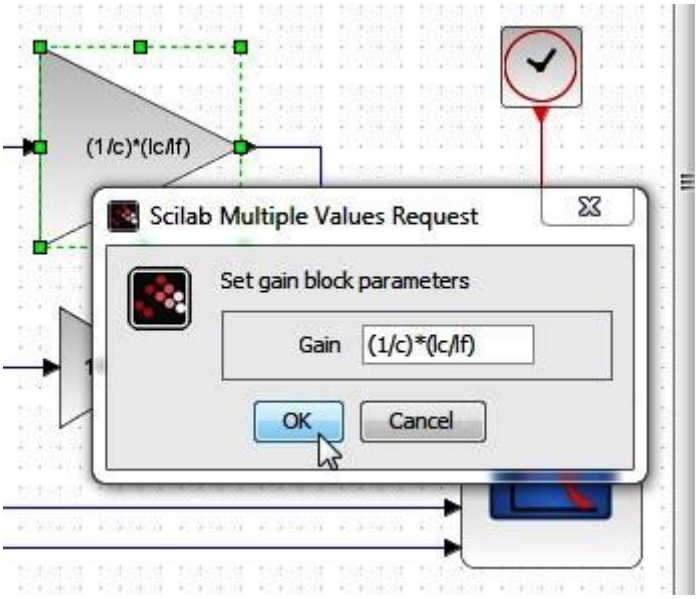
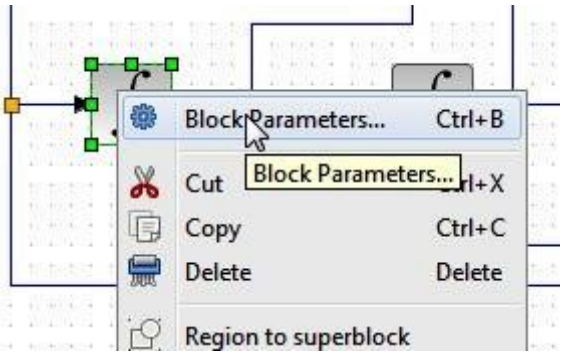

(1/c)*(lc/lf)
Scilab Multiple Values Request
Set gain block parameters
Gain
(1/c)*(lc/lf)
OK
Cancel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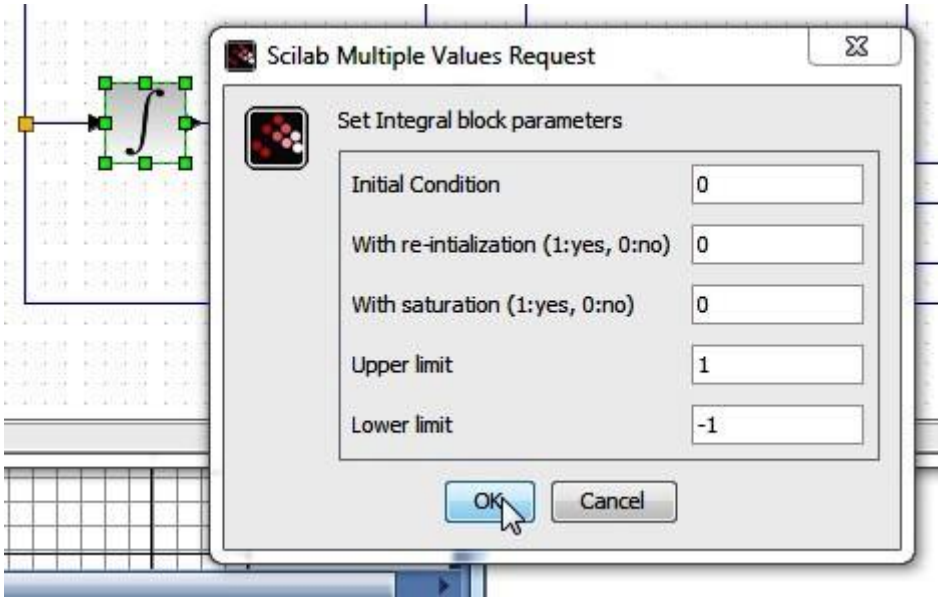
Region to superblock


Scilab Multiple Values Request
Set Integral block parameters
Initial Condition
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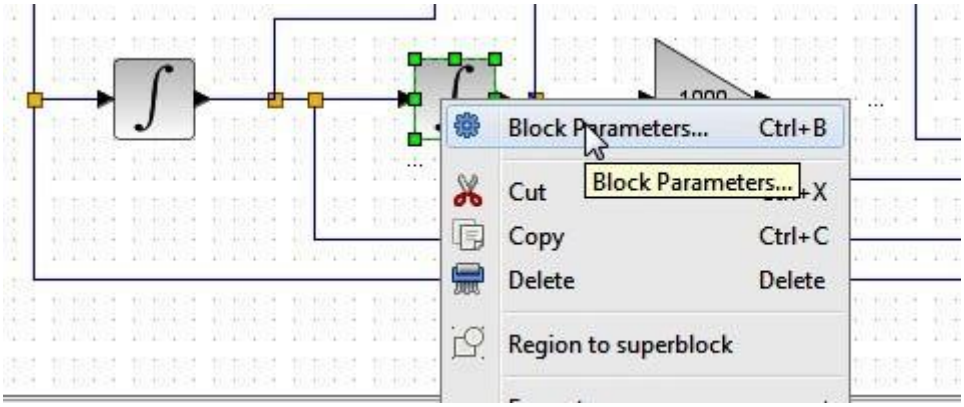
With re-intialization (1:yes, 0:no)
0
With saturation (1:yes, 0:no)
0
Upper limit
1
Lower limit
-1
OK
Cancel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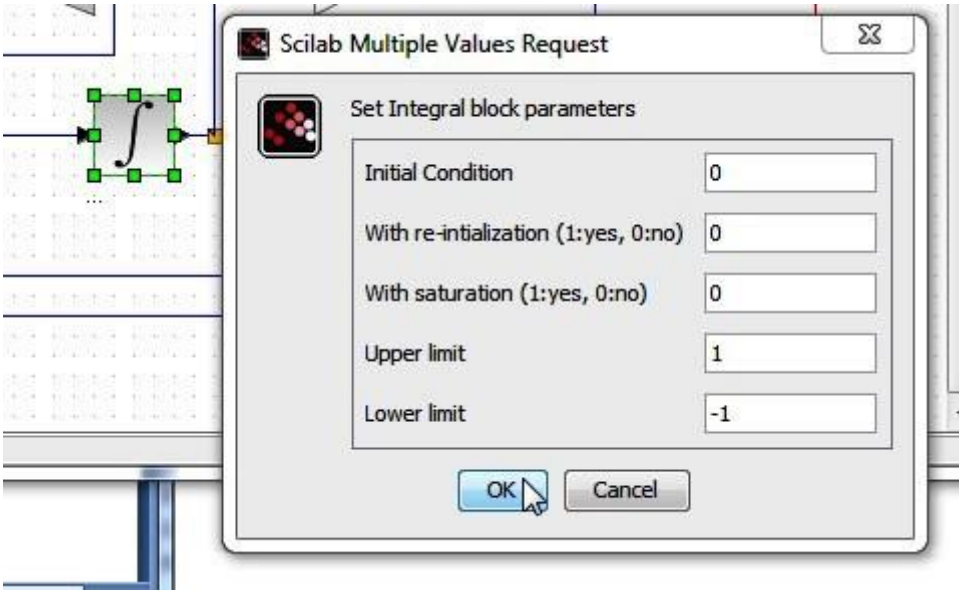
Region to superblock


Scilab Multiple Values Request
Set Integral block parameters
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With re-intialization (1:yes, 0:no) 0
With saturation (1:yes, 0:no) 0
Upper limit 1
Lower limit -1
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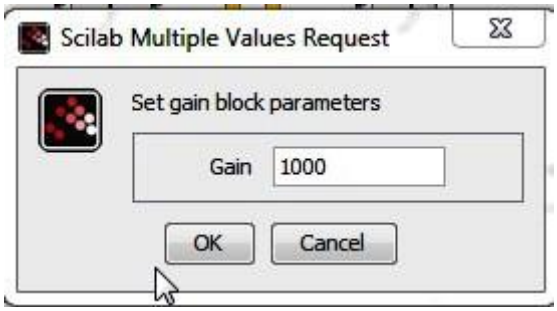
Cancel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Gain 1000
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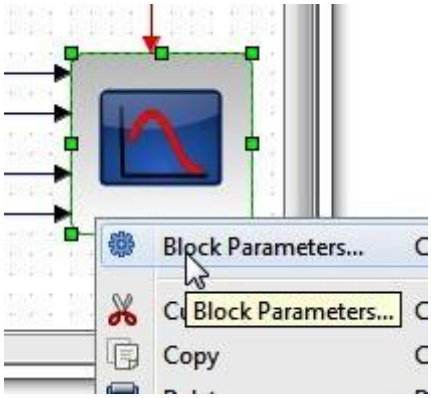
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Block Parameters...
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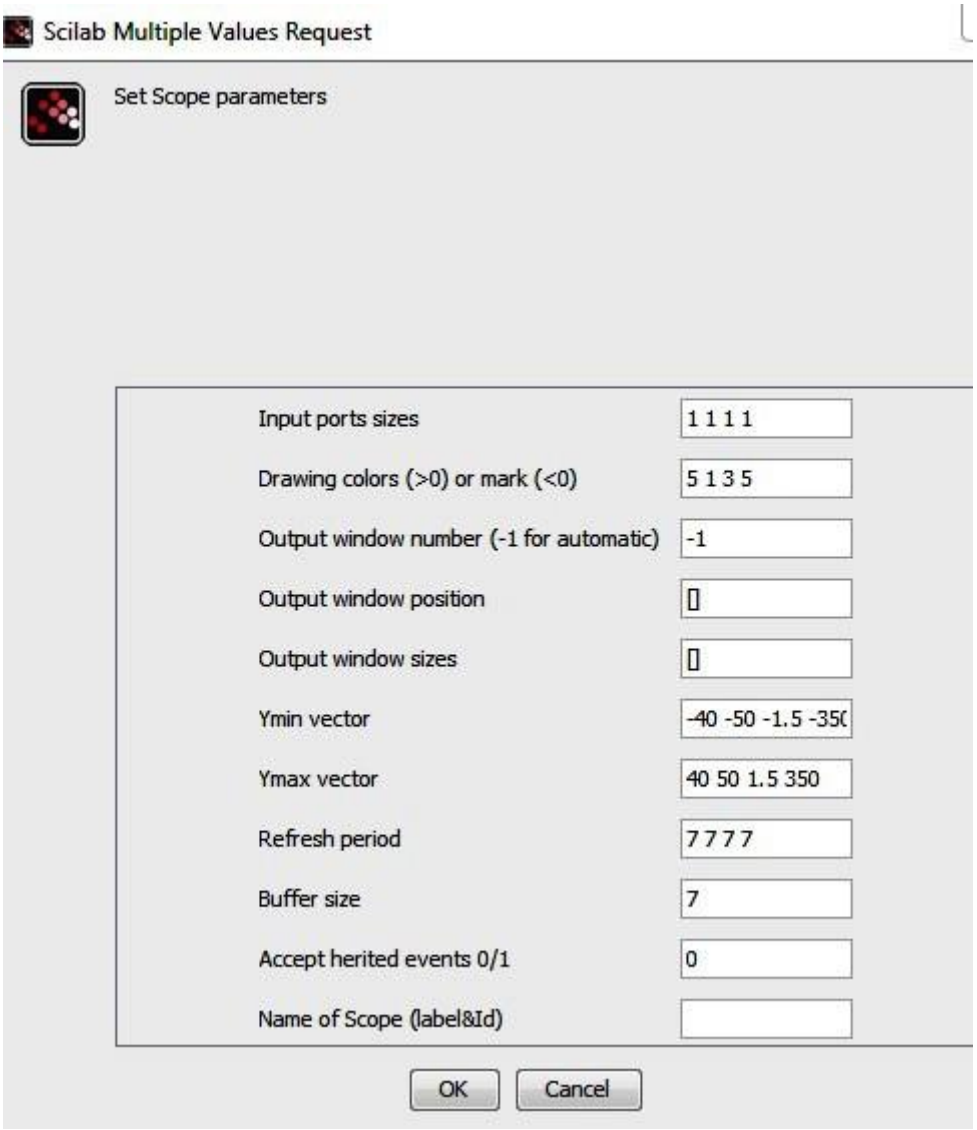
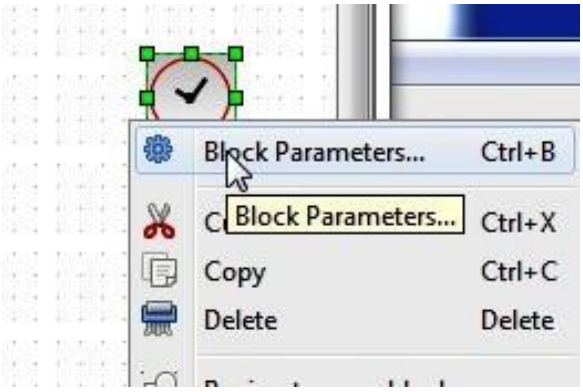

Scilab Multiple Values Request
Set Scope parameters
Input ports sizes
1 1 1 1
Drawing colors (>0) or mark (<0)
5 1 3 5
Output window number (-1 for automatic)
-1
Output window position
[]
Output window sizes
[]
Ymin vector
-40 -50 -1.5 -35(
Ymax vector
40 50 1.5 350
Refresh period
7 7 7 7
Buffer size
7
Accept herited events 0/1
0
Name of Scope (label&Id)
OK
Cancel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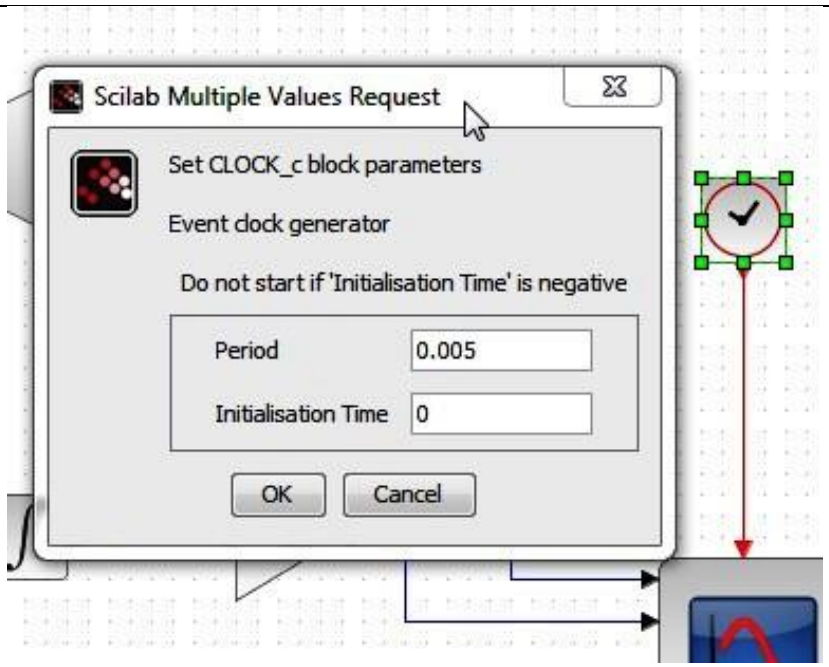
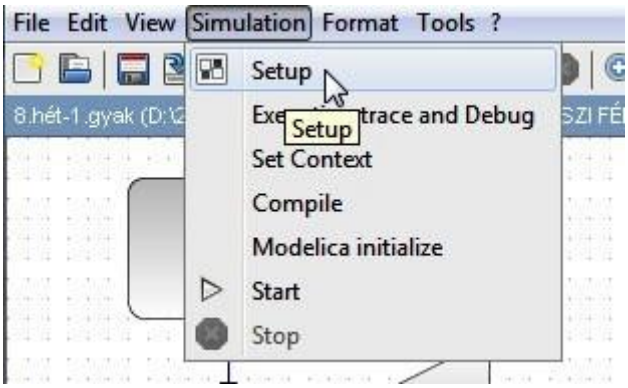
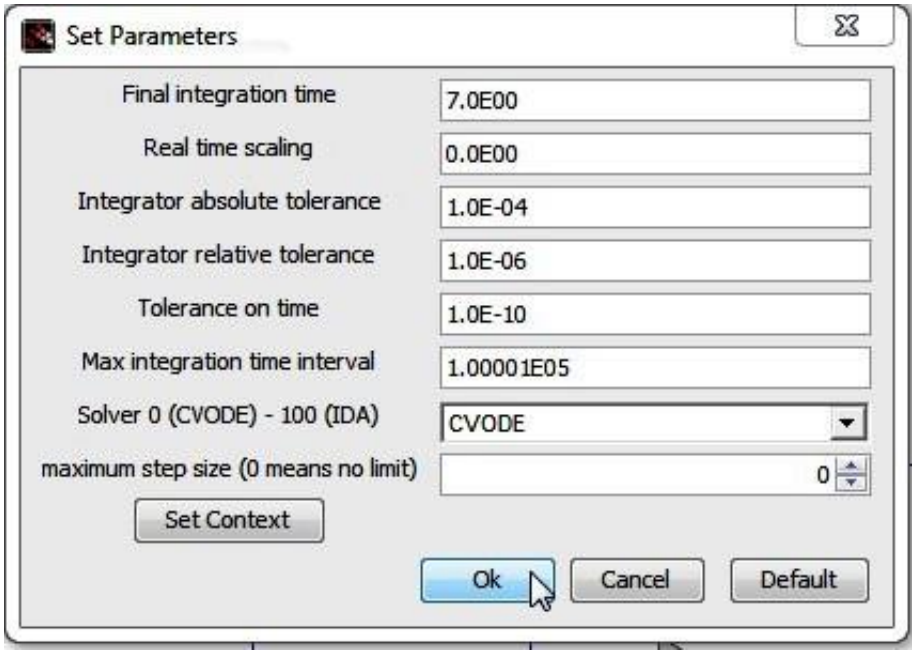
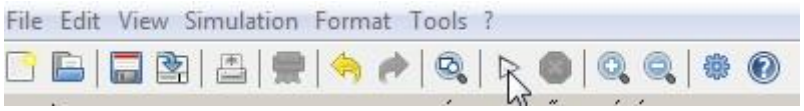
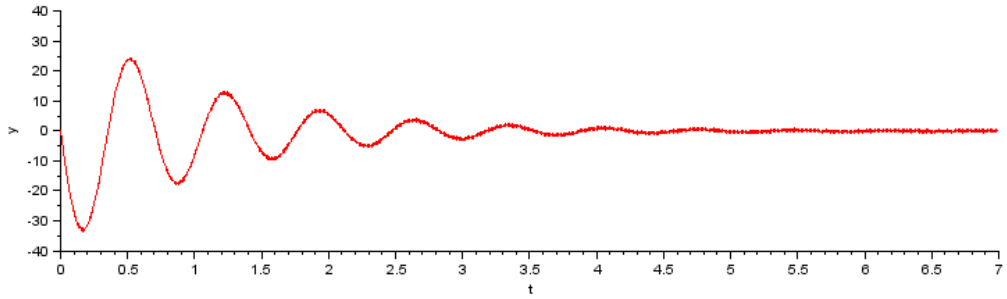
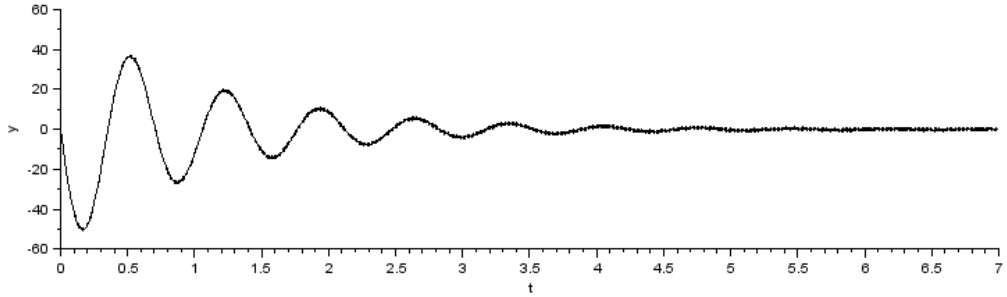
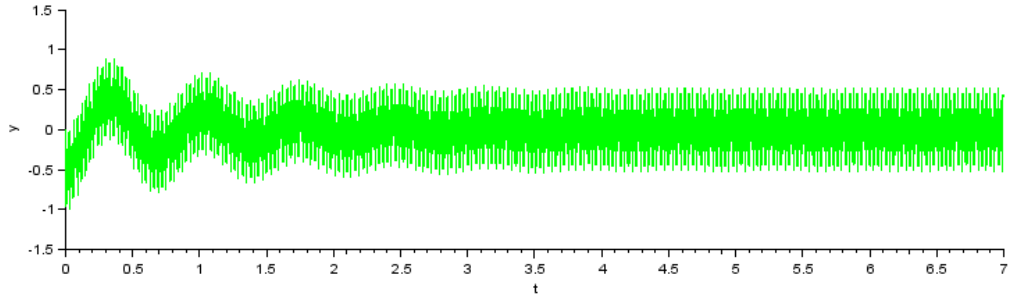
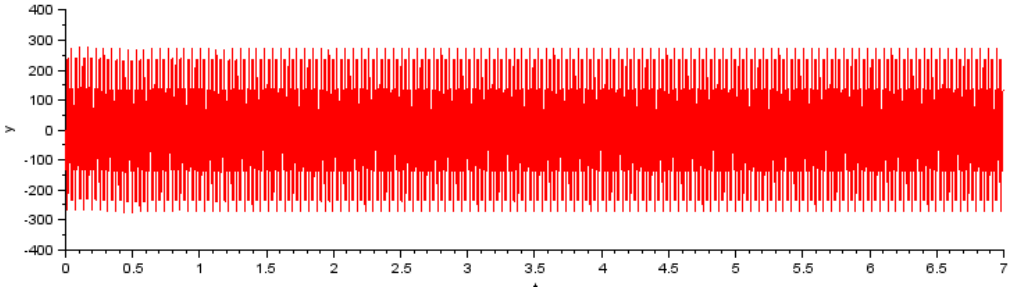




Integrálási időhossz beállítása: t= 7 s



Program futtatása