MATLAB: MATrix LABoratory

Matlab is a high-performance special purpose program/language optimized to perform engineering and scientific calculations.

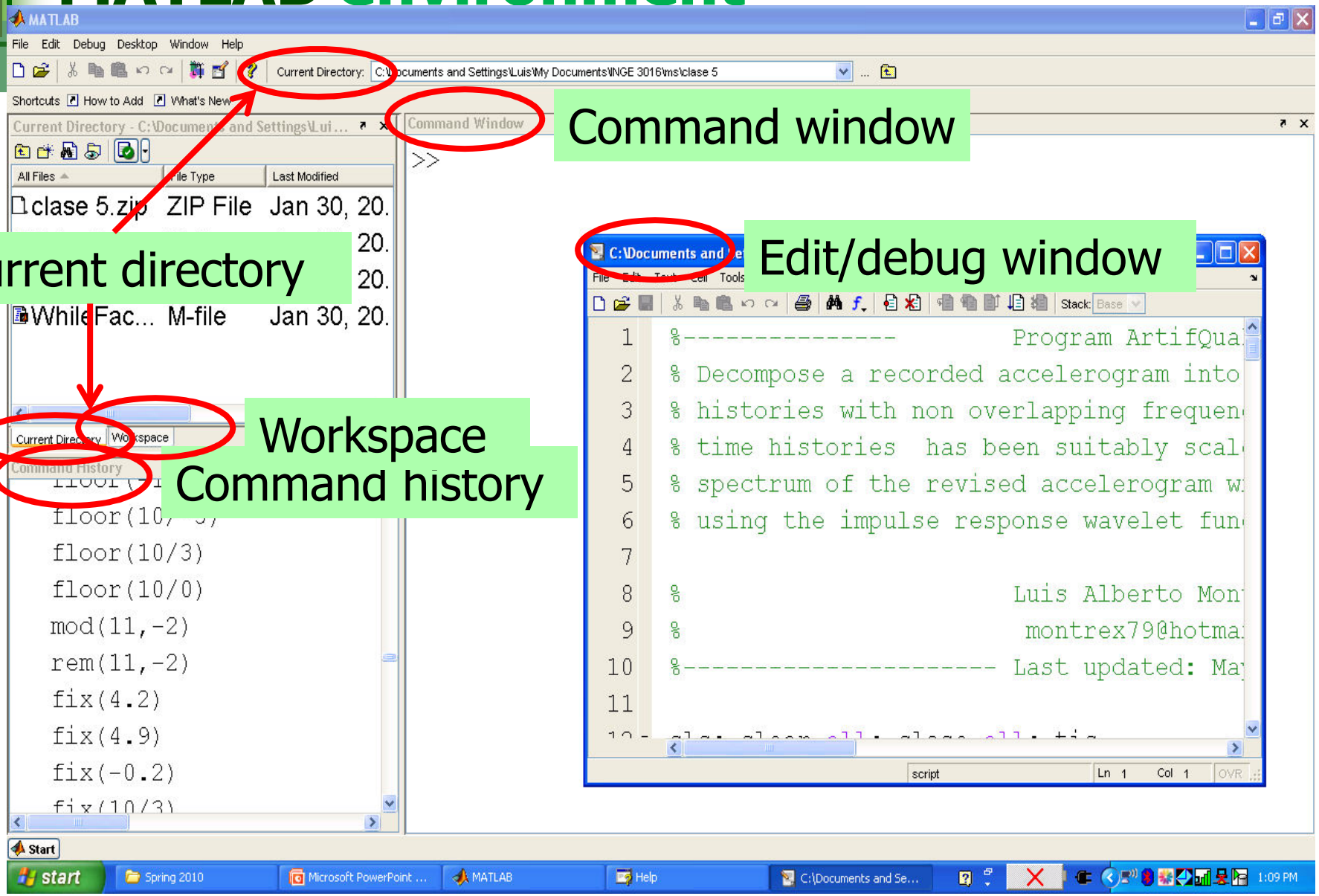
Advantages:

- **Easy** to use
- Predefined **functions**: trigonometric, statistics…
- Device independent **plotting**

Disadvantages:

- Mostly an **interpreted** language:
  - no stand-alone executable
  - "time consuming"
- **Expen$$$ive**

MATLAB environment



Getting Help

Use the help browser: by selecting the icon, or typing helpdesk or doc or F1 in the Command Window.

In the command window, type “help” followed by the function name.

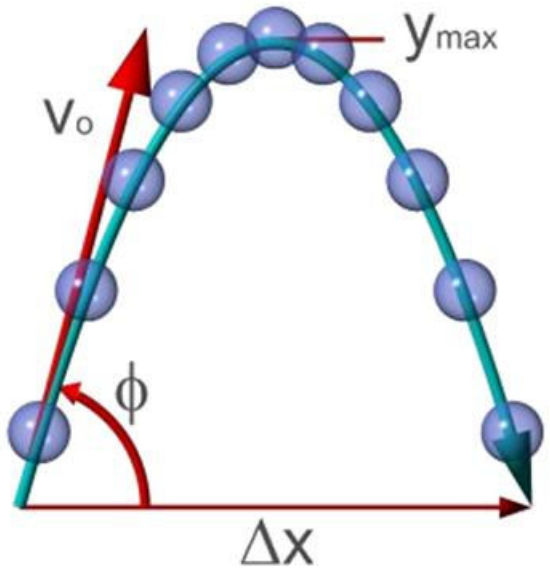
In the command window, type “lookfor” followed by the function name.

Using the help is the best way to learn/master Matlab!

Some important commands

CLC: Clear command window
CLEAR: Clear variables and functions from memory
CLEAR ALL: removes all variables
CLOSE: Close figure
CLOSE ALL closes all the open figure windows

Movimiento Parabólico



$$V_{oy} = v_o \sin(\phi)$$

$$y = y_o + v_{oy}t + \frac{1}{2}at^2$$

$$a = -g$$

$$V_{ox} = v_o \cos(\phi)$$

$$x(t) = x_o + v_{ox}t$$

Calcule las coordenadas x & y de la bola después de 3 segundos si: $x_o=y_o=0$, v_o= 18m/s, $\theta=80°$. Primero use la ventana de comandos y después escriba un programa.

Movimiento Parabólico

The code is available at the e-courses page (parabolico1.m)

Command Window

```
==========================================================================
calcula las coordenadas x & y de una particula en movimiento parabolico
==========================================================================

posicion inicial en x [m] : 0
posicion inicial en y [m] : 0
velocidad inicial en [m/s] : 10
angulo de salida [deg] : 15
tiempo al que desea calcular la posicion [s] : 10
aceleracion de la gravedad [m/s2] usulamente ~9.8 : 9.8

==========================================================================
la coordenada en x es: 96.5926m
la coordenada en y es: -464.1181m
==========================================================================
fx >>
```

User defined functions

Structured Programming: Also known as: ***top-down programming (in your textbook),*** procedure-oriented programming, GOTO-less programming.

Divides a procedure or algorithm into parts known as subprograms, subroutines, modules, blocks, procedures or ***functions (in MATLAB)***.

Matlab functions

A **Matlab function** is a special type of M-file that runs in its **own independent workspace**. It receives input data through an **input argument** list, and return results through an **output argument** list.

The names of the M-file and of the function should be the same.

```
Function [argout1,argout2,...] = fname(inarg1,inarg2,...)
%UNTITLED2 Summary of this function goes here
%   Detailed explanation goes here


.
.
.
end
```

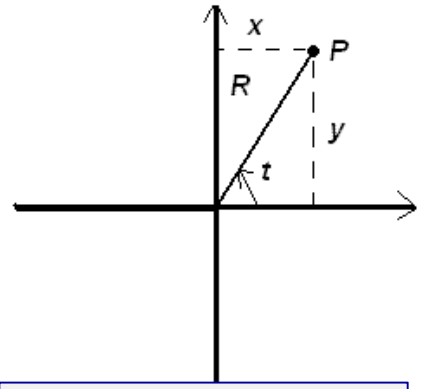
Examples (simple functions)

```
function [C] = Fahrenheit2Celsius(F)
%Fahrenheit2Celsius Converts a temperature from Fahrenheith to Celsius
%    Implements the equation C = (F-32)*5/9

C = (F-32)*5/9;

end
```

Make sure the current directory in the command window is the one that contains the function you are calling

Do not include "clc, clear, close all"

Examples (multi-input / multi-output functions)



$R^2 = x^2 + y^2$
$\tan(t) = y/x$

```
function [r,theta] = rect2polar(x,y)
%rect2polar Converts from rectangular to polar coordinates
%   Output angle between 0-360 degrees

r     = (x^2 + y^2)^0.5;

theta = atan2(y,x); % atan2(Y,X) returns values in the closed interval [-pi,pi]
theta = (180/pi)*theta; % converts to degrees

if theta<0 % ensures the angle is between 0-360 degrees
    theta = 360-abs(theta);
end

end
```

Command Window

```
>> [dist,angulo] = rect2polar(-2,-2)

dist =

    2.8284


angulo =

   225
```

Examples (calling functions from a program)

Vuelva a escribir el programa de movimiento parabólico pero ahora compuesto de funciones.

```
clc, clear, close all
[xo,yo,vo,theta,t,a] = EntrarDatos;
a = -abs(a); % asegura que la gravedad es negativa
x = AnalizarMovEnX(vo,xo,theta,t);
y = AnalizarMovEnY(vo,yo,theta,t,a);
MostrarResultado(x,y)
```

The functions are available at the e-courses page

Make sure the functions are saved in the same folder with the program or use addpath to specify the folder(s) where the functions are located

e.g.addpath('c:/matlab/myfiles')