First steps - Mathematica

This document is compiled in order to introduce the program mathematica available in the version 7 on the computer system of the CIP pool in the P.I. and the KIP.

Important mathematica documentation links:

- http://documents.wolfram.com
- http://library.wolfram.com/infocenter
- http://demonstrations.wolfram.com

The later link includes all kinds of examples and demonstrations, among them some from physcis:
http://demonstrations.wolfram.com/StaticEquilibriumAndTriangleOfForces/

Introduction

- Mathematica (kernel, frontend) is a highly interactive system for doing mathematics in the numerical, symbolic and graphical domain.

- First released in 1988

- Mathematica was to create once and for all a single system that could handle all the various aspects of technical computing in a coherent and unified way. This was possible due to the invention of a new kind of symbolic computer language that could for the first time manipulate the very wide range of objects involved in technical computing using only a fairly small number of basic primitives.

- Used today throughout the sciences, physical, biological, social and other.

- In engineering, Mathematica has become a standard tool for both development and production.

- Important tool in computer science and software development

Mathematica structure

`Mathematica kernel` the part that actually performs computations

`Mathematica front end` the part that handles interaction with the user

Notebooks:

the most common type of front end for Mathematica is based on interactive documents known as notebooks. Notebooks mix Mathematica input and output with text, graphics, palettes and other material. You can use notebooks either for doing ongoing computations, or as means of presenting or publishing your results.

The notebook front end includes many menus and graphical tools for creating and reading notebook documents and for sending and receiving material from the Mathematica kernel.

Mathematica prints a prompt of the form

```
In[n]:=
```

to tell you that it is ready to receive input. When you have entered your input, Mathematica processes it, and then displays the result with a label of the form

```
Out[n]=
```

Mathematica notebooks are structured interactive documents that are organized into a sequence of cells. Each cell contains material of a definite type--usually text, graphics, sounds or Mathematica expressions. When a notebook is displayed on the screen, the extent of each cell is indicated by a bracket on the right.

`Shift-Enter or Shift-Return` send a cell of input to the Mathematica kernel

- Particularly in larger notebooks, it is common to have chapters, sections and so on, each represented by groups of cells.
- You can set up a button in a Mathematica notebook which causes various operations to be performed whenever you click it.
- Hyperlinks in notebooks work very much like the buttons

Example:

In[1]:= 2 ^ 100

Shift-Enter

Out[1]= 1 267 650 600 228 229 401 496 703 205 376

This is your first notebook. Try to save it as first.nb in the directory MyMathematicaApp . Close Mathematica and open it with the notebook first.nb

As aid to input data palettes are available via pull down menues, but all symbols can be obtained by a combination of key strokes.

```
In[2]:= %
```
returns the last result

```
In[3]:= %n
```
returns the result of Output line n

```
In[1]:= 77^2
Out[1]= 5929

In[2]:= % + 1
Out[2]= 5930
```

You can always go back to a specific line in the notebook and continue the calculation.

```
In[n]:= 2^22 ;
```
the ; suppresses the output, but you can still go back by

```
In[2]:= %
```

```
In[10]:= expr1 ; expr2 ; expr3
```
do several operations, and give the result after the last one

Configuration files for Mathematica

```
$HOME/.Mathematica
```

There are two main subdirectories, one for the kernel

```
$HOME/.Mathematica/Kernel
```

another one for the front end

```
$HOME/.Mathematica/FrontEnd
```

You can edit the file

```
init.m
```

and configure the behaviour of mathematica. The commands

```
$UserBaseDirectory
$BaseDirectory
```

return the Unix path to your and the system's base directories.

Mathematica's Help:

the Help menu gives you access to the Help Browser, which serves as an entry point into a large amount of online documentation for Mathematica.

`In[2]:=?Name` gives detailed information on Name

`In[3]:=?N*` gives detailed information on everything which starts with N

Tutorials

A nice tutorial on the college entry level by Mike Pepe is available here:
Mathematica Tutorial, © 2007, Seattle Central Community College Math Dept., Mike Pepe
http://www.physi.uniheidelberg.de/~marks/PhysikI/MathematicaTutorial.nb

For a mathematica tutorial including example notebooks see

http://www.physi.uni-heidelberg.de/~marks/mathematica