The Figure Class

Basic plotting in C++

Contents

1 Installation

Follow the steps in the `INSTALL` file.
In the directory of the `CMakeLists.txt` do:

Under Linux/Mac OS:

```
$ mkdir build
$ cd build
$ cmake ..
$ sudo make install
```

Under Windows:

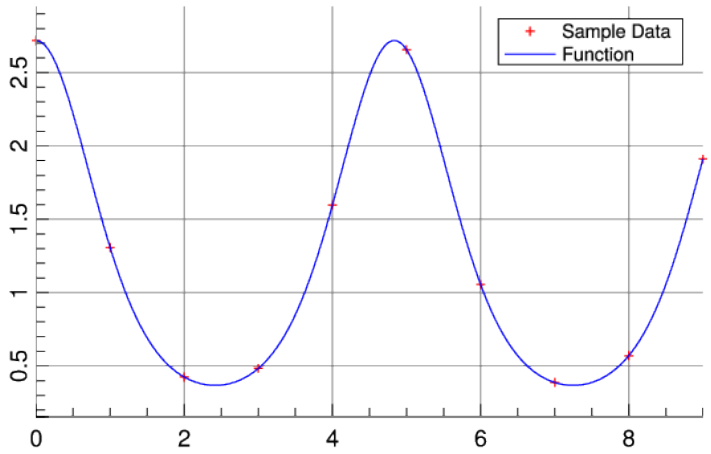
- open a terminal with administrator rights
- do the same as above but without the `sudo`

This installation requires CMake (`https://cmake.org/download/`). The "manual" way of installing it is described in `INSTALL`.

1.1 Opening example

This short example code will show, how the Figure class can be used.

```
int main()
{
  std::vector<double> x(10), y(10);
  for (int i = 1; i <= 10; ++i){
    x[i] = i; y[i] = std::exp(std::cos(0.2*i));
  }
  Eigen::VectorXd u = Eigen::VectorXd::LinSpaced(500, 1, 10),
                  v = ( (0.2*u.array()).cos().exp() ).matrix();
  Figure fig;
  fig.plot(x, y, " +r", "Sample Data");
  fig.plot(u, v, "b", "Function");
  fig.legend();
  fig.save("plot.eps");
  return 0;
}
```



2 Commands

2.1 grid

Definition:

```
void grid( const bool on = true,
           const std::string gridType = "-",
           const std::string gridCol = "h" )
```

Restrictions: None.

Examples:

```
Figure fig;
fig.plot(x, y, "r");
fig.grid(false); // unset grid
fig.save("plot.eps");

Figure fig;
fig.plot(x, y, "r");
fig.grid(true, "!", "b"); // blue fine mesh
fig.save("plot.eps");
```

2.2 xlabel

Definition:

```
void xlabel( const char* label,
             const double pos = 0 )
```

Restrictions: If `setlog` is called `xlabel` should be called beforehand.

Examples:

```
Figure fig;
fig.plot(x, y, "+g"); // '+g' equals matlab/python '+-g'
fig.xlabel("Linear x axis");
fig.save("plot.eps");

Figure fig;
fig.setlog(true, true);
fig.plot(x, y, "+g");
fig.xlabel("Logarithmic x axis"); // Not good - should be called before 'setlog'
fig.save("plot.eps");

Figure fig;
fig.xlabel("Logarithmix x axis"); // Good
fig.setlog(true, true);
fig.plot(x, y, "+g");
fig.save("plot.eps");
```

2.3 ylabel

Definition:

```
void ylabel( const char* label,
             const double pos = 0 )
```

Restrictions: If `setlog` is called `ylabel` should be called beforehand.

Examples: See `xlabel`.

2.4 legend

Definition:

```
void legend( const double xPos = 1,
             const double yPos = 1 )
```

Restrictions: None.

2.5 setlog

Definition:

```
void setlog( const bool logx = true,
             const bool logy = true )
```

Restrictions: All plots will use the latest `setlog` options or default if none have been set.

Examples:

```
Figure fig;
fig.setlog(true, false); // -> semilogx
fig.plot(x0, y0, "b");
fig.setlog(false, true); // -> semilogy
fig.plot(x1, y1, "r");
fig.setlog(true, true); // -> loglog
fig.plot(x2, y2, "g");
fig.save("plot.eps"); // ATTENTION: all plots will have been plotted in loglog-scale

Figure fig;
fig.plot(x, y, "b");
fig.save("plot.eps"); // -> default (= linear) scaling
```

2.6 plot

Definition:

```
template <typename yVector>
void plot( const yVector y,
           const std::string style,
           const char* legend = 0 )
```

```
template <typename xVector, typename yVector>
void plot( const xVector x,
           const yVector y,
           const std::string style,
           const char* legend = 0 )
```

Restrictions: `xVector` and `yVector` must have a `size()` method, which returns the size of the vector and a `data()` method, which returns a pointer to the first element in the vector. Furthermore `x` and `y` must have same length. Also note that the `style`-argument is required!

Examples:

```
Figure fig;
fig.plot(x, y, "b");
fig.save("data.eps");

Figure fig;
fig.plot(x, y); // Not OK - style missing
fig.save("data.eps");

Figure fig;
fig.plot(x, y, " *r", "Data w/ red dots"); // ' *r' equals matlab/python 'r*'
fig.save("data.eps");
```

2.7 fplot

Definition:

```
void fplot( const std::string function,
            const std::string style,
            const char* legend = 0 )
```

Restrictions: None.

Examples:

```
Figure fig;
fig.fplot("3*x\^2 + 4.5/x + exp(x)", "b");
fig.fplot("exp(cos(pi*x))","r","some periodic function");
fig.ranges(0.5, 2, 0, 5); // be sure to set ranges for fplot!
fig.save("plot.eps");

Figure fig;
fig.plot(x, y, "b", "Benchmark");
fig.fplot("x\^2", "k;", "\\ O(x\^2)");
// here we don't set the ranges as it uses the range given by the x,y data
// and we use fplot to draw a reference line (O(x\^2))
fig.save("runtimes.eps");
```

2.8 ranges

Definition:

```
void ranges( const double xMin,
             const double xMax,
             const double yMin,
             const double yMax )
```

Restrictions: xMin < xMax, yMin < yMax and ranges must be > 0 for axis in logarithmic scale.

Examples:

```
Figure fig;
fig.ranges(-1,1,-1,1);
fig.plot(x, y, "b");

Figure fig;
fig.plot(x, y, "b");
fig.ranges(0, 2.3, 4, 5); // ranges can be called before or after 'plot'

Figure fig;
fig.ranges(-1, 1, 0, 5);
fig.setlog(true, true); // will run but MathGL will throw a warning
fig.plot(x, y, "b");
```

2.9 save

Definition:

```
void save( const char* file )
```

Restrictions: The filename *must* end on `.eps`!

Examples:

```
Figure fig;
fig.save("plot.eps"); // OK

Figure fig;
fig.save("plot.png"); // Not OK - Only eps-format supported!
```

2.10 title

Definition:

```
void title( const char* text )
```

Restrictions: None.

3 Line characteristics

Linecolors[a]:

blue	`b`
green	`g`
red	`r`
cyan	`c`
magenta	`m`
yellow	`y`
gray	`h`
green-blue	`l`
sky-blue	`n`
orange	`q`
green-yellow	`e`
blue-violet	`u`
purple	`p`

[a] Upper-case letters will give a darker version of the lower-case version.

Linestyles:

none	
solid	`-`
dashed	`;`
small dashed	`=`
long dashed	`|`
dotted	`:`
dash-dotted	`j`
small dash-dotted	`i`

None is used as follows: `" r*"` gives red stars w/o any lines

Linemarkers:

+	`+`
o	`o`
◇	`d`
·	`.`
△	`^`
▽	`v`
◁	`<`
▷	`>`
⊙	`#.`
⊞	`#+`
⊠	`#x`