

MATLAB: kasutajaliides, muutujate sisestus- jm käsud

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FILE | VARIABLE | CODE | SIMULINK | ENVIRONMENT | RESOURCES

C:\Users\andres\Documents\MATLAB

Current Folder

Name	Date Modified
arduUI1.fig	30.08.2017 22:56
arduUI1.m	30.08.2017 22:56

Command Window

```

Classroom License -- for classroom instructional use only.

>> a=[1 2 3] %row vector. see siin on kommentaar
a =
    1     2     3

>> A=[9 7 5; 3 1 8; 6 4 2] %Matrix, semicolon separates the rows
A =
    9     7     5
    3     1     8
    6     4     2

>> A*a' % A multipl by transpose of the a
ans =
    38
    29
    20

fx >> diag(A)
    
```

Workspace

Name	Value
a	[1 2 3]
A	[9 7 5; 3 1 8; 6 4 2]
ans	[38; 29; 20]

Command History

```

A15-(9.3-0.3-ur)
%piirangud:
MaxX1=10, MaxX2=0
%olekumudelil maa
A=[1 1 0 0; 0 0 1 0; 0 0 0 1]
B=[0; 0; 1/M; -1/M]
G=[0; 0; 0; -1/(m
C=[1 1 0 0] % väl
%-- 2.04.2018 10:
a=[1 2 3] %row ve
A=[9 7 5; 3 1 8;
A*a' % A multipl
    
```

Annotations:

- Layout → Default
- Preferences → Fonts (šrifti suurus)
- Präegune MATLAB-i töökaust opsüsteemis.
- Current directory / Jooksev kataloog / Текущая директория
- Command window / Käsurida / Командная строка
- MATLAB-i Workspace salvestatakse kõik käsuresas või skriptis loodud muutujaid.
- Workspace / Рабочее пространство
- Sisestatud käskude ajalugu
- MATLAB-i käsurida. Käsk täidetakse kohe peale **Enter** nupu vajutamist. Käsu tulemus salvestatakse MATLAB-i jooksvate andmete hulka. Noole klahvidega "↑" ja "↓" saab liikuda läbi käskude ajaloo.

Command Window

```
b =
     5
    -3
    -2
```

```
>> t=0:7 %ühikulise sammuga vahemik-rida
```

```
t =
     0     1     2     3     4     5     6     7
```

```
>> t2=3:-0.5:0 % mitteühikulise sammuga
```

```
t2 =
     3.0000     2.5000     2.0000     1.5000     1.0000     0.5000     0
```

```
>> A %displays the content of the variable
```

```
A =
     9     7     5
     3     1     8
     6     4     2
```

```
>> A(3,1)=b(3) % A(i,j) - i.rea ja j.veeru element
```

Workspace

Name	Value
a	[1 2 3]
A	[9 7 5; 3 1 8; 6 4 2]
ans	[9;1;2]
b	[5;-3;-2]

Variables - A

VIEW

plot area bar

SELECTION

A

3x3 double

	1	2	3	4	5	6	7
1	9	7	5				
2	3	1	8				
3	6	4	2				
4							
5							

```
C=[1 I 0 0] % välju...
%-- 2.04.2018 10:25...
a=[1 2 3] %row vect...
A=[9 7 5; 3 1 8; 6 ...
A*a' % A multipl by...
diag(A)
b=ans-4
t=0:7 %ühikulise sa...
t2=3:-0.5:0 % mitte...
A %displays the con...
```

```
>> 12^2      % “^” on astendamine
```

```
>> sqrt(-1) % i tähistab imaginaarosa  
ans =  
    0 + 1.0000i
```

```
>> log(0)  
ans =  
    -Inf
```

```
>> % s.o. lõpmatus – infinity
```

```
>> var1=1.602e-4  
var1 =  
    1.6020e-004
```

```
>> % 1,6020 korda kümme miinus  
neljandas astmes
```

```
>> m = abs(3+4i)  
m =  
    5
```

Kompleksarvu kuju:

```
>> help käsk/funktsiooni_nimi
```

inv – pöördmaatriks (inverse of matrix)

eig – omaväärtused (eigvalues of matrix)

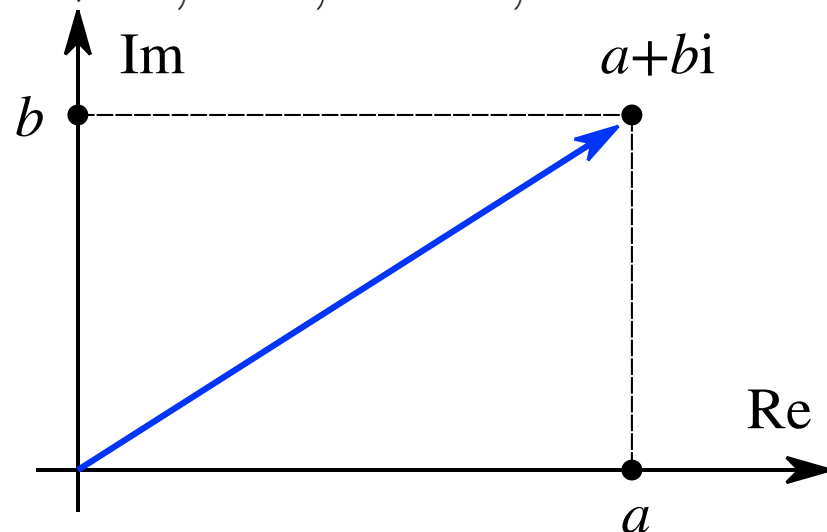
```
>> p = poly(A) ...
```

% characteristic polynomial of matrix A
p is a vector containing the coefficients (a_i)
of the polynomial ($a_3s^3+a_2s^2+a_1s+a_0 \Rightarrow$
 $p=[a_3 \ a_2 \ a_1 \ a_0]$) – polünoomi esitus

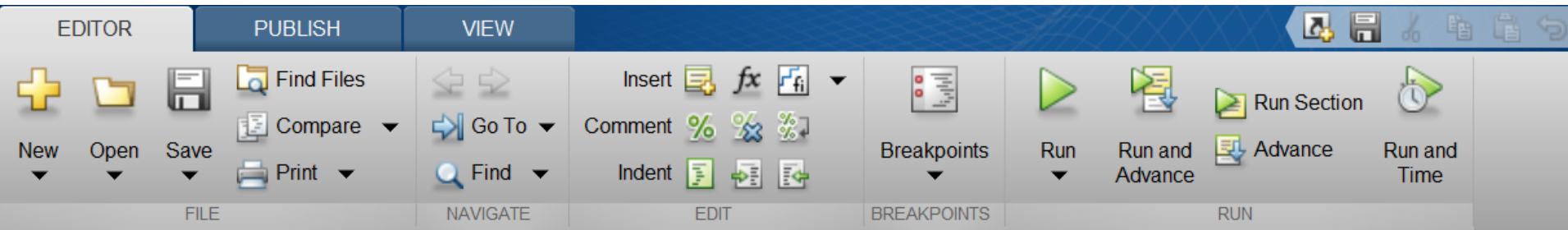
```
>> r = roots(p) % roots of the polynomial –  
polünoomi juured
```

```
>> p1 = conv(p,p1) % convolution of the  
polynomials p and p1 – polünoomide  
korrutamine
```

$$z = a + bi, \quad a, b \in \mathbb{R}, \quad i^2 = -1.$$



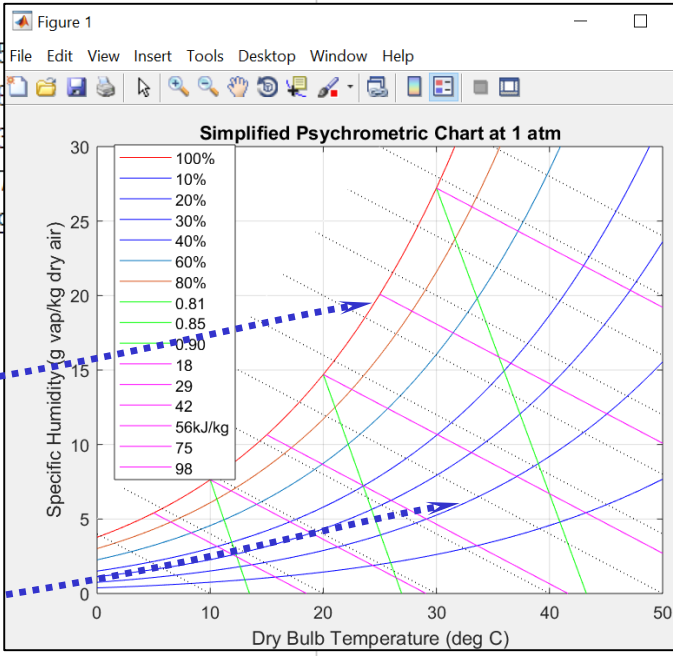
m – fail e. script (käsufail)



```

3 % saturation temp/pressure
4 t = [0.01 1:1:50]'; % temperature (C)
5 pg = [0.61165 0.65709 0.70599 0.75808 0.81355 0.87258 0.935
6 1.22820 1.31300 1.40280 1.49810 1.59900 1.70580 1.818
7 2.33930 2.48820 2.64530 2.81110 2.98580 3.16990 3.363
8 4.24700 4.49690 4.75960 5.03540 5.32510 5.62900 5.947
9 7.38490 7.78780 8.20960 8.65080 9.11240 9.59500 10.09
10 12.35200]'; % saturation vapor pressure (kPa)
11 patm = 101.325; % standard atmosphere (kPa)
12 rair = 0.287; % gas constant of air (kJ/kg.K)
13 wg = 622*pg./(patm-pg); % saturation specific humidity
14 plot(t,wg,'r-')
15 hold
16 grid
17 for phi = 0.1:0.1:0.4, % phi = relative humidity 10% - 40%
18 w = 622*phi*pg./(patm-phi*pg);
19 plot(t,w,'b-');
20 end
21 for phi = 0.6:0.2:0.8, % phi = 60%, 80%
22 w = 622*phi*pg./(patm-phi*pg);
23 plot(t,w)
axis([0,50,0,30])
legend('100%','10%','20%','30%','40%','60%','80%','0.81','0.85','0.90','18'
title('Simplified Psychrometric Chart at 1 atm')
xlabel('Dry Bulb Temperature (deg C)')

```



Simulink

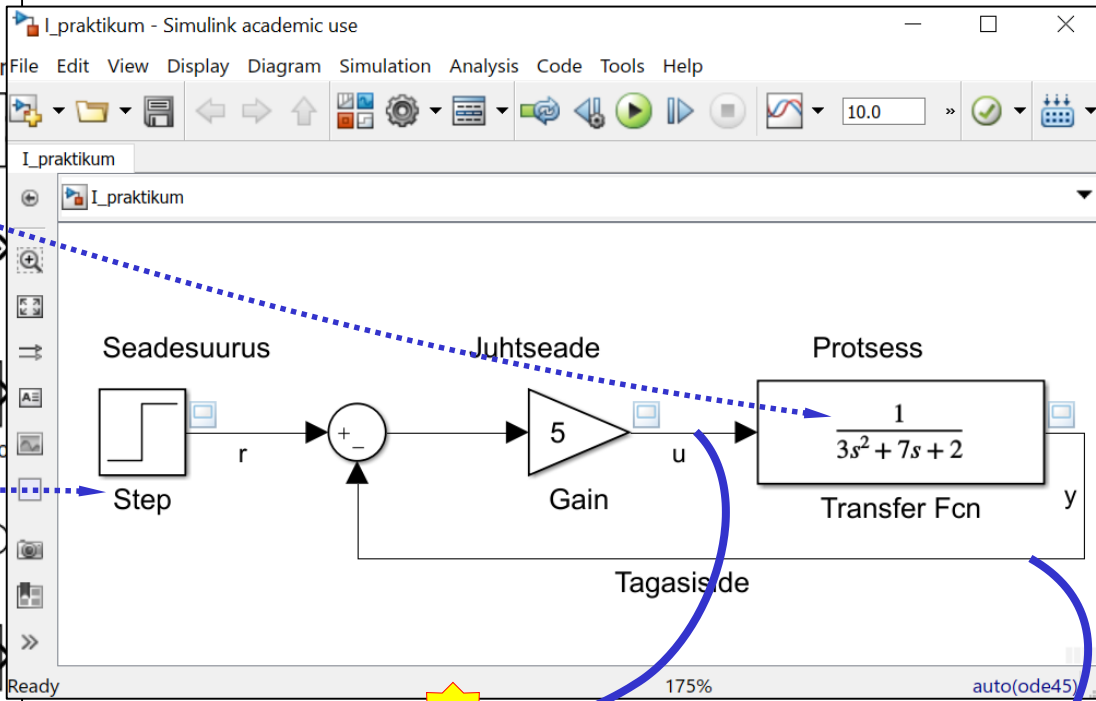
The image displays the Simulink software interface. At the top is a main toolbar with categories: FILE (New Script, New, Open, Compare), VARIABLE (Import Data, Save Workspace, New Variable, Open Variable, Clear Workspace), CODE (Analyze Code, Run and Time, Clear Commands), SIMULINK (Simulink), ENVIRONMENT (Layout, Set Path, Preferences, Add-Ons), and RESOURCES (Help, Community, Request Support, Learn MATLAB). Below this is the Simulink Library Browser window, which has a search bar and a tree view of Simulink sources. The tree view includes categories like Commonly Used Blocks, Continuous, Discrete, Logic and Bit Operations, Math Operations, Model Verification, Ports & Subsystems, Signal Attributes, Signal Routing, Sinks, Sources, and User-Defined Functions. A list of specific blocks is shown on the right, including Ramp, Repeating Sequence, Repeating Sequence Stair, Signal Generator, Step, and Waveform Generator. The main workspace shows a blank Simulink model titled 'untitled - Simulink classroom use'. The workspace toolbar includes icons for file operations, navigation, and simulation. A dropdown menu is open, showing 'Simulink' and 'Blank Model'. The status bar at the bottom indicates 'Ready', '100%' zoom, and 'VariableStepAuto'.

delay

Simulink/ Commonly Used Blocks

- 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
 - Signal Routing
 - Sinks
 - Sources
 - User-Defined Functions
 - Additional Math & Discrete
 - Control System Toolbox
 - Data Acquisition Toolbox
 - DSP System Toolbox
 - DSP System Toolbox HDL Support
 - Fuzzy Logic Toolbox
 - HDL Coder
 - Image Acquisition Toolbox
 - Instrument Control Toolbox
 - Model Predictive Control Toolbox
 - Neural Network Toolbox
 - OPC Toolbox
 - Robotics System Toolbox
 - Robust Control Toolbox
 - Simscape

Bus Creator, Bus Selector, convert, z-1, Data Type Conversion, Delay, Discrete-Time Integrator, Gain, Integrator, In1, Out1, Mux, Relational Operator, Saturation



Ready 175% auto(ode45)

Create & Connect Viewer **A**

- Simulink
 - Scope
 - XY Graph

Connect To Viewer **C**

- Scope
 - Display 1
 - Display 2

Viewer: Scope (u, y, r)

File Tools View Simulation Help

Scale

B

Layout

diferentsiaalvõrrand:

$$3 \frac{d^2 y}{dt^2} + 7 \frac{dy}{dt} + 2y(t) = u(t)$$

- Simulink
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 - Sinks
 - Sources
 - User-Defined Functions
 - Additional Math & Disc
- Control System Toolbox
- Data Acquisition Toolbox
- DSP System Toolbox
- DSP System Toolbox HDL S
- Fuzzy Logic Toolbox

Derivative	Integrator
Integrator, Second-Order	Integrator, Second-Order Limited
Integrator Limited	PID Controller
PID Controller (2DOF)	State-Space
Transfer Fcn	

simulink/Continuous/Transfer Fcn:

Block Parameters: Transfer Fcn

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:

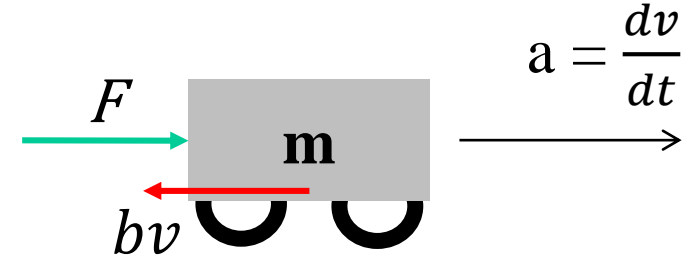
[3 7 2]

delay

Simulink/ Commonly Used Blocks

- Simulink
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 - Robust Control Toolbox
 - Simscape

Bus Creator, Bus Selector, convert, z⁻¹, K Ts / z-1, Delay, Gain, Integrator, In1, Out1, Mux, Relational Operator, Subsystem, Sum



$$m \frac{dv}{dt} + bv(t) = F$$

$$\frac{dv}{dt} = \frac{1}{m} (F - bv(t))$$

cruise0 - Simulink academic use

File Edit View Display Diagram Simulation Analysis Code Tools Help

cruise0

$F = u$

$+$

$1/m$

dv/dt

$1/s$

$v(0)$

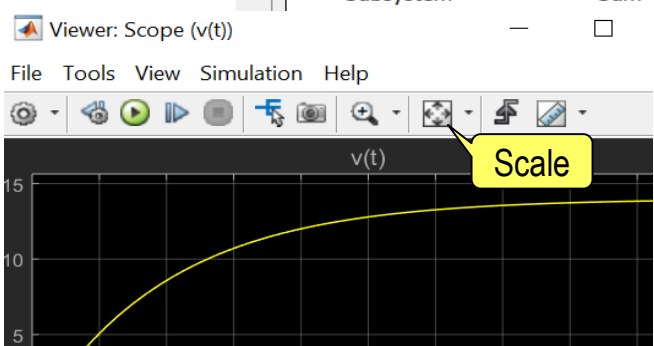
$v(t)$

b

1400 N -> 28 m/s = 100 km/h
 1000 N -> 20 m/s = 72 km/h
 700 N -> 14 m/s = 50 km/h

$m = 1000 \text{ \% [kg]}$
 $b = 50 \text{ \% [Ns/m]}$

Ready 150% ode45



Create & Connect Viewer

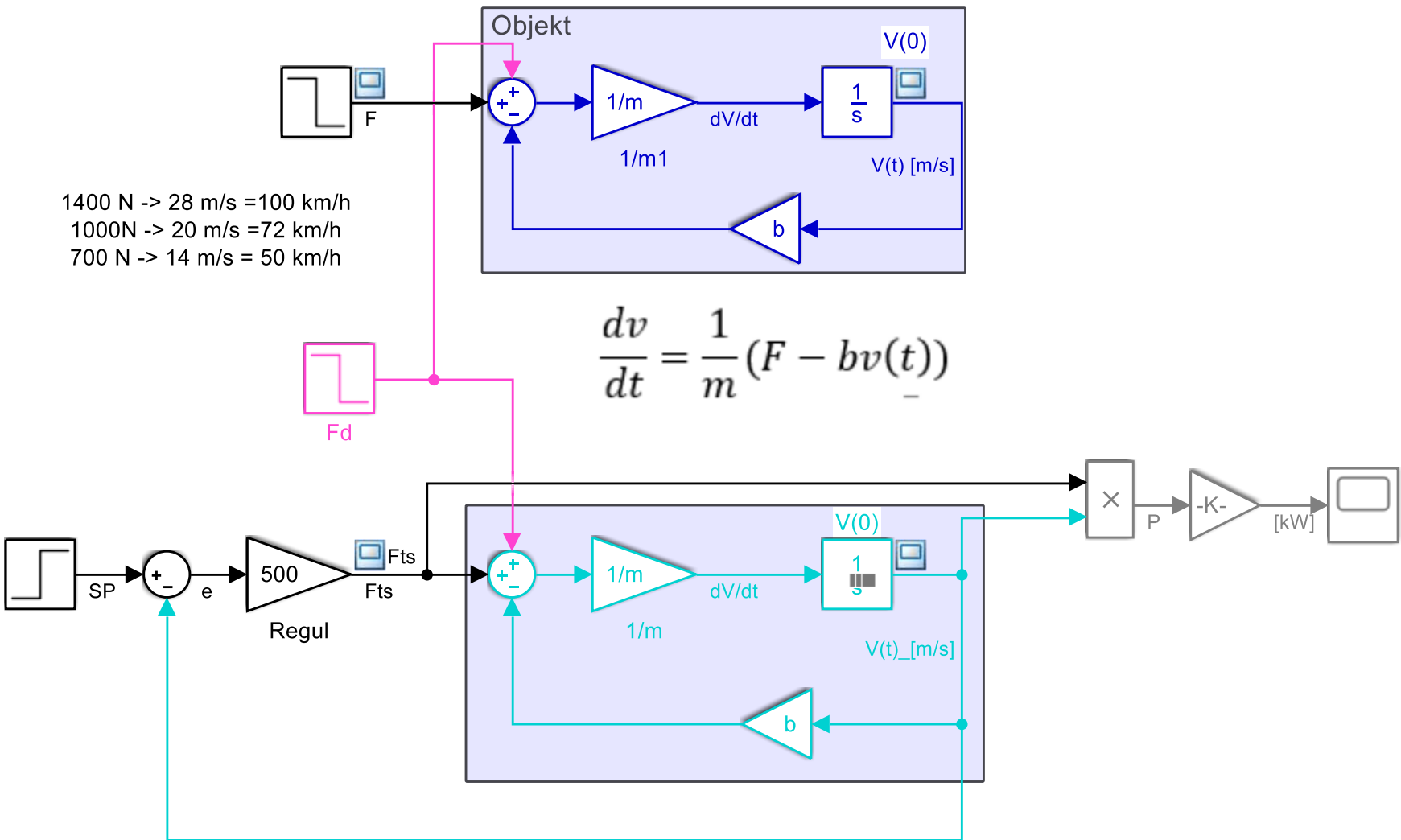
Connect To Viewer

Simulink

DSP

Scope

XY Graph









1400 N -> 28 m/s = 100 km/h
 1000N -> 20 m/s = 72 km/h
 700 N -> 14 m/s = 50 km/h



$$\frac{dv}{dt} = \frac{1}{m} (F - bv(t))$$







$m=1000$ % [kg]
 $b=50$ % [Ns/m]




<http://www.engin.umich.edu/group/ctm/examples/cruise/cc.html>





LIVE EDITOR INSERT VIEW





 Find Files
  Compare
  Print

 Go To
  Find

 Text
  Aa Heading
  B
  I
  U
  M

 Code
  %
  %

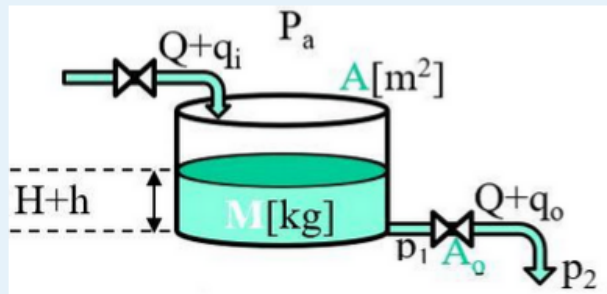
 Section Break
  Run Section
  Run and Advance
  Run to End

 Run All

FILE NAVIGATE TEXT CODE SECTION RUN

paak.mlx +

Maba välja- ja ülevooluga puhverpaagi mudel (vt. nt)



Mahuühikutes:

Q - püsivoog läbi paagi, q_i - sissevoolu muutus, q_o - väljavoolu muutus [m³/s]

```

H = 3 %püsivoo (head) [m]
A = 0.46 % nivoo pinna pindala [m2]
Ao = 0.00185 % väljalaske toru ristlõike pindala [m2] algv
g = 9.81; % raskuskiirendus [m/s2]
rho = 1000; % vedeliku tihedus [kg/m3]
  
```

```

H = 3
A = 0.4600
Ao = 0.0019
  
```

Massiühikutes $\frac{dM}{dt} = (w_i - w_o)$, vool on võrdeline rõhkude vahega

$$w_o = \frac{1}{R} (p_1 - p_2)^{\frac{1}{\alpha}}, \quad p_1 = \rho g H(t), \quad p_2 \approx P_a$$

$$\text{ehk } \rho A \frac{dH(t)}{dt} = w_i - \rho A_o \sqrt{2gH(t)} \quad [\text{kg/s}]$$