Gnuplot/C

Reference Manual

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Gnuplot/C Introduction

Gnuplot/C is an open source C/C++ interface library for the Gnuplot application : http://www.gnuplot.info. Gnupolot/C has been developed and tested under UNIX (Linux) and Windows. It is available from http://www.numerix-dsp.com/files or https://sourceforge.net/projects/gnuplotc/.

The API is based on the original Numerix Host Library (NHL) that was written in the early 1990s for Microsoft MS/DOS using the Microsoft and Borland C compilers. The API has been updated to change the underlying API to more closely match that of Gnuplot for example the 2D graph types point, line and stem are now “point”, “line” and “impulse” respectively. The original NHL colour #defines are now replaced by the Gnuplot colors which can be found by performing the following command in Gnuplot :

```
gnuplot> show colornames
```

Note : please accept our apologies for mixing the spellings of the words colour and color in this library. It is for purely historical reasons that the original library and documentation used the spelling colour but Gnuplot uses color.

Gnuplot/C supports multiple plots and multiple datasets (graphs) within a plot.

The maximum number of graphs supported on a plot is 50 but this can be changed by modifying the `#define MAX_NUM_GRAPHS` in `gpcPlot.h`. The maximum number of plots is unlimited.

The general strategy used for managing Gnuplot is to open a separate pipe to independent Gnuplot instances, for each plot required.

When plotting 2D graphs, two modes are available :
`GPC_MULTIPLOT` - Intermediate files are used for saving the data for each graph, which allows the graphs to be overlaid and re-scaled but has the side effect that it is slightly slower than piping the data directly.

`GPC_FASTPLOT` - Pipes the data directly to Gnuplot which means that the plot state is not stored so only single graphs can be added to a plot.

Options for Building multi-plots :

`GPC_MULTIPLOT`
`GPC_NEW` - Used to indicate the first graph in a plot
`GPC_ADD` - Used to indicate subsequent graphs added to a plot

`GPC_FASTPLOT`
`GPC_NEW` - Used to indicate the first graph in a plot
`GPC_ADD` - Used to indicate subsequent graphs added to a plot

Unlike NHL there is no limit to the maximum number of points in a dataset.

The original NHL graph types of `line`, `stem` and `point` are now replaced by the Gnuplot versions "`lines`" "`impulses`" and "`points`". It is now possible to use any of the additional Gnuplot plot styles such as "`linespoints`" and "`steps`". In addition it is also possible to include further Gnuplot style controls for example to specify circular points of size 1.5 use the following function parameter :

```
"points pt 7 ps 1.5",
```

Gnuplot/C Installation

Ensure Gnuplot is installed on your computer (see below for Gnuplot installation instructions).
Extract Gnuplot/C into a folder.
Ensure that the Gnuplot/C folder is registered in the INCLUDE and LIB environment variables so that your compiler can locate the header and library files.
Use make (or gmake) to build the library.
Move to the examples directory, build one and run it.

Gnuplot Installation

Windows

Download and install Gnuplot from http://www.gnuplot.info/download.html.
Ensure that the Gnuplot binary folder is registered in the PATH environment variable so that you can call the Gnuplot executable from any folder.

MacOS

You may find that Gnuplot reports that the wxt is an unknown terminal type; in which case, use the following command :

Uninstall your current version of Gnuplot and then install the +wxt variant.
`port variants gnuplot` to list available variants.

```
sudo port install gnuplot +wxwidgets
```

Source : http://stackoverflow.com/questions/13001847/wxt-terminal-for-gnuplot-on-mac-os-x

Note : After this I had to reboot MacOS to enable Gnuplot to recognize the new terminal types.

Note : Some OSX installations may struggle with this installation procedure. Please refer to this blog entry for further details :
http://blog.numerix-dsp.com/2017/01/gnuplotc-on-mac.html

Linux

Under Linux you need to install both Gnuplot and Gnuplot-X11 :

```
sudo apt-get install gnuplot
sudo apt-get install gnuplot-x11
```

Rebuilding the Library

This library has been developed and tested using Microsoft 64 bit Visual C/C++ Express, GCC under Cygwin and GCC under Ubuntu v16.

To rebuild the library under Windows, using the Microsoft compiler, you can use the following batch files :

mbuildlib.bat - Release mode
mbuildlibd.bat - Debug mode, enables Gnuplot debug output

To rebuild the library under Windows, using the Cygwin GCC compiler, you can use the following batch files :

gcc_win_buildlib.bat - Release mode

To rebuild the library under Linux you can use the following shell script files :

makefile.lx - Release mode

The functions are little more than parsers that output text values via pipes so this library can be used under any operating system to which Gnuplot is ported.

IMPORTANT

AFTER INSTALLATION PLEASE ENSURE THAT THE LIBRARY SRC DIRECTORY IS INCLUDED IN THE COMPILER; LIBRARY AND INCLUDE PATHS.

Building The Example Programs

The examples are located in the gnuplot_c/examples folder. To rebuild and execute the examples under Windows, using the Microsoft compiler, you can use the following batch files :

mbr.bat - Release mode
mbrd.bat - Debug mode, enables Gnuplot debug output

To rebuild and execute the examples under Windows, using the Cygwin GCC compiler, you can use the following batch files :

gbr.bat - Release mode

To rebuild the LinesAndPoints example under Linux, using the GCC compiler, you can use the following command :

```
gcc LinesAndPoints.c -I ../src -L ../src -l gnuplot_c -o LinesAndPoints
```

Modifying Gnuplot/C - Debug And Development

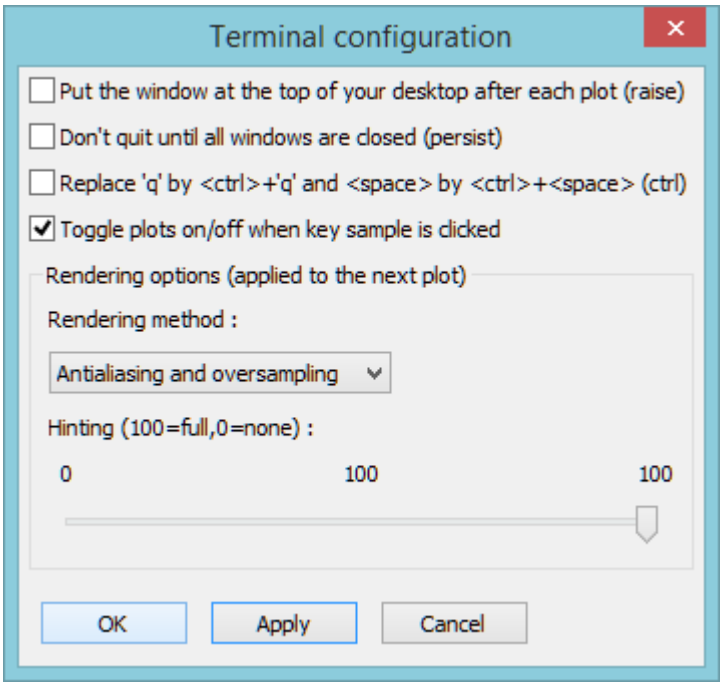
By default the library pipes the text output from Gnuplot to `null` (`nul` in Windows). This improves plotting performance because Gnuplot doesn't then echo the commands received, via the pipe, to the screen. If you wish to modify this library and debug your changes then a really useful tip is to use Gnuplot without output redirection so that the commands can be viewed in Gnuplot.

The `#define GPC_DEBUG` in `gpcPlot.h` can be set to `'1'` to enable command viewing or this can be defined on the compiler command line by using the following compiler option :

```
-D "GPC_DEBUG=1"
```

Gnuplot Usability Suggestions

By default Gnuplot brings the plot window to the front, which takes control away from the application generating the plot. In order to stop Gnuplot from doing this open the Configuration Dialog from any Gnuplot plot window and uncheck the tick box entitled : "Put the window at the top of your desktop after each plot (raise)" :



Click OK to save this configuration.

gpc_init_2d

FUNCTION NAME

gpc_init_2d

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

```
h_GPC_Plot *gpc_init_2d (const char *plotTitle,          Plot title
        const char *xLabel,                              X axis label
        const char *yLabel,                              Y axis label
        const double scalingMode,                        Scaling mode
        const enum gpcPlotSignMode signMode,             Sign mode
        const enum gpcMultiFastMode multiFastMode,       Multiplot / fast plot mode
        const enum gpcKeyMode keyMode);                  Legend / key mode
```

FUNCTION DESCRIPTION

Initialize the 2D plot function and returns a handle to a new plot.

NOTES ON USE

Scaling mode is either the maximum value on the Y axis or `GPC_AUTO_SCALE` which auto scales the Y axis.

signMode should be set to either `GPC_SIGNED`, `GPC_POSITIVE` or `GPC_NEGATIVE` depending on whether the plot should display signed (positive and negative) or only positive or only negative numbers.

multiFastMode should be set to either `GPC_MULTIPLOT` or `GPC_FASTPLOT` depending on which mode is required.

keyMode should be set to either `GPC_KEY_DISABLE` or `GPC_KEY_ENABLE` depending on whether or not the key/legend is required.

FUNCTION NAME

gpc_init_2d_logscalex

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

```
h_GPC_Plot *gpc_init_2d (const char *plotTitle,     Plot title
        const char *xLabel,                         X axis label
        const char *yLabel,                         Y axis label
        const double scalingMode,                   Scaling mode
        const enum gpcPlotSignMode signMode,        Sign mode
        const enum gpcMultiFastMode multiFastMode,      Multiplot / fast plot mode
        const enum gpcKeyMode keyMode);             Legend / key mode
```

FUNCTION DESCRIPTION

Initialize the 2D plot function and returns a handle to a new plot.

NOTES ON USE

Scaling mode is either the maximum value on the Y axis or `GPC_AUTO_SCALE` which auto scales the Y axis.

signMode should be set to either `GPC_SIGNED`, `GPC_POSITIVE` or `GPC_NEGATIVE` depending on whether the plot should display signed (positive and negative) or only positive or only negative numbers.

multiFastMode should be set to either `GPC_MULTIPLOT` or `GPC_FASTPLOT` depending on which mode is required.

keyMode should be set to either `GPC_KEY_DISABLE` or `GPC_KEY_ENABLE` depending on whether or not the key/legend is required.

FUNCTION NAME

gpc_plot_2d

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

int gpc_plot_2d (h_GPC_Plot *plotHandle,	Plot handle
const double *pData,	Dataset pointer
const int graphLength,	Dataset length
const char *pDataName,	Dataset title
const double xMin,	Minimum X value
const double xMax,	Maximum X value
const char *plotType,	Plot type
const char *pColour,	Colour
const enum gpcNewAddGraphMode addMode);	Add / new mode

FUNCTION DESCRIPTION

Plots the dataset onto the 2D graph.

NOTES ON USE

plotHandle is the plot created with the init function.

plotType is one of the standard Gnuplot plot types e.g. `"lines"`, `"points"`, `"impulses"`, `"linespoints"`, `"steps"` etc.

pColour is a standard Gnuplot color string e.g. `"blue"`. Use gnuplot> show colornames to see available colours.

addMode should be set to either `GPC_NEW` or `GPC_ADD` depending on whether or not this is a new graph or the dataset should be added to an existing plot.

FUNCTION NAME

gpc_init_xy

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

```
h_GPC_Plot *gpc_init_xy (const char *plotTitle,          Plot title
        const char *xLabel,                              X axis label
        const char *yLabel,                              Y axis label
        const double dimension,                          Dimension - this is square
        const enum gpcKeyMode keyMode);                  Legend / key mode
```

FUNCTION DESCRIPTION

Initialize the XY plot function and returns a handle to a new plot.

NOTES ON USE

Scaling mode is either the maximum value on the Y axis or `GPC_AUTO_SCALE` which auto scales the Y axis.

keyMode should be set to either `GPC_KEY_DISABLE` or `GPC_KEY_ENABLE` depending on whether or not the key/legend is required.

FUNCTION NAME

gpc_plot_xy

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

int gpc_plot_xy (h_GPC_Plot *plotHandle,	Plot handle
const ComplexRect_s *pData,	Dataset pointer
const int graphLength,	Dataset length
const char *pDataName,	Dataset title
const char *plotType,	Plot type
const char *pColour,	Colour
const enum gpcNewAddGraphMode addMode);	Add / new mode

FUNCTION DESCRIPTION

Plots the dataset onto the XY graph.

NOTES ON USE

plotHandle is the plot created with the init function.

plotType is one of the standard Gnuplot plot types e.g. `"lines"`, `"points"`, `"impulses"`, `"linespoints"`, `"steps"` etc.

pColour is a standard Gnuplot color string e.g. `"blue"`. Use gnuplot> show colornames to see available colours.

addMode should be set to either `GPC_NEW` or `GPC_ADD` depending on whether or not this is a new graph or the dataset should be added to an existing plot.

The complex data type is defined as :

```
typedef struct                  // Complex data type
{
  double  real;
  double  imag;
} ComplexRect_s;
```

FUNCTION NAME

gpc_init_pz

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

h_GPC_Plot *gpc_init_pz (const char *plotTitle,	Plot title
const double dimension,	Dimension - this is square
const enum gpcKeyMode keyMode);	Legend / key mode

FUNCTION DESCRIPTION

Initialize the pole-zero plot function and returns a handle to a new plot.

NOTES ON USE

keyMode should be set to either `GPC_KEY_DISABLE` or `GPC_KEY_ENABLE` depending on whether or not the key/legend is required.

FUNCTION NAME

gpc_plot_pz

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

int gpc_plot_pz (h_GPC_Plot *plotHandle,	Plot handle
const ComplexRect_s *pData,	Dataset pointer
const int graphLength,	Dataset length
const char *pDataName,	Dataset title
const enum gpcPoleZeroMode poleZeroMode,	Pole-zero mode
const enum gpcNewAddGraphMode addMode);	Add / new mode

FUNCTION DESCRIPTION

Plots the dataset onto the pole-zero graph.

NOTES ON USE

plotHandle is the plot created with the init function.

poleZeroMode should be set to either is one of the standard Gnuplot plot types e.g. "GPC_COMPLEX_POLE", "GPC_CONJUGATE_POLE", "GPC_COMPLEX_ZERO" or "GPC_CONJUGATE_ZERO " depending on what the data values represent.

addMode should be set to either GPC_NEW or GPC_ADD depending on whether or not this is a new graph or the dataset should be added to an existing plot.

The complex data type is defined as :

```
typedef struct                  // Complex data type
{
  double  real;
  double  imag;
} ComplexRect_s;
```

FUNCTION NAME

gpc_init_spectrogram

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

h_GPC_Plot * gpc_init_spectrogram (const char *plotTitle,	Plot title
const char *xLabel,	X axis label
const char *yLabel,	Y axis label
const int xAxisLength,	X axis length
const int yAxisLength,	Y axis length
const double yMin,	Minimum Y value
const double yMax,	Maximum Y value
const double zMin,	Minimum Z value
const double zMax,	Maximum Z value
const char *colourPalette,	Colour colourPalette
const enum gpcKeyMode keyMode);	Legend / key mode

FUNCTION DESCRIPTION

Initialize the spectrogram plot function and returns a handle to a new plot.

NOTES ON USE

colourPalette can be set to either of the standard palettes L `GPC_MONOCHROME` or `GPC_COLOUR` or you can supply your own palette in the following Gnuplot format :

```
"set palette defined (0 'black', 1 'blue', 2 'red', 3
'yellow', 4 'white')"
```

keyMode should be set to either `GPC_KEY_DISABLE` or `GPC_KEY_ENABLE` depending on whether or not the key/legend is required.

FUNCTION NAME

gpc_plot_spectrogram

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

int gpc_plot_spectrogram (h_GPC_Plot *plotHandle,	Plot handle
const double *pData,	Dataset pointer
const char *pDataName,	Dataset title
const double xMin,	Minimum X value
const double xMax);	Maximum X value

FUNCTION DESCRIPTION

Plots the dataset onto the spectrogram.

NOTES ON USE

Spectrogram plots plot by column, rather than row as per a standard 2D image.

plotHandle is the plot created with the init function.

This function can support spectrogram datasets that do not fill up the complete X axis range specified in gpc_init_spectrogram but passing the virtual pointer "GPC_END_PLOT" to the function as the data array pointer. For example :

```
gpc_plot_spectrogram (hSpectrogram,  // Graph handle
                      GPC_END_PLOT,  // Dataset pointer
                     "Plot Title",   // Dataset title
                      X_MIN,         // Minimum X value
                      X_MAX);        // Maximum X value
```

FUNCTION NAME

gpc_init_image

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

h_GPC_Plot *gpc_init_image (char *plotTitle,	Plot title
const int xAxisLength,	X axis length
const int yAxisLength,	X axis length
const unsigned int zMin,	Minimum Z value
const unsigned int zMax,	Maximum Z value
const char *colourPalette,	Colour colourPalette
const enum gpcKeyMode keyMode);	Legend / key mode

FUNCTION DESCRIPTION

Initialize the image plot function and returns a handle to a new plot.

NOTES ON USE

colourPalette can be set to either of the standard palettes L `GPC_MONOCHROME` or `GPC_COLOUR` or you can supply your own palette in the following Gnuplot format :

If zMin and zMax are both set to "`GPC_IMG_AUTO_SCALE`" then the image will autoscale the z axis values.

```
"set palette defined (0 'black', 1 'blue', 2 'red', 3
'yellow', 4 'white')"
```

keyMode should be set to either `GPC_KEY_DISABLE` or `GPC_KEY_ENABLE` depending on whether or not the key/legend is required.

FUNCTION NAME

gpc_plot_image

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

int gpc_plot_image (const h_GPC_Plot *plotHandle,	Plot handle
const unsigned char *pData,	Dataset pointer
const char *pDataName);	Dataset title

FUNCTION DESCRIPTION

Plots the dataset onto the image graph.

NOTES ON USE

plotHandle is the plot created with the init function.

FUNCTION NAME

gpc_init_polar

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

h_GPC_Plot *gpc_init_polar (const char *plotTitle,	Plot title
const double gMin,	Minimum gain value
const double gMax,	Maximum gain value
const enum gpcKeyMode keyMode);	Legend / key mode

FUNCTION DESCRIPTION

Initialize the polar plot function and returns a handle to a new plot.

NOTES ON USE

FUNCTION NAME

gpc_plot_polar

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

int gpc_plot_polar (h_GPC_Plot *plotHandle,	Plot handle
const double *pAngles,	Angles dataset pointer
const double *pGains,	Gains dataset pointer
const int graphLength,	Dataset length
const char *pDataName,	Dataset title
const char *plotType,	Plot type
const char *pColour,	Colour
const enum gpcNewAddGraphMode addMode);	Add / new mode

FUNCTION DESCRIPTION

Plots the dataset onto the polar plot.

NOTES ON USE

plotHandle is the plot created with the init function.

FUNCTION NAME

gpc_close

FUNCTION PROTOTYPE AND PARAMETER DESCRIPTION

void gpc_close (h_GPC_Plot *); Plot handle

FUNCTION DESCRIPTION

Plots closes the plot, frees all associated memory and closes the Gnuplot window.

NOTES ON USE

plotHandle is the plot created with the init function.

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