

Software

5.3 Scilab Software-Theoretical Introduction

Scilab:

Scilab is open-source software that is used for data analysis and computation. It is also an alternative for MATLAB as this is not open-source. Scilab is named as Scientific Laboratory which resolves the problem related to numeric data and scientific visualization. It is capable of interactive calculations as well as automation of computations through programming. It provides all basic operations on matrices through built-in functions so that the trouble of developing and testing code for basic operations are completely avoided. Further, the numerous toolboxes that are available for various specialized applications make it an important tool for research. Being compatible with Matlab, all available Matlab M-files can be directly used in Scilab with the help of the Matlab to Scilab translator. The greatest features of Scilab are that it is multiplatform and is free. It is available for many operating systems including Windows, Linux and MacOS X. Some basic features of Scilab are given below:

1. It is capable to solve different algebraic equations.
2. It supports the development of certain complicated algorithms.
3. Capable of the model the previous computations.
4. Performs visualization in Bar Graphs, lines, Histograms, MathML annotation.

When we start up Scilab, we see a window shown in Fig. 1.3.

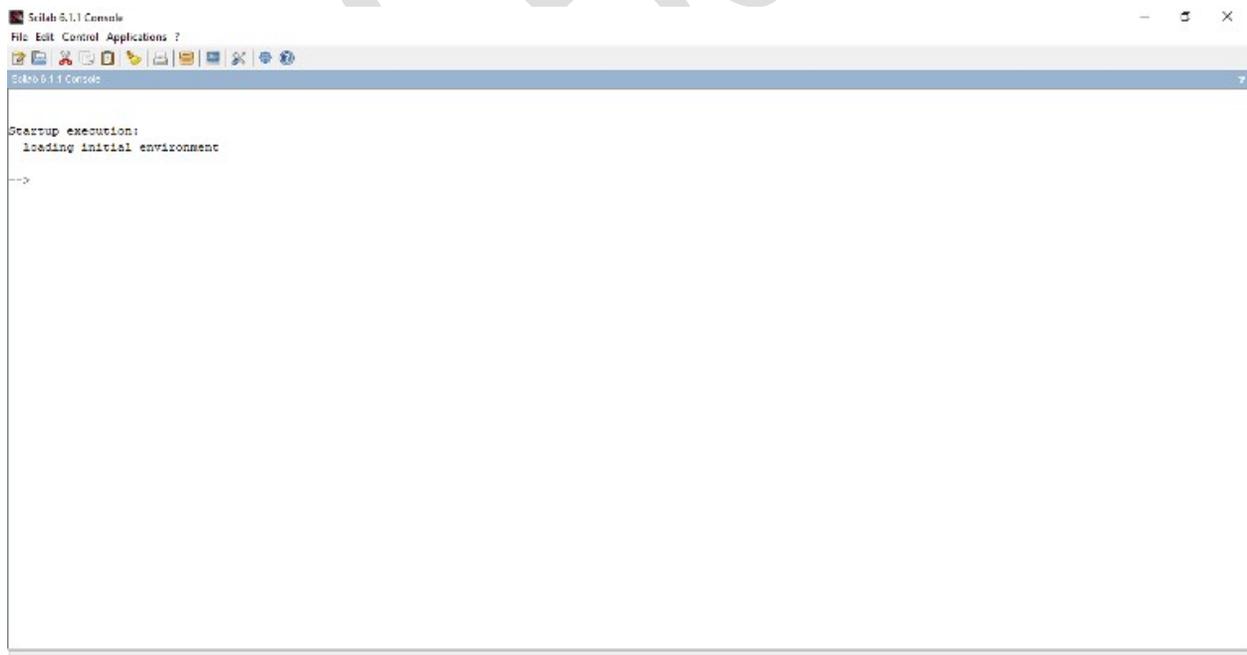


Fig. 5.1

The user enters Scilab commands after the prompt -->. But many of the commands are also available through the menu at the top. The most important menu for a beginner is

the “Help” menu. Clicking on the “Help” menu opens up the *Help Browser*, showing a list of topics on which help is available (see the Fig. 5.1).

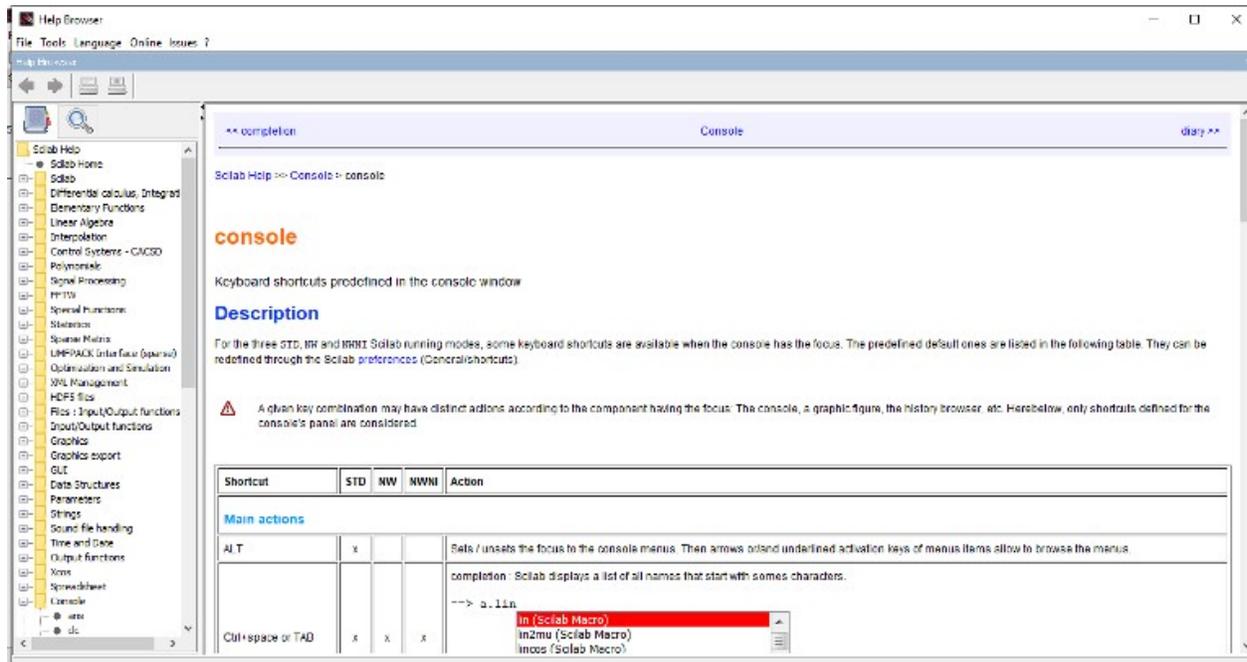


Fig. 5.2

Clicking on the relevant topic takes you to hyperlinked documents similar to web pages. The Help Browser has two tabs – *Table of Contents* and *Search*.

Table of Contents contains an alphabetically arranged list of topics and we may use the Search tab to search the help for particular topic by typing the topic in it.

Starting with Scilab

After completion of installation process, we can enter in Scilab by double-clicking on the Scilab shortcut *icon* available on our desktop. When we start Scilab, a special window called the Scilab Console appears which contains some *other* windows. The major tools within the Scilab Console are:

Scilab Console

Variable Browser

Scilab Demonstrations

The Help Browser

The Command History Window

File Browser

Graphic Window

Quitting Scilab

In order to quit Scilab, type **quit** or **exit** after the prompt, followed by pressing the enter or return key.

Entering Commands

To execute commands, every command has to be followed by enter key. Scilab commands are case sensitive and **lower case** letters are used throughout.

The Semicolon Symbol (;)

If the semicolon symbol (;) is typed at the end of a command, the output of the command is not displayed.

The clc Command

Typing **clc** command and pressing enter key cleans the command window. Once the clc command is executed, a clear window is displayed.

The clear Command

The **clear** command remove all the variables from the memory.

Help

To obtain help on a particular topic in the Scilab-list of built-in functions, e.g., Determinant, type help det after prompt.

Special Variable Names and Constants

1. **ans** It represents a value computed by an expression but not stored in a variable name.
2. **i, j** Imaginary unit/operator defined as $\sqrt{-1}$.
3. **inf** Infinity (∞)
4. **eps** Smallest floating point number.
5. **pi** $\pi = 3.141592653589793$
6. **NaN** Stands for not a number. E.g., 0/0.
7. **clock** It represents the current time in a row vector of six elements containing year, month, day, hour, minute, and seconds.
8. **date** It represents the current date in a character string format.

Note: (i) Overwriting/using these variables and constants should be avoided in programming.

(ii) Scilab is a case sensitive language for function, script and variable names for all the platforms. For instance, Ab, ab, aB and AB are the names of four different variables.

Arithmetic Operations

Name of Arithmetic Operation	Symbol	Exapmle
Addition	+	$10+5 = 15$
Subtraction	-	$10-5 = 5$
Multiplication	*	$10*5 = 50$
Right Division	/	$10/5 = 2$
Left Division	\	$10\5 = 5/10 = \frac{1}{2}$
Exponentiation	^	$10^5 = 10^5 = 100000$

Some General Commands

Command Name	Description
Clc	It clears the command window.
Clear	It clears the Workspace, all variables are removed.
clear all	Same as the command clear.
clear a b c	It clears only the variables a, b and c from the Workspace.
Clf	It clears the figure window.
Who	Lists variables currently in the Workspace.
whos	Lists variables currently in the Workspace with their sizes.

Constant	Meaning
%pi	$\pi = 3.14159 \dots$
%e	$e = 2.71828 \dots$
%i	iota i.e. $\sqrt{-1}$
%eps	Epsilon
%inf	Infinity i.e. ∞
%nan	Not a number

Some calculations in Scilab and their results are given below:

```
--> 2+3
ans =

    5.

--> a=2+3
a =

    5.

--> p=sin(%pi/3)+2*cos(%pi/3)
p =

    1.8660254

--> b=2+3-5*6
b =

   -25.
```

Here we can see that **ans** is used as the default variable. Further, the predefined constants in Scilab are shown in the table given below:

5.4 Basic Difference Between MATLAB and Scilab Software

S. No.	MATLAB	Scilab
1	MATLAB is used for performing mathematical computing.	Scilab is used for performing scientific computations.
2	MATLAB is written in C, C++ and Java.	Scilab is programmed with C, C++ and Fortran.
3	MATLAB is used for Matrix Laboratory.	Scilab is used for Scientific Laboratory.
4	MATLAB files save with extension ".m"	Scilab files save with extension ".sci"
5	The comment line begins with %	The comment line begins with //
6	It is not an open-source language.	It is open-source software.
7	MATLAB is used for solving high level computations.	Scilab is used for solving low level scientific computations.

8	The syntax for declaring an empty matrix is [] in MATLAB.	The syntax for declaring an empty matrix is [] + 1 in Scilab and returns 1.
9	Predefined variables are not write protected in MATLAB.	Predefined variables usually have the % prefix in Scilab. They are write protected.
10	Boolean variables are 0 and 1 in MATLAB.	Boolean variables are %T and %F in Scilab.
11	Polynomials are considered as vectors of coefficients in MATLAB.	Polynomials and Polynomial matrices are defined by the function poly in Scilab.
12	MATLAB functions are collectively defined by (M-files)	Scilab doesn't prefer functions to load automatically; instead, it executes the command getf(" ") before loading it.
13	MATLAB could be run from Python Interpreter.	Scilab couldn't be run from Python Interpreter. Interactive visualizations and browser based techniques are done in Scilab.
14	MATLAB could easily learn by using Simplistic interface and meets the need of the business compared with Scilab.	Scilab is multiplatform.
15	Modulo is represented as mod(a,n) in MATLAB.	Modulo is represented as Pmodulo(a,n) in Scilab.
16	Due to paid software, MATLAB is less accessible.	Scilab is free and has less support for add-on modules.

5.5 Calculation with MATLAB or Scilab

(a) **Representation of matrix (2×2 order):** Here we will learn to create a matrix in MATLAB and Scilab. Some examples of matrices and their notations in MATLAB and Scilab are as follow:

Matrix Type	Type the command after Prompt (>>) in MATLAB	MATLAB Notations and Results
Row Vector or Row Matrix	A=[1 0 -1 2]	<pre>>> A=[1 0 -1 2] A = 1 0 -1 2</pre>

<p>Column Vector or Column Matrix</p>	<p>B=[1; 2; 3; 4]</p> <p>Or</p> <p>B=[1 2 3 4]'</p>	<pre>>> B=[1; 0; -1; 2] B = 1 0 -1 2 >> B=[1 0 -1 2]'</pre>
<p>Matrix of order 2×2</p>	<p>A=[0 1; -2 3]</p> <p>Or</p> <p>A=[0 1 -2 3]</p>	<pre>>> A=[0 1; -2 3] A = 0 1 -2 3 >> A=[0 1 -2 3] A = 0 1 -2 3</pre>

- Note:** (i) Semicolon or Enter Key is used for new row while assigning or entering a matrix.
(ii) Using the symbol ' after closing of Matrix means Transpose of the matrix.

(b) Addition, Subtraction of matrices (2×2 order) in MATLAB or SciLab: Performing addition and subtraction operation of matrices in MATLAB is so easy and interesting for beginners. Now we will learn addition and subtraction of Matrices in MATLAB by various examples in table as follow:

Assignments of Matrices	Name of Matrix Operations	Symbols of operations	Remarks
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<pre>>> A=[2 5; 7 9] A = 2 5 7 9 >> B=[-5 8; -3 1] B = -5 8 -3 1 >> C=[6 -4] C = 6 -4</pre>	Assignment	=	Created three matrices A, B and C of sizes 2×2, 2×2 and 1×2 respectively by assignment operation.
<pre>>> D=A+B D = -3 13 4 10</pre>	Addition	+	Addition of matrices A and B is assigned to new variable D.
<pre>>> E=A-B E = 7 -3 10 8</pre>	Subtraction	-	Subtraction A-B is assigned to the new variable E.
<pre>>> Z=A+C Error using + Matrix dimensions must agree. >> H=B-C Error using - Matrix dimensions must agree.</pre>	Addition Subtraction	+ -	Matrices A and C are tried to be added and C is tried to be subtracted from B, but MATLAB showed an error message due to their different sizes.

Note: While performing addition and subtraction of matrices, the size/order of matrices must be same, otherwise MATLAB will give an error message.