Laplace

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COLLABORATORS

	TITLE : Laplace		
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REVISION HISTORY

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Contents

Chapter 1

Laplace

1.1 tutorial

- Laplace Manual ↩

-- Tutorial -

4) Turorial

This chapter is still under construction. I will just give some keywords and examples; a more extensive description needs a lot of more work. Please wait for the later releases.

Laplace offers a lot of functions. The easiest way to learn how to use it, is to start with some examples. This should be enough for most applications. For a more detailed view, you should look at the descriptions of the command syntax and internal functions. But I think that those chapters are too detailes for a first introduction.

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Analysis

*
Linear Algebra

*
Function plotting

*
Statistics

*
Error distribution

*
Programming

1.2 tutanalysis

```
- Laplace Manual -------------------------------------------------- Analysis -
```

4.1) Analysis

Define a function

```
> f(x) = x^2
> f(4)
>    => 16
```

Derive a function

The function derive() calculated the partial derivation of a given function.

```
> f'(x) = derive( sin(x), x );
> f''(x) = derive( sin(x), x, 2 );
> g(x) = sin(x)
> g'(x) = derive(g)
> h(x,y) = sin(x)*cos(y)
> h'_x(x,y) = derive(h(x,y), x)
> h'_y(x,y) = derive(h(x,y), y)
```

```
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```

1.3 tutlinalg

```
- Laplace Manual -------------------------------------------- Linear Algebra -
```

4.2) Linear Algebra

Create vectors and matrices

Vectors are always column vectors.

The elements of a matrix row are seperated by commas, the rows are seperated by semicolons. You can leave out some elements, which are then filled with zeros.

```
> v = [7,9,4]
> M = [4,7,8;6,1,9;7,2,9]
> N = [4;,1;,,9]
```

Access elements

```
> v_1 = v[1]
>    => 7
> m_23 = M[2,3]
>    => 9
```

The first element of a vector (row/column of a matrix) has the index one. To fetch a column or row vector of a matrix, use .. as an index

```
> r = M[2,..]
>    => second row
> c = M[..,1]
>    => first column

Invert matrix

   Matrix must be square and det(M) != 0
> invert(M)

Matrix determinant

   Matrix must be square.
> det(M)

Gaussian algorithm

   The Gaussian algorithm converts the matrix to the form

                               / 1 * * * * * \
                               | 0 0 1 * * * |
                               | 0 0 0 1 * * |
                               | 0 0 0 0 0 1 |
                               \ 0 0 0 0 0 0 /

> gsolve(M)

Matrix rank

   Apply the Gaussian algorithm and count non-zero rows.
> rank(M)


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```

1.4 tutplot

```
- Laplace Manual ----------------------------------------- Function plotting -

4.3) Function plotting

   Simple plot of an expression:
> plot(x^2, x)
> plot(sin(y)^2, y)
> f(x)= x^3 - x^2 + 4
> plot(f(x), x=0..10)

   Simple animated plot of an expression:
> animate(sin(y*sinh(x))^2, x, y)

   Several graphs in one window:
> p = plot_new()
> plot_addfunc(p, x^2, x)
> plot_addfunc(p, sin(y), y)
> plot_open(p)
```

```
   Several graphs in one window (animated):
> p = plot_newanim()
> plot_addfunc(p, x^(2+t), x, t)
> plot_addfunc(p, sin(y)*exp(z*y), y, z)
> plot_open(p)


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```

1.5 tutstats

```
- Laplace Manual ------------------------------------------------ Statistics -

4.4) Statistics

   Don’t forget to load the standard.lh library
> include("Init.lh")

   In most cases it is useful to enable floatpoint calculations:
> $usefloat = TRUE

   Create a array of numbers:
> A = array(75.8, 74.6, 76.2, 75.5, 75.9, 78.0, 79.2, 74.7, 75.5, 75.3)

   Calculate average value of this array
> average(A)
>    => 76.07

   Calculate standard variation
> sigma(A)
>    => 1.449943

   Relative error of this array is
> error(A)
>    => 0.458512

   Your final average value is 76.07\ensuremath{\pm}0.46


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```

1.6 tuterrdist

```
- Laplace Manual ---------------------------------------- Error distribution -

4.5) Error distribution


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```

1.7 tutprog

```
- Laplace Manual ----------------------------------------------- Programming -

4.6) Programming


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