Le modèle à courant continu

Modélisation causale

MCC : équations

$$u(t) = e(t) + R \cdot i(t) + L \frac{di(t)}{dt}$$
$$e(t) = K_e \omega_m(t)$$
$$J \frac{d\omega_m(t)}{dt} = C_m(t) - C_r(t) - f\,\omega_m(t)$$
$$C_m(t) = K_m \cdot i(t)$$

$u(t)$ = tension appliquée aux bornes du moteur [V]
$e(t)$ = force électromotrice [V]
$i(t)$ = le courant [A]
$C_m(t)$ = le couple moteur [N.m]
$C_r(t)$ = le couple résistant [N.m]
$\omega_m(t)$ = la vitesse de rotation du moteur [rad/s]
R = la résistance des armatures du moteur [Ω]
L = l'inductance des armatures du moteur [H]
J = l'inertie du moteur [kg.m^2]
f = coefficient de frottement [N.m.s]
K_m = constante du couple moteur [N.m/A]
K_e =constante de force électromotrice [V.s/rad]

Les équations dans l'espace de Laplace

$$f(t) \rightarrow F(s)$$

La transformée de Laplace et la dérivée :

$$f'(t) \rightarrow zF(s) - f(0)$$

Grandeur	$u(t)$	$i(t)$	$e(t)$	$\omega(t)$	$C_m(t)$	$C_r(t)$
Transformée de Laplace	U	I	E	Ω	$F(C_m)$	$F(C_r)$

Tableau 1

$$u(t) = e(t) + R \cdot i(t) + L \frac{di(t)}{dt}$$
$$e(t) = K_e \omega_m(t)$$
$$J \frac{d\omega_m(t)}{dt} = C_m(t) - C_r(t) - f\,\omega_m(t)$$
$$C_m(t) = K_m \cdot i(t)$$

$$U = E + RI + sL \cdot (I + i(0))$$
$$E = K_e \Omega$$
$$sJ\Omega - J\,\omega_m(0) = F(C_m) - F(C_r) - f\,\Omega$$
$$F(C_m) = K_m I$$

$$U = E + RI + sL \cdot (I + i(0))$$
$$E = K_e \Omega$$
$$sJ\Omega - J\,\omega_m(0) = F(C_m) - F(C_r) - f\,\Omega$$
$$F(C_m) = K_m I$$

$$(U - E)\frac{1}{Ls + R} = I$$
$$E = K_e \Omega$$
$$(F(C_m) - F(C_r))\frac{1}{Js + f} = \Omega$$
$$F(C_m) = K_m I$$

$$(U-E)\frac{1}{Ls+R}=I$$

$$E=K_e\Omega$$

$$(F(C_m)-F(C_r))\frac{1}{Js+f}=\Omega$$

$$F(C_m)=K_m I$$

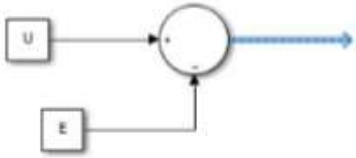
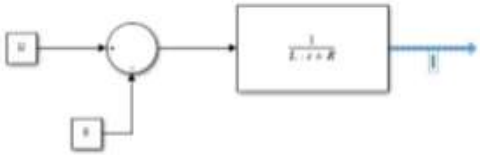
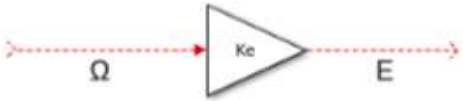
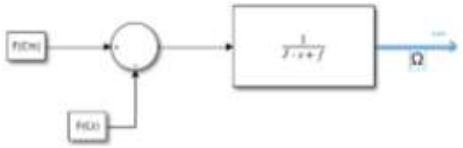
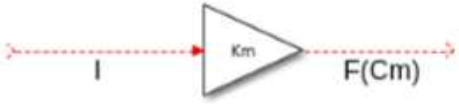
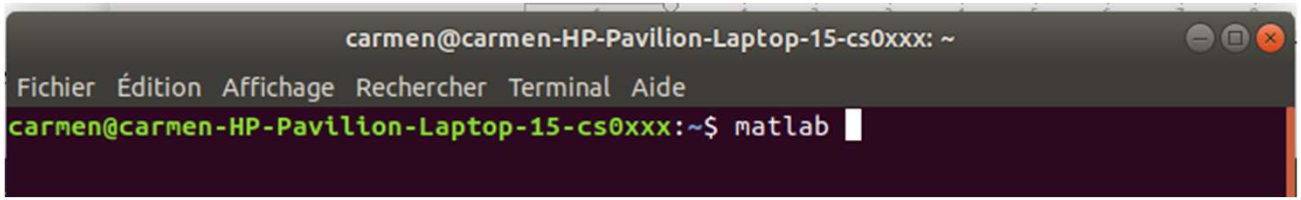
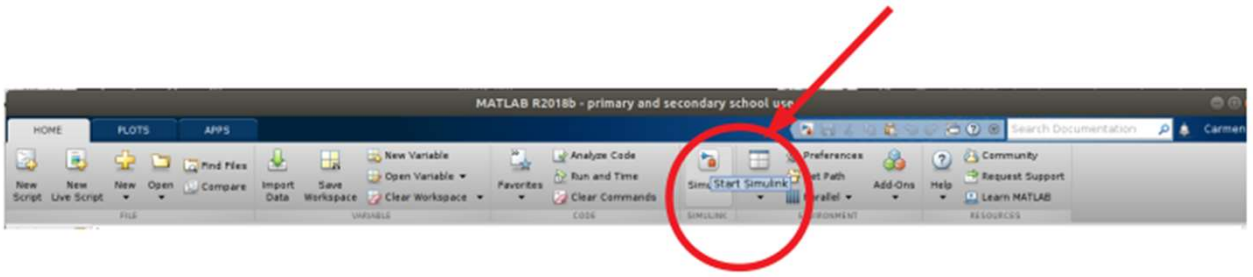
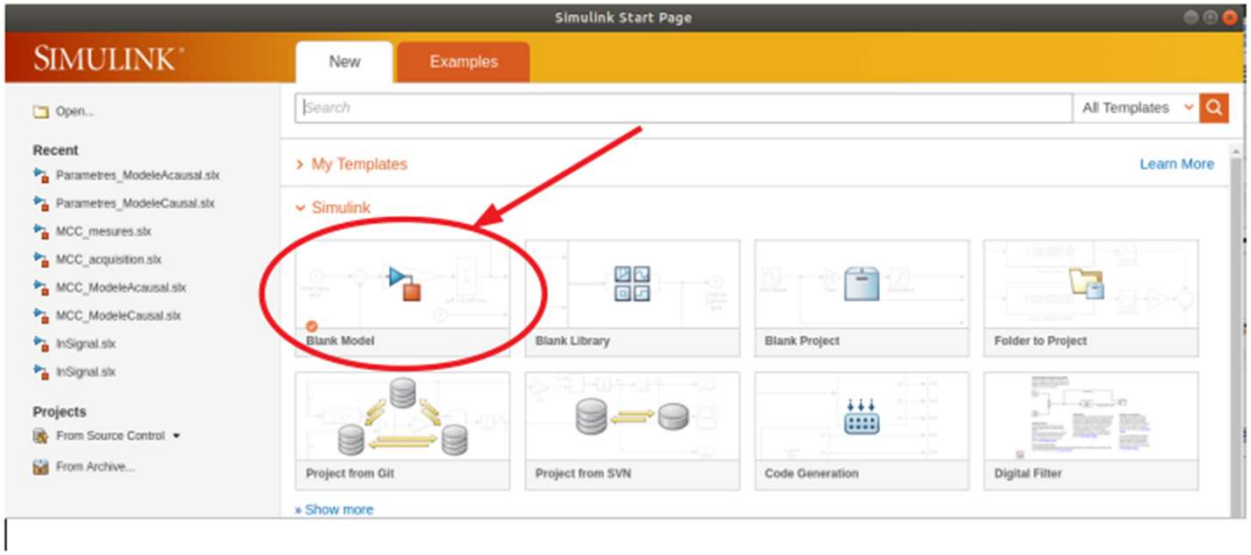
Équation	Blocs associés
$U-E$	
$(U-E)\frac{1}{Ls+R}=I$	
$E=K_e\Omega$	
$(F(C_m)-F(C_r))\frac{1}{Js+f}=\Omega$	
$F(C_m)=K_m I$	

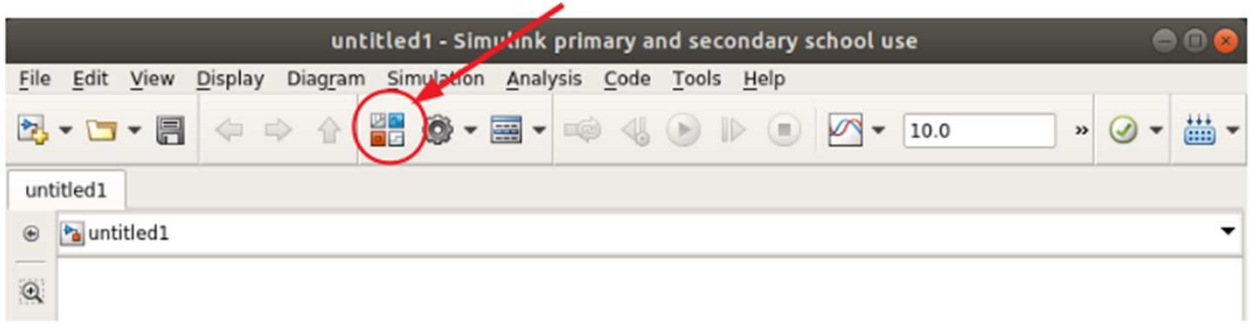
Tableau 2

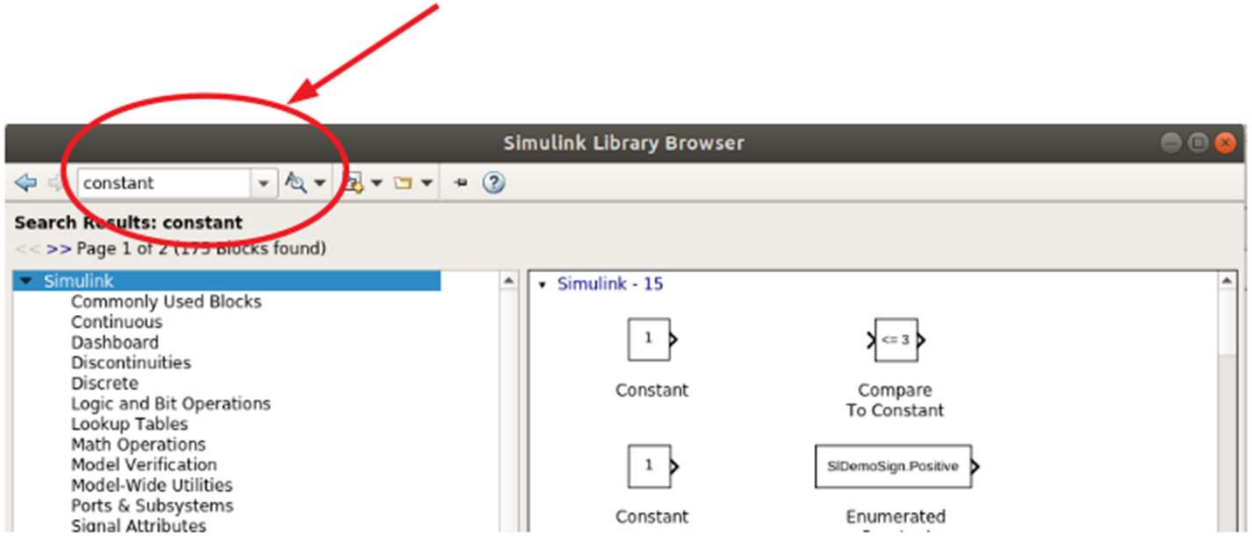
Construction du modèle Simulink

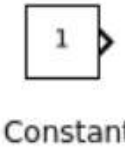
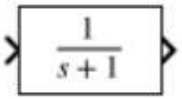
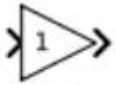


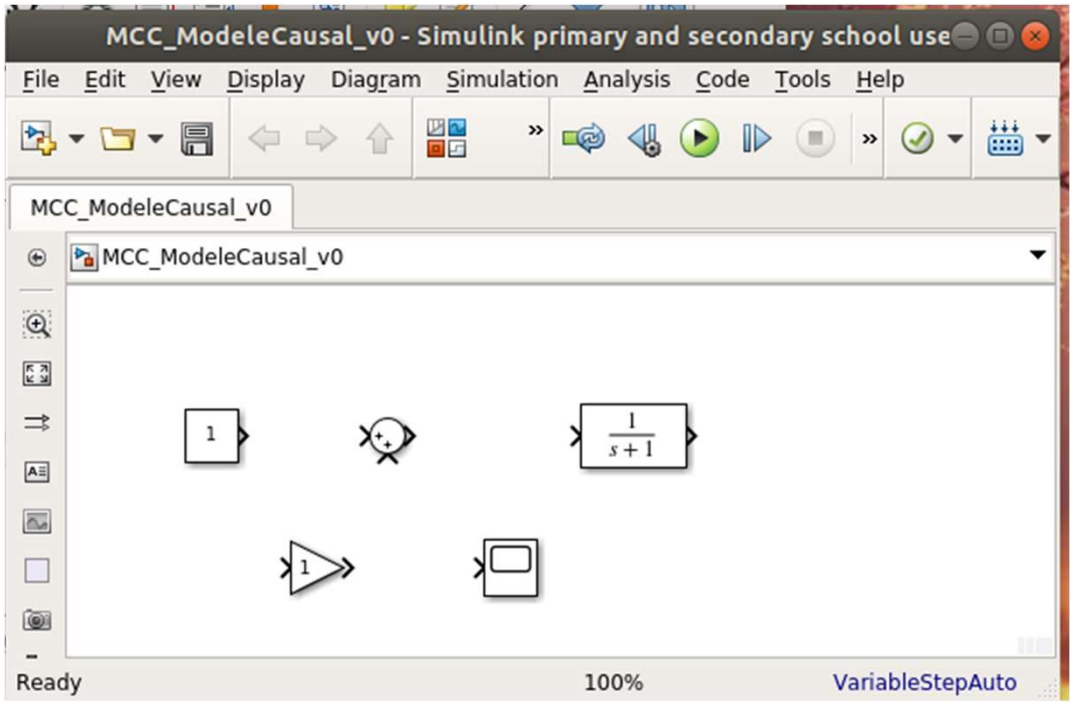


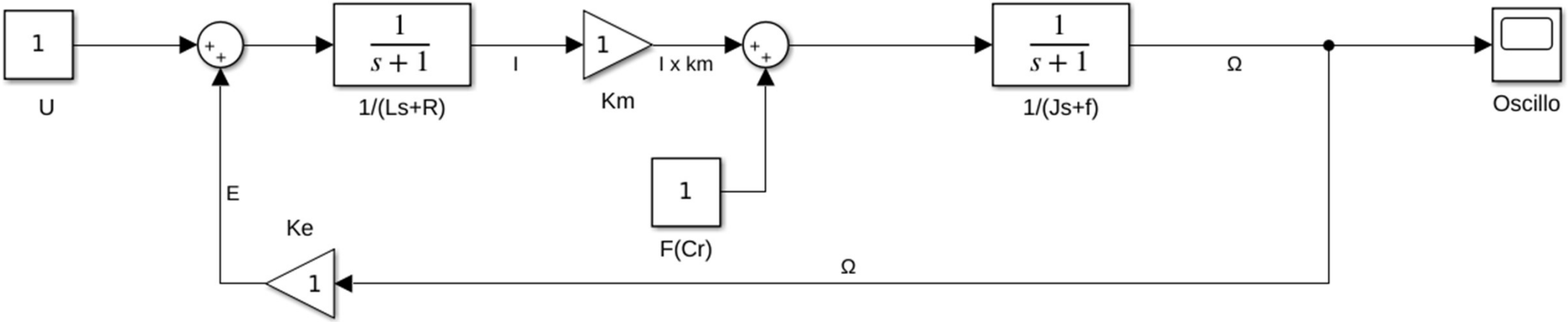

Simulink Start Page
SIMULINK
New
Examples
Open...
Search
All Templates
Recent
Parametres_ModeleAcausal.slx
Parametres_ModeleCausal.slx
MCC_mesures.slx
MCC_acquisition.slx
MCC_ModeleAcausal.slx
MCC_ModeleCausal.slx
InSignal.slx
InSignal.slx
My Templates
Learn More
Simulink
Blank Model
Blank Library
Blank Project
Folder to Project
Projects
From Source Control
From Archive...
Project from Git
Project from SVN
Code Generation
Digital Filter
» Show more


untitled1 - Simulink primary and secondary school use
File Edit View Display Diagram Simulation Analysis Code Tools Help
10.0
untitled1
untitled1

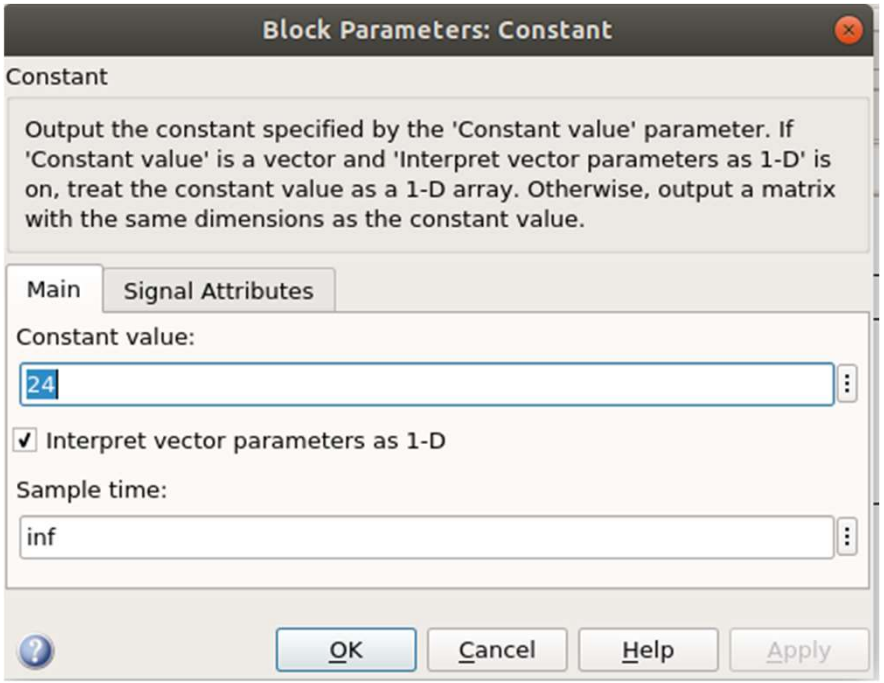

Simulink Library Browser
constant
Search Results: constant
<< >> Page 1 of 2 (175 blocks found)
Simulink
Commonly Used Blocks
Continuous
Dashboard
Discontinuities
Discrete
Logic and Bit Operations
Lookup Tables
Math Operations
Model Verification
Model-Wide Utilities
Ports & Subsystems
Signal Attributes
Simulink - 15
1
Constant
<= 3
Compare
To Constant
1
Constant
SlDemoSign.Positive
Enumerated

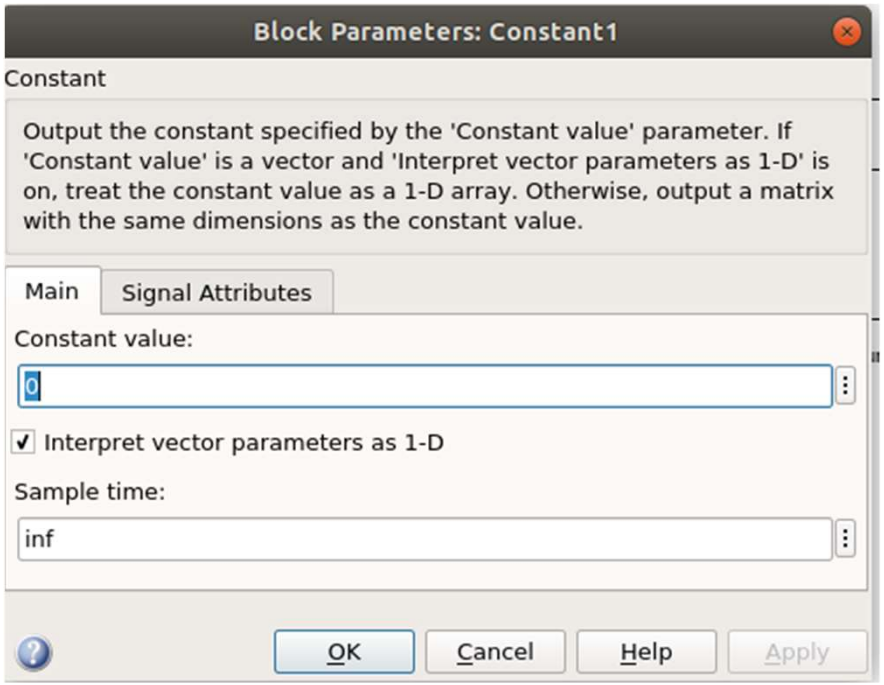
Nom et rôle du bloc	Bloc Simulink	Bibliothèque
« Constant » Tension		Simulink/Commonly Used Blocks
« Sum » Soustraction ou Addition		Simulink/Commonly Used Blocks
« Transfer Fcn » Fonction de transfert		Simulink/Continuous
« Gain » Multiplication par une constante		Simulink/Commonly Used Blocks
« Scope » Oscilloscope		Simulink/Commonly Used Blocks

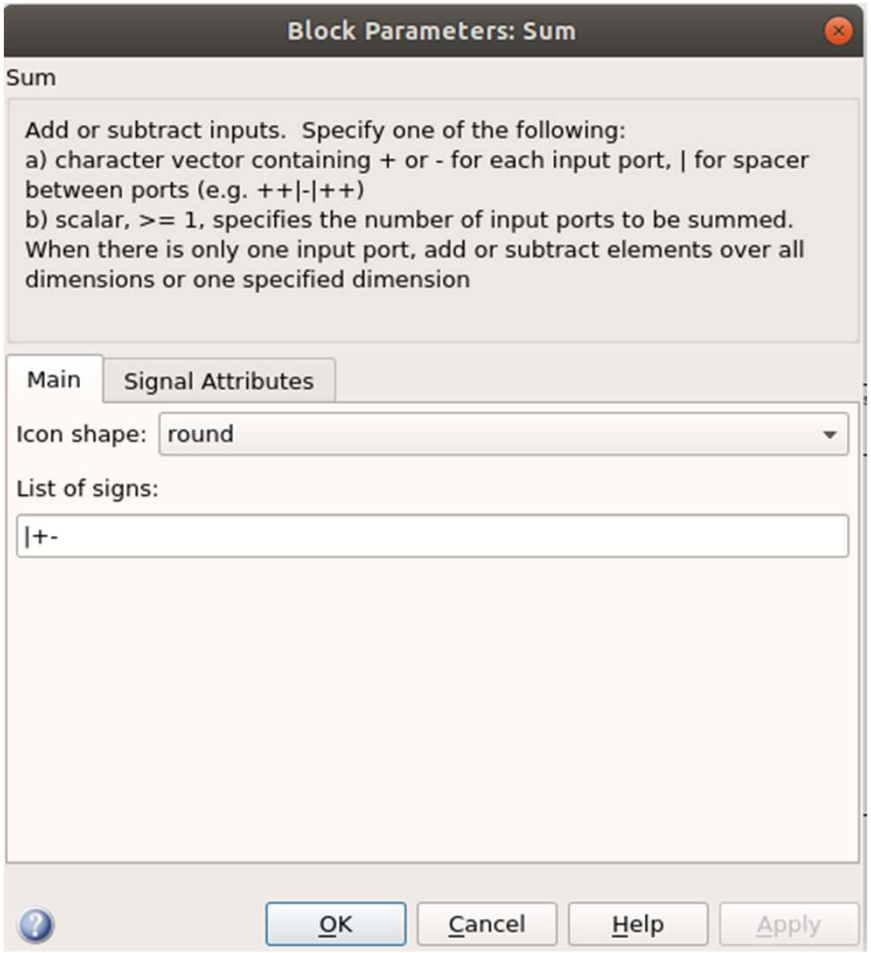

MCC_ModeleCausal_v0 - Simulink primary and secondary school use
File Edit View Display Diagram Simulation Analysis Code Tools Help
MCC_ModeleCausal_v0
MCC_ModeleCausal_v0
1
1
s + 1
1
Ready
100%
VariableStepAuto

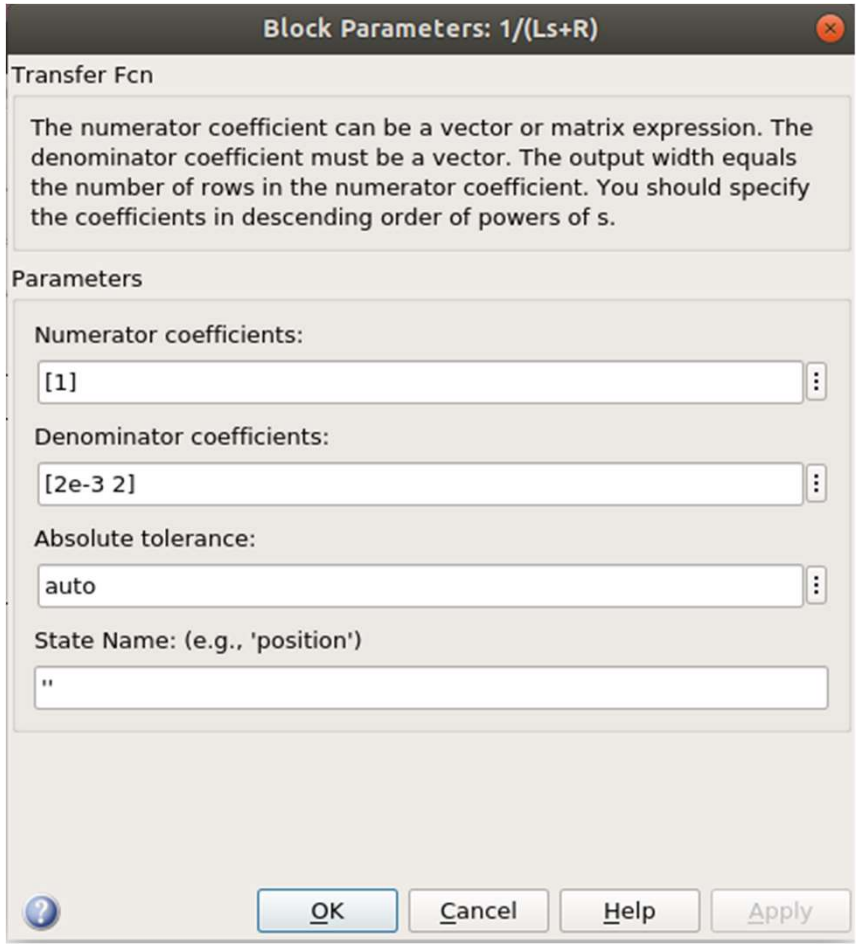

1
U
1/(Ls+R)
I
1
Km
I x km
1/(Js+f)
Ω
Oscillo
E
Ke
1
F(Cr)
Ω

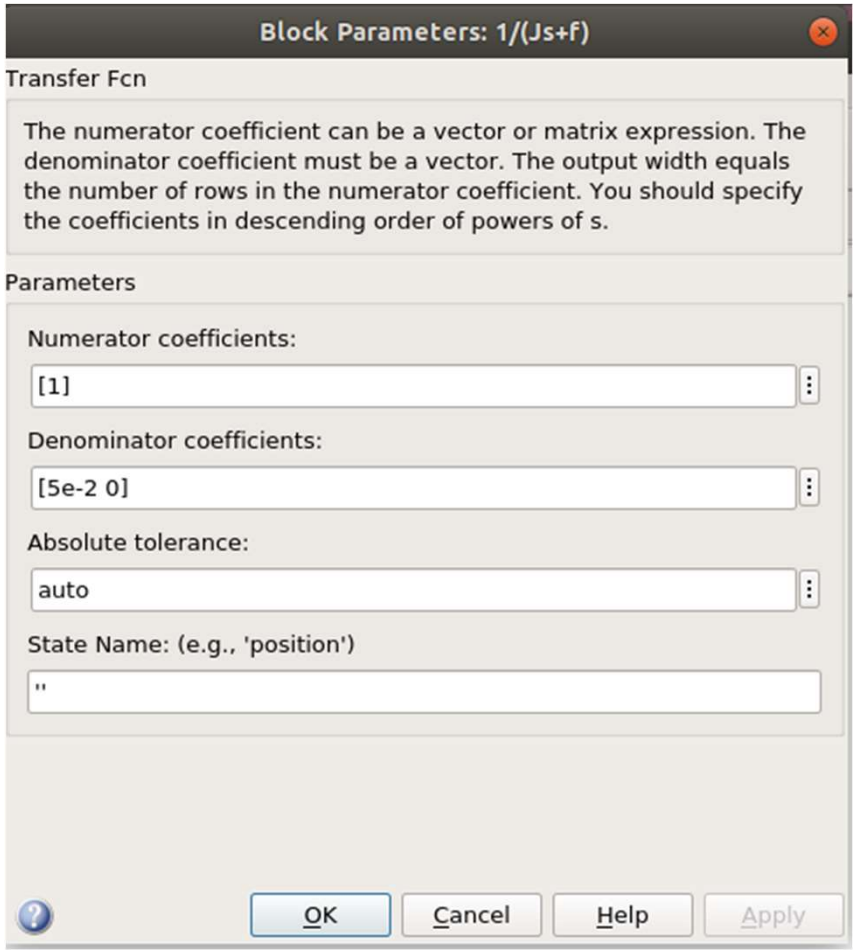
Paramétrisation des blocs

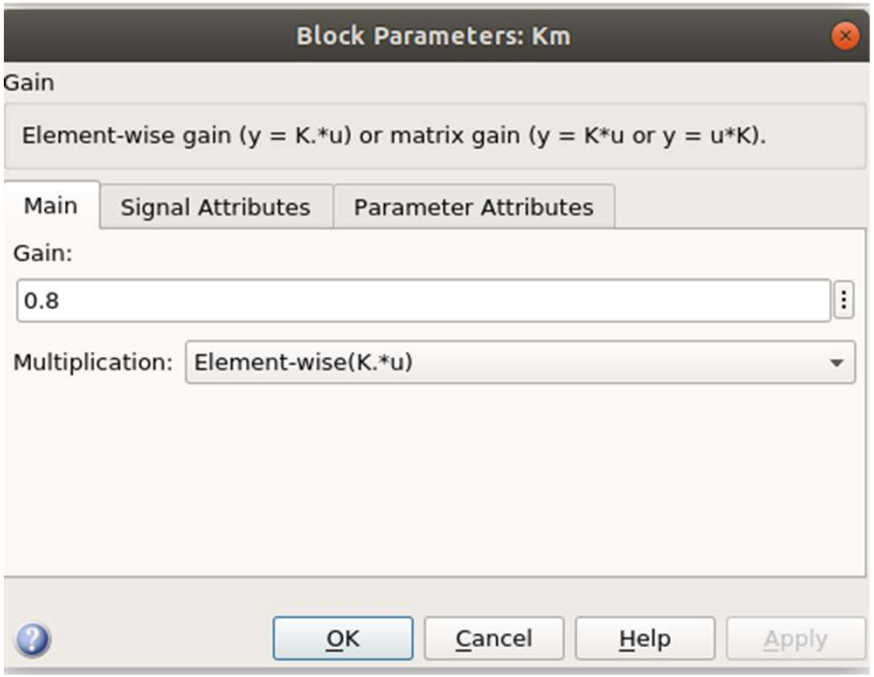


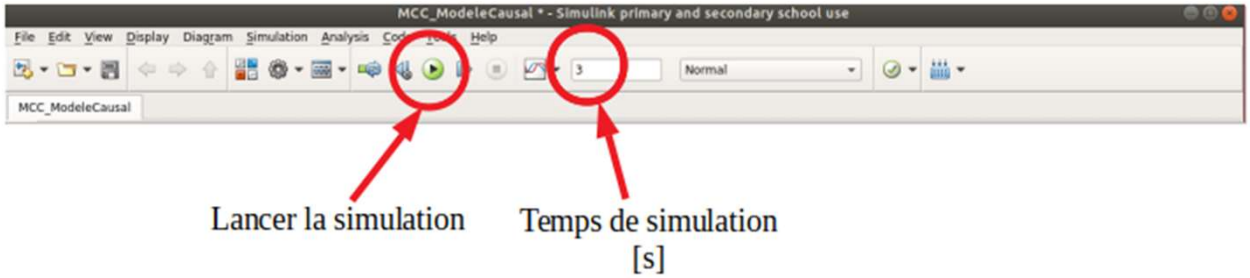


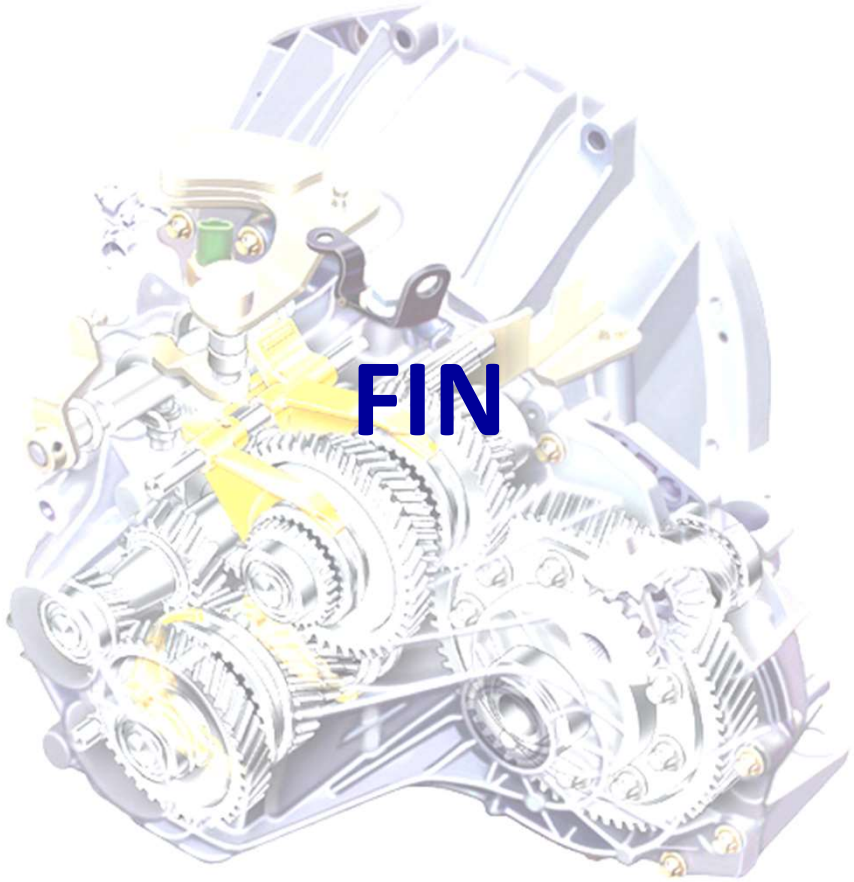

Block Parameters: Sum
Sum
Add or subtract inputs. Specify one of the following:
a) character vector containing + or - for each input port, | for spacer between ports (e.g. ++|-|++)
b) scalar, >= 1, specifies the number of input ports to be summed. When there is only one input port, add or subtract elements over all dimensions or one specified dimension
Main
Signal Attributes
Icon shape:
round
List of signs:
|+-
OK
Cancel
Help
Apply


Block Parameters: 1/(Ls+R)
Transfer Fcn
The numerator coefficient can be a vector or matrix expression. The denominator coefficient must be a vector. The output width equals the number of rows in the numerator coefficient. You should specify the coefficients in descending order of powers of s.
Parameters
Numerator coefficients:
[1]
Denominator coefficients:
[2e-3 2]
Absolute tolerance:
auto
State Name: (e.g., 'position')
''
OK
Cancel
Help
Apply


Block Parameters: 1/(Js+f)
Transfer Fcn
The numerator coefficient can be a vector or matrix expression. The denominator coefficient must be a vector. The output width equals the number of rows in the numerator coefficient. You should specify the coefficients in descending order of powers of s.
Parameters
Numerator coefficients:
[1]
Denominator coefficients:
[5e-2 0]
Absolute tolerance:
auto
State Name: (e.g., 'position')
''
OK
Cancel
Help
Apply


Block Parameters: Km
Gain
Element-wise gain (y = K.*u) or matrix gain (y = K*u or y = u*K).
Main
Signal Attributes
Parameter Attributes
Gain:
0.8
Multiplication:
Element-wise(K.*u)
OK
Cancel
Help
Apply


MCC_ModeleCausal * - Simulink primary and secondary school use
File Edit View Display Diagram Simulation Analysis Help
3
Normal
MCC_ModeleCausal
Lancer la simulation
Temps de simulation
[s]



FIN