

UbiLAB

Virtual laboratory using Scilab

Multiplier Event 1 - Skopje

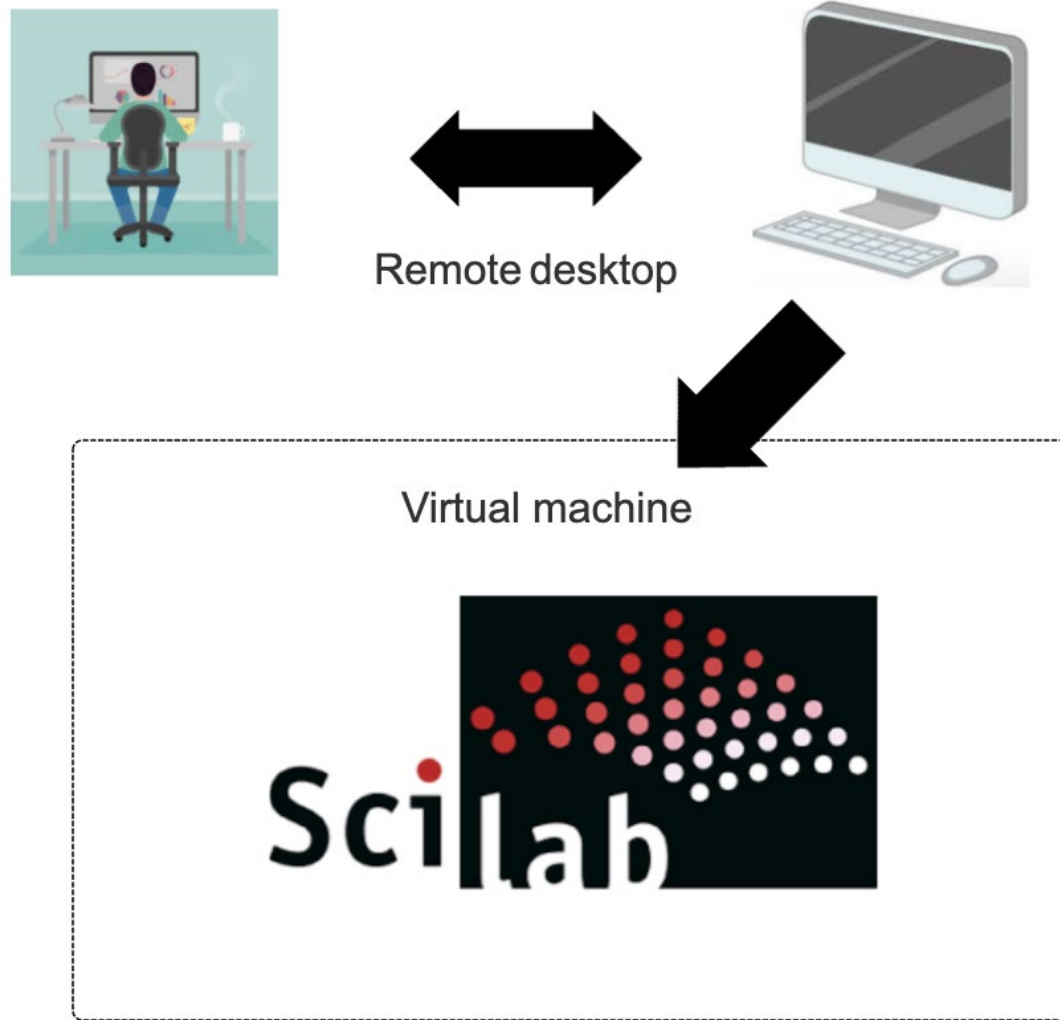
Host: Ss. Cyril and Methodius University in Skopje

01.02.2023

Outline

- Virtual laboratory using Scilab
- What is Scilab
- Simple example
- ATOMS Toolboxes
- Communication Toolbox
- What is Xcos?
- Laboratory exercise 1 (SciNotes)
- Laboratory exercise 2 (Xcos)

Virtual laboratory - Scilab

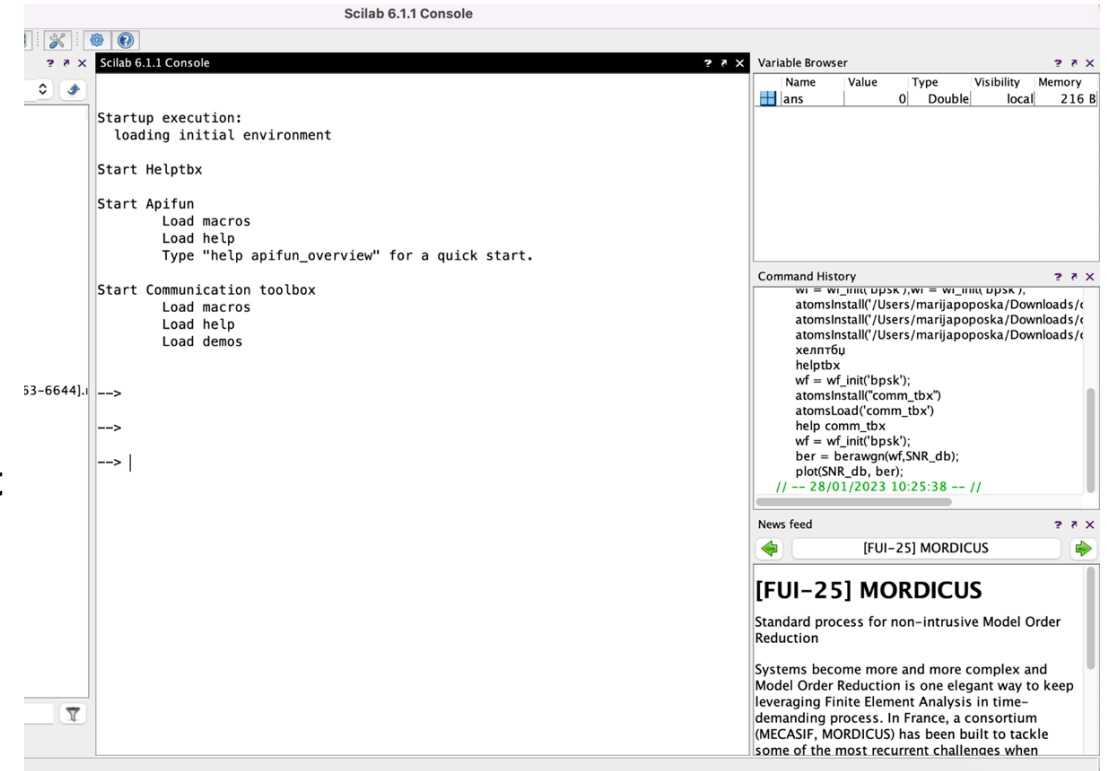


What is Scilab? (1/2)

- A software package for scientific and engineering computing, quite similar to Matlab
- Scilab is tool for **numerical computing**, as are Excel, GNU, Octave, Matlab, etc.
- Included in Scilab package is **Xcos**, a graphic modeling and simulation tool.
- Scilab is **free** and can be downloaded at www.scilab.org
- Scilab is matrix-oriented, just like Matlab
- It allows matrix manipulations, 2D/3D plotting, animation, etc.
- It is an open programming environment that allows users to create their own functions and libraries

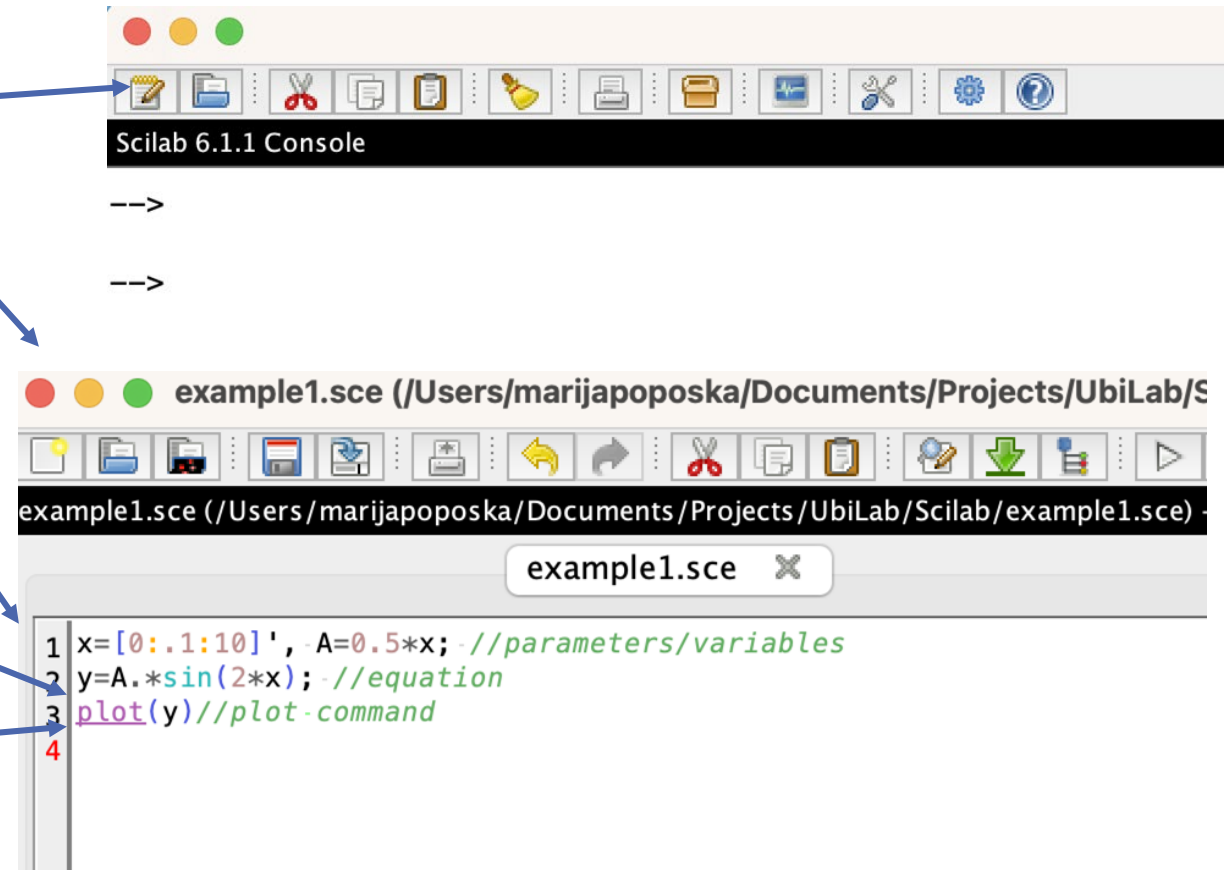
What is Scilab? (2/2)

- The Scilab language allows to dynamically compile and link other languages, such as C, C++, Java: this way, external libraries can be used as if they were a part of Scilab built-in features
- Scilab also interfaces LabVIEW, a platform and development environment for a visual programming language from National Instrument
- It includes Matlab-to-Scilab translator



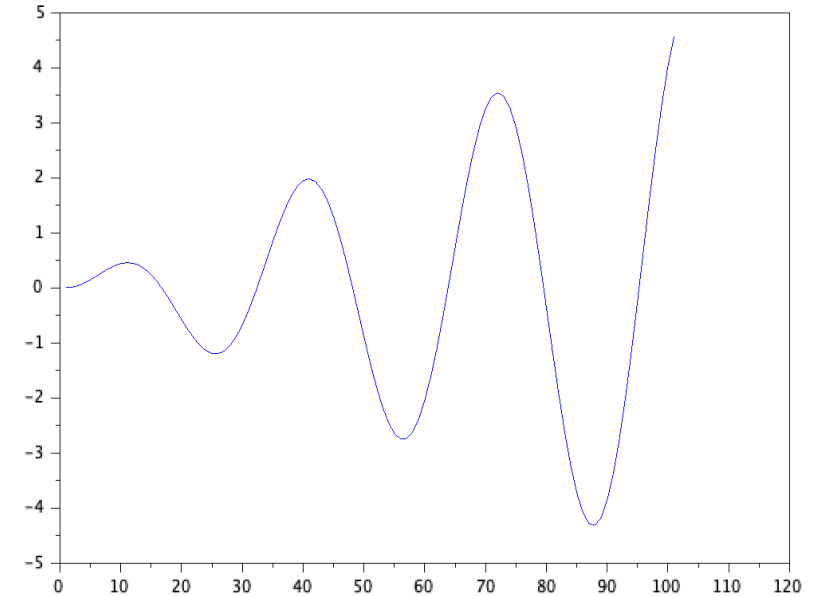
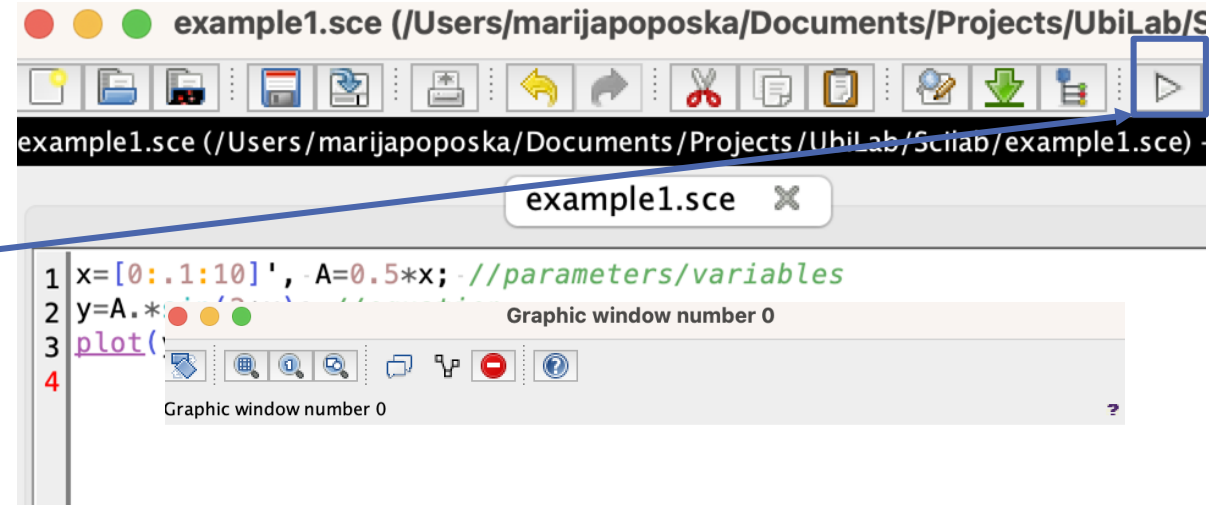
Simple example (1/2)

- **Step 1 :** On the console, Click the leftmost icon on the toolbar, The Editor pops up
- **Step 2:** Define whatever variables your function needs
- **Step 3:** Next, define the function (in our case sin function)
- **Step 4:** Finally, write the needed command (in our case plot())



Simple example (2/2)

- **Step 5:** Finish by running (executing) the script by clicking the executing icon
- **Step 6:** Up pops the Graphics Window with the plot of the defined equation



On scripts and functions

- Scilab has two command types:
 - **Scripts:** A set of commands used to automate computing. Script commands are normally returned to the Console, but plots are return to the Graphics Window
 - **Functions (macros):** Short programs that interface with the environment through input and output variables. A list of common built-in functions is given bellow. Functions defined by the user can either be local (integrated in script) or global (stored as a separate file and accessible to any script)

sin(), cos(), tan(), cotg(), asin(), acos(), atan()	trigonometric functions
sqrt(), exp()	square root/ exponent
sum(), min(), max()	sum, minimum/maximum value
abs(), sign()	absolute value/ sign
real(), imag()	real & imaginary parts of a complex numebr

Scilab ATOMS - Toolboxes

- ATOMS (AuTomatic mOdules Management for Scilab) is the repository for packaged extension modules ("Toolboxes").
- <https://atoms.scilab.org/>

All ATOMS Toolboxes

Image Processing Design Toolbox - This toolbox implements functions for object detection.
277400 downloads - 221 comments - ★★★★★ --> `atomsInstall("IPD")`

MinGw toolbox - Dynamic link with MinGW for Scilab on Windows
232940 downloads - 92 comments - ★★★★★ --> `atomsInstall("mingw")`

Arduino - Arduino Communication through Serial
209288 downloads - 105 comments - ★★★★★ --> `atomsInstall("arduino")`

Scilab Image and Video Processing toolbox - SIVP intends to do image processing and video processing tasks
202783 downloads - 80 comments - ★★★★★ --> `atomsInstall("SIVP")`

CPGE - Control systems for French preparatory classes - CPGE dedicated Xcos blocks
191665 downloads - 15 comments - ★★★★★ --> `atomsInstall("CPGE")`

Image Processing and Computer Vision Toolbox - A Module of Image Processing and Computer Vision Toolbox for Scilab
180223 downloads - 61 comments - ★★★★★ --> `atomsInstall("IPCv")`

Coselica - Standard Open Modelica Blocks
165852 downloads - 21 comments - ★★★★★ --> `atomsInstall("coselica")`

GUI Builder - A Graphic User Interface Builder
129617 downloads - 49 comments - ★★★★★ --> `atomsInstall("guibuilder")`

Apifun - Check input arguments in macros
126181 downloads - 5 comments --> `atomsInstall("apifun")`

iodelay toolbox - manipulation and frequency analysis of linear dynamical systems with input or output delays
121858 downloads - 2 comments --> `atomsInstall("iodelay")`

SIMM - SIMM - teaching sciences for the engineer with Xcos
104203 downloads - 20 comments - ★★★★★ --> `atomsInstall("SIMM")`

Time Frequency Toolbox - 162 functions to analyze non-stationary signals using time-frequency distributions
100752 downloads - 8 comments - ★★★★★ --> `atomsInstall("stftb")`

CelestLab - CNES Space Mechanics Toolbox for Mission Analysis
96858 downloads - 51 comments - ★★★★★ --> `atomsInstall("celestlab")`



Scilab Wavelet Toolbox - mimic matlab wavelet toolbox
92284 downloads - 5 comments - ★★★★★ --> `atomsInstall("swt")`

Distfun - Distribution functions
89700 downloads - 27 comments --> `atomsInstall("distfun")`

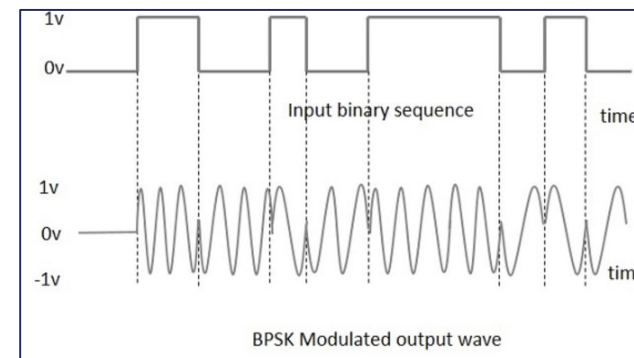
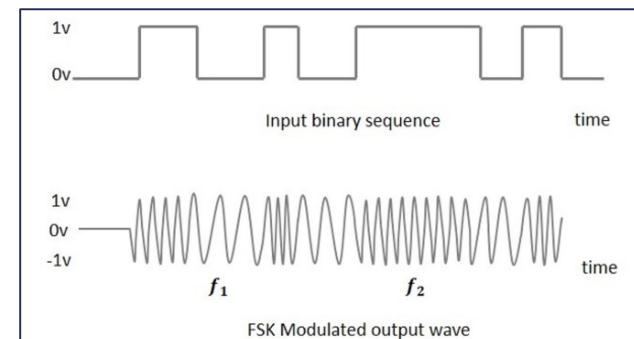
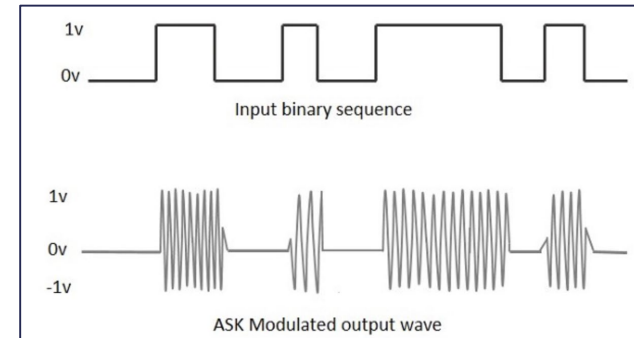
Fuzzy Logic Toolbox - sciFLT is a Fuzzy Logic Toolbox for scilab
85635 downloads - 40 comments - ★★★★★ --> `atomsInstall("sciFLT")`

Communication Toolbox

- A toolbox for telecommunications <http://www.tsdconseil.fr/log/sct/>
- Goals/ usage examples:
 - Facilitation of prototyping modulators/demodulators for RF links
 - Analysing/plotting of data obtained from other programs
 - Generating data for real time implementation
- Toolbox sub-modules
 - modulations: classical waveforms (FSK,PSK,etc), modulation and demodulation algorithms
 - sym-gen: Several functions to generate binary sequences (alternating 010101, pseudo-random)
 - simulation: Propagation channel simulation (AWGN channel, fading)
 - channelization: frequency multiplexing/demultiplexing

Laboratory exercise 1: Digital modulations (1/2)

- **ASK (Amplitude Shift Keying)** is a type of Amplitude Modulation which represents the binary data in the form of variations in the amplitude of a signal.
- **FSK (Frequency Shift Keying)** is the digital modulation technique in which the frequency of the carrier signal varies according to the digital signal changes.
- **PSK (Phase Shift Keying)** is the digital modulation technique in which the phase of the carrier signal is changed by varying the sine and cosine inputs at a particular time. PSK technique is widely used for wireless LANs, bio-metric, contactless operations, along with RFID and Bluetooth communications.



Laboratory exercise 1: Digital modulations (2/2)

The image displays a Scilab workspace with a script editor on the left and a graphic window on the right. The script editor contains the following code:

```
1 //Amplitude-Shift-Keying,-Frequency-Shift-Keying-And-Phase-Shift-keying-waveform-generation
2 clc;
3 clear;
4 xdel(winsid());
5 sym=10; //no.-of-symbols
6 g=[1 0 0 1 1 0 1 1 1 0] //binary-data
7 f1=1;f2=2; //frequencies-of-carrier
8 t=0:2*pi/99:2*pi; //range-of-time
9 //ASK
10 cp=[];bit=[];mod_ask=[];mod_fsk=[];mod_psk=[];cp1=[];cp2=[];
11 for n=1:length(g); //ASK-modulation-//Zeros-and-ones-are-inserted-for-proper-plot-of-message-signal
12     if g(n)==0;
13         die=zeros(1,100);
14     else g(n)==1;
15         die=ones(1,100);
16     end
17     c_ask=sin(f1*t);
18     cp=[cp die];
19     mod_ask=[mod_ask c_ask];
20 end
21 ask=cp.*mod_ask; //ASK-modulated-signal
22 //FSK
23 for n=1:length(g);
24     if g(n)==0;
25         die=ones(1,100);
26         c_fsk=sin(f1*t);
27     else g(n)==1;
28         die=ones(1,100);
29         c_fsk=sin(f2*t);
30     end
31     cp1=[cp1 die];
32     mod_fsk=[mod_fsk c_fsk];
33 end
34 fsk=cp1.*mod_fsk; //FSK-modulated-signal
35 //PSK
36 for n=1:length(g);
37     if g(n)==0;
38         die=ones(1,100);
39         c_psk=sin(f1*t);
40     else g(n)==1;
41         die=ones(1,100);
42         c_psk=sin(f2*t);
43     end
44     cp2=[cp2 die];
45     mod_psk=[mod_psk c_psk];
46 end
47 psk=cp2.*mod_psk; //PSK-modulated-signal
```

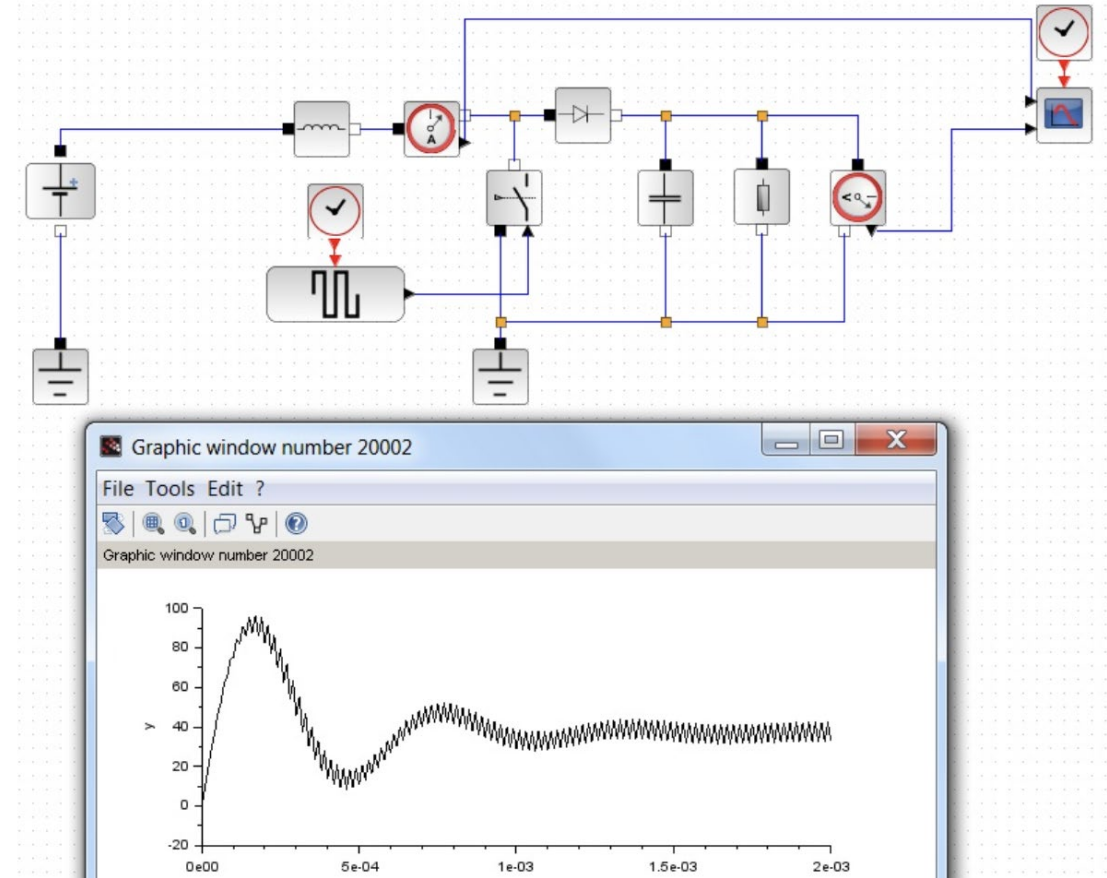
The graphic window, titled "Graphic window number 0", displays four plots:

- Binary Signal:** A step function representing the binary data sequence [1 0 0 1 1 0 1 1 1 0].
- ASK modulation:** A plot showing the Amplitude Shift Keying (ASK) modulated signal, where the carrier wave is present for '1' and absent for '0'.
- FSK modulation:** A plot showing the Frequency Shift Keying (FSK) modulated signal, where the carrier frequency is higher for '1' and lower for '0'.
- PSK modulation:** A plot showing the Phase Shift Keying (PSK) modulated signal, where the carrier phase is different for '1' and '0'.

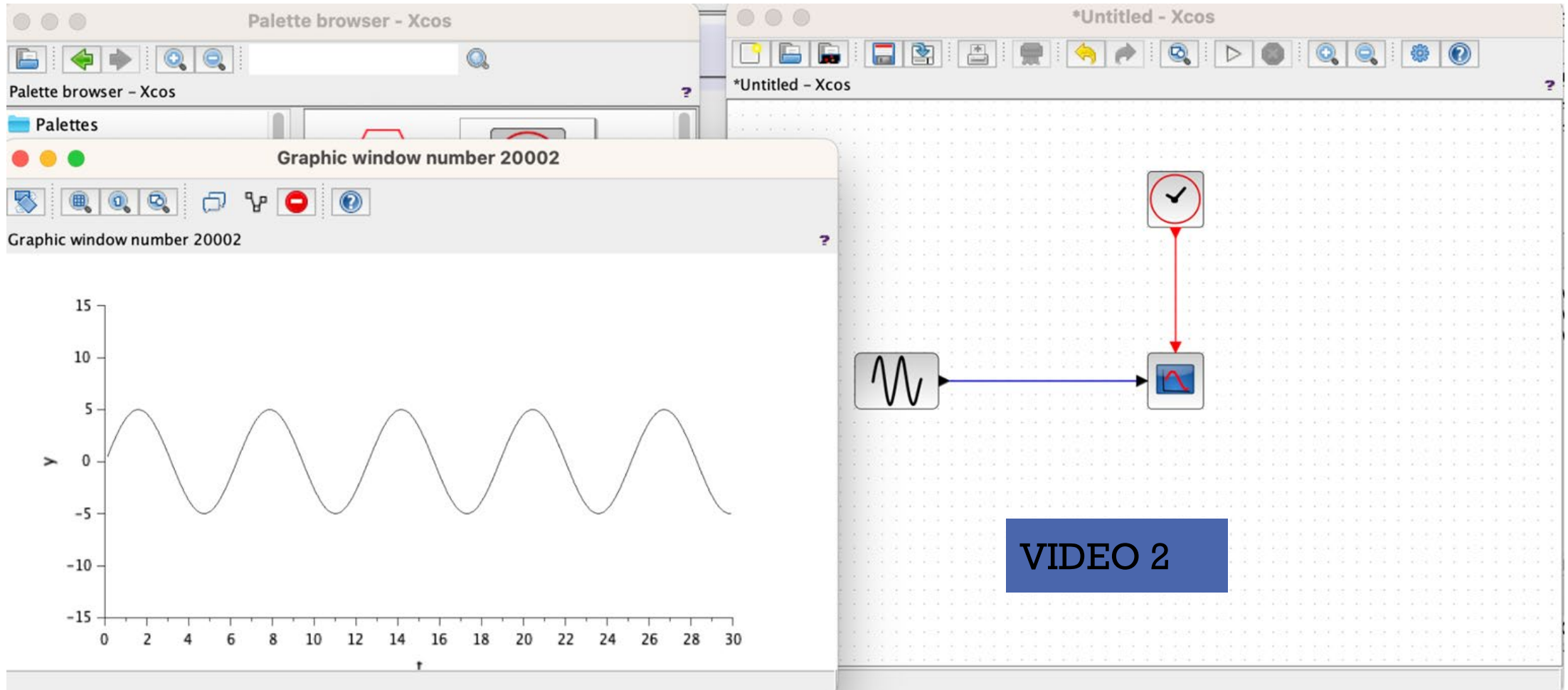
At the bottom of the graphic window, there is a blue box with the text "VIDEO 1" and a partially visible text "demand been bu speakin pool of" and "n (MECASIF, MORDICUS) has rent challenges when is proud to be part of this".

Scilab Xcos

- Xcos in Scilab is tool dedicated to the modeling and simulation of hybrid dynamic systems including both continuous and discrete models
- Xcos includes a graphical editor which allows to easily represent models as block diagrams by connecting the blocks to each other
- Each block represent a predefined basic function or a user-defined one.

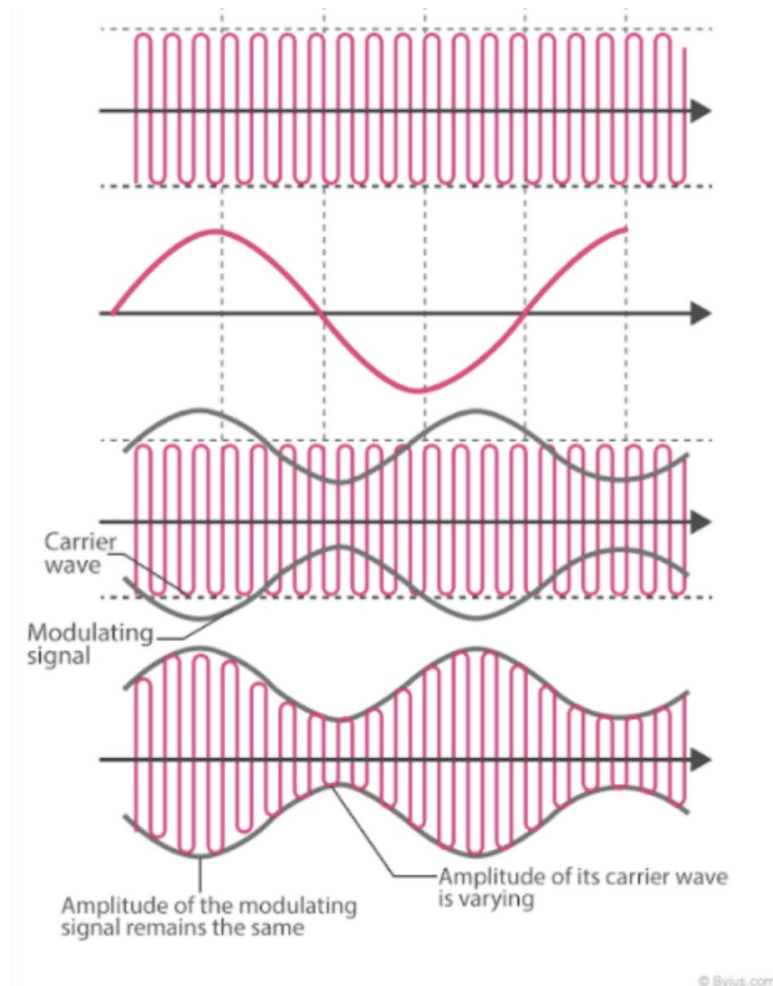


Simple example using Xcos

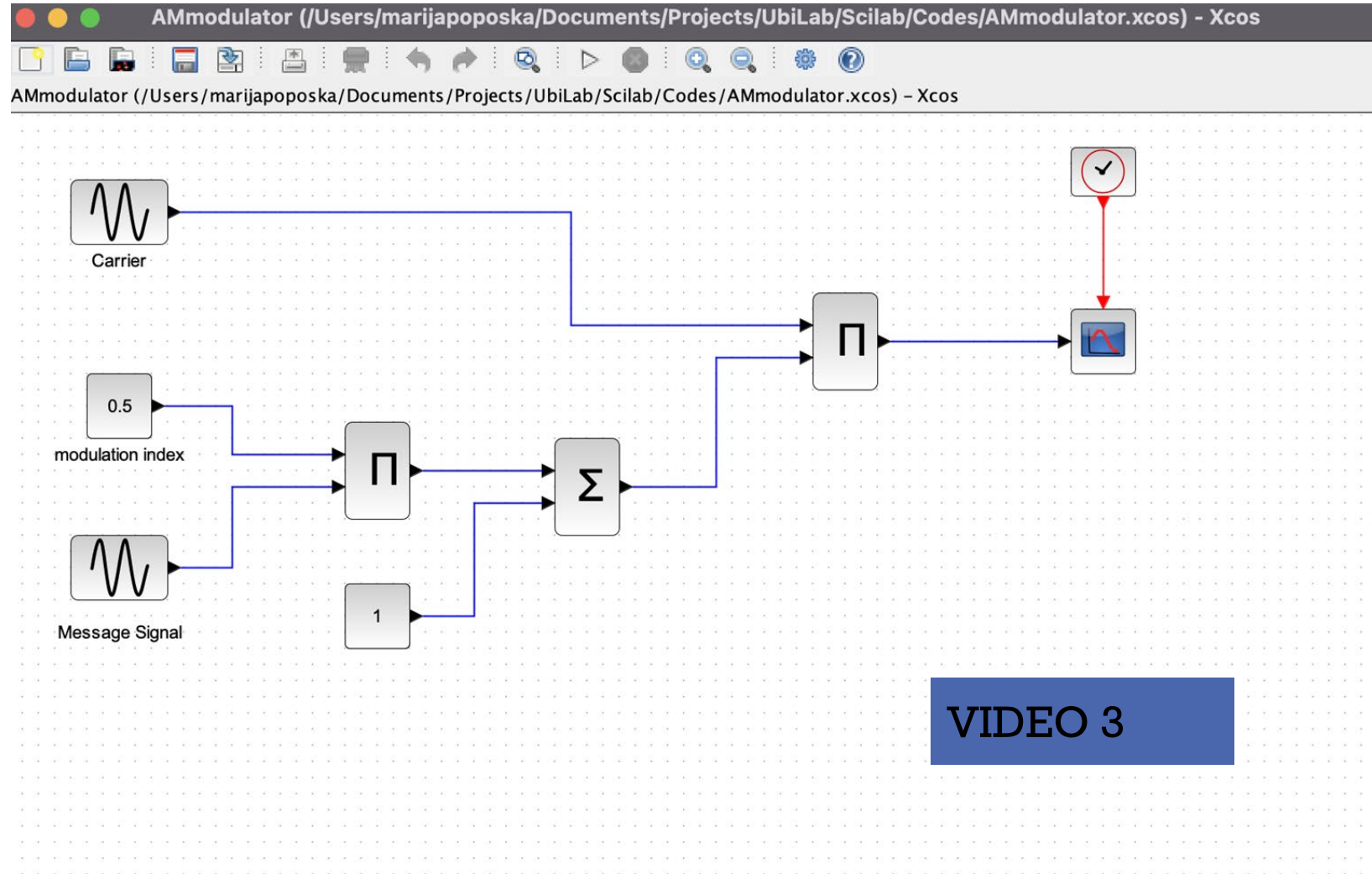


Laboratory exercise 2: Amplitude Modulation (1/2)

- Amplitude modulation is a process by which the wave signal is transmitted by modulating the amplitude of the signal.
- It is often called AM and is commonly used in transmitting a piece of information through a radio carrier wave. Amplitude modulation is mostly used in the form of electronic communication.



Laboratory exercise 2: Amplitude Modulation (2/2)



VIDEO 3



Co-funded by the
Erasmus+ Programme
of the European Union



Thank You!