

NumericPlots - plot numeric data with latex

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Plotting numeric data is a task which often has to be done for scientific papers. In \LaTeX , however, it is only possible to include graphics created with an external program. The `pstricks`-packages provide many commands to generate graphics in \LaTeX . To generate simple graphics from numeric data, however, it is difficult to use. This package provides a simpler interface for the `pstricks`-package to plot numeric data.

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Contents

I. Introduction	2
II. Using the package	4
1. Basic Functionality	4
1.1. plots	4
1.2. Label and TickLabels	6
1.3. Place “Objects” in the plot.	7
1.4. Linestyles and colors	9
1.5. Legend	12
1.6. Add Lines to the Plot	13
1.7. Add Boxes to the Plot	14
1.8. Grid	14
1.9. Logarithmic axes	15
1.10. plots with holes	16
2. Multiple plots in one picture	18

3. Matlab Support	22
3.1. export2latex.m	22
3.2. struct2latex.m	23
3.3. dspace2struct	24
3.4. dspace2latex	25
4. Options	26
4.1. General	26
4.2. Automatic list with xkvview	26
5. Details	29
5.1. Labels and TickLabels	29
5.2. Coordinate Systems	30
5.3. Undistorted plot	33
6. Further Examples	35
6.1. Fill area between plots	35
6.2. Custom Grid	36
6.3. Plotting noisy data	37
6.4. Customized Tick Labels	38
7. Some test plots	39
7.1. example	39
7.2. bode plot	39
7.3. areas in a plot	41
III. Version	43
8. History	43

Part I.

Introduction

Plotting numeric data is a task which often has to be done for scientific papers. In \LaTeX , however, it is only possible to include graphics created with an external program. The pstricks-packages provide very many commands to generate graphics in \LaTeX . To generate simple graphics from numeric data, however, it is difficult to use. This package provides a simpler interface for the pstricks-package to plot numeric data.

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Part II.

Using the package

1. Basic Functionality

The package `NumericPlots`

```
\usepackage{NumericPlots}
```

is intended to be used to plot numeric data which may, e.g., be exported from Matlab by `export2latex.m`. The data must be defined in the form

```
1 \def\IdentI{
2   1.0 1.0e2
3   1.1 11e1
4   1.2 1.25e2
5   1.3 110
6   1.4 100
7   1.5 90
8   1.6 80
9 }
```

where the first column contains the x, the second column the y-data.

Please note that the package relies on the `listplot`-command from `pstricks`!

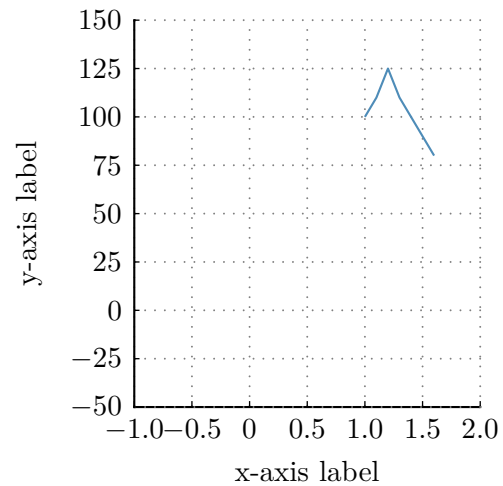
1.1. plots

The easiest plot may be done by

```

1 \begin{NumericDataPlot}{\textwidth
   }{6.5cm}
2 \setxAxis{xMin=-1, xMax=2, Dx=0.5,
   x0=0}
3 \setyAxis{yMin=-50, yMax=150, Dy
   =25, y0=0}
4
5 \plotxAxis{x-axis label}
6 \plotyAxis{y-axis label}
7
8 \listplot[style=StdLineStyleA]{\
   IdentI}
9 \end{NumericDataPlot}

```

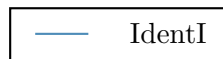


if you want to add a legend, you simply call

```

1 \LegendDefinition{
2 \LegLine{style=StdLineStyleA} &
   IdentI
3 }

```

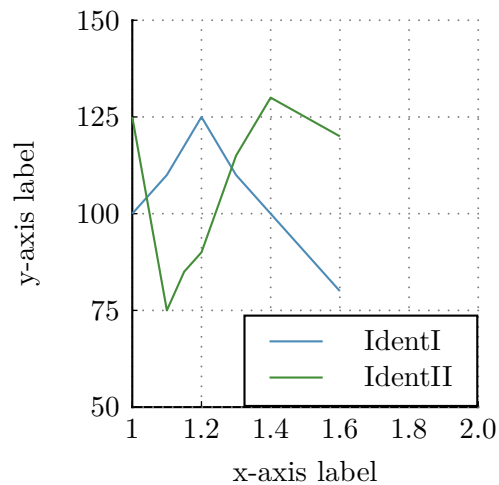


To plot multiple data in one plot call

```

1 \begin{NumericDataPlot}
2   {\textwidth}{6.5cm}
3   \setxAxis
4     {xMin=1, xMax=2, Dx=0.2}
5   \setyAxis
6     {yMin=50, yMax=150, Dy=25}
7
8   \plotxAxis{x-axis label}
9   \plotyAxis{y-axis label}
10
11  \listplot[style=StdLineStyleA]
12    {\IdentI}
13  \listplot[style=StdLineStyleB]
14    {\IdentII}
15
16  \putSE{\LegendDefinition{
17    \LegLine{style=StdLineStyleA} &
18      IdentI \\\
19    \LegLine{style=StdLineStyleB} &
20      IdentII
21  }}
22 \end{NumericDataPlot}

```



1.2. Label and TickLabels

The commands `plotxAxis` and `plotyAxis` take the options `NoLabel`, `NoTicks`, `NoTickLabel` as well as `LabelOption` and `TickLabelOption` which may be used to eliminate or change the look of the labels.

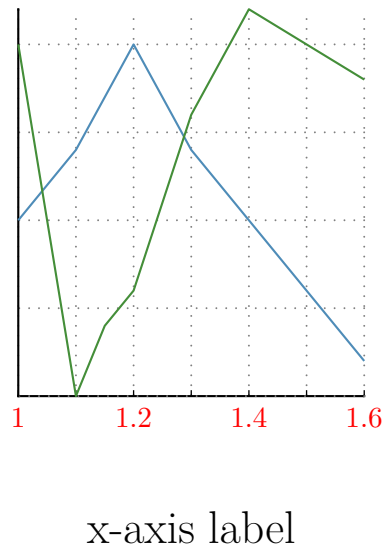
Standard values for `LabelOption` and `TickLabelOption` may be set by `\newcommand{\StdLabelOption}{\color{blue}}` and `\newcommand{\StdTickLabelOption}{\small}`.

The option `LabelSep` may be used for `\plotxAxis` and `\plotyAxis` to set the separation between the axis and the label. Standard value is `\baselineskip+1ex` for the x-label and `7ex` for the y-label.

```

1 \begin{NumericDataPlot}{\textwidth
   }{6.5cm}
2 \setxAxis{xMin=1, xMax=1.6, Dx
   =0.1, DDx=0.2}
3 \setyAxis{yMin=75, yMax=130, Dy
   =12.5}
4
5 \plotxAxis
6 [LabelOption=\LARGE,%
7 TickLabelOption=\color{red},%
8 LabelSep=40pt]
9 {x-axis label}
10 \plotyAxis
11 [NoLabel, NoTicks, NoTickLabel]
12 {y-axis label}
13
14 \listplot[style=StdLineStyleA]{\
   IdentI}
15 \listplot[style=StdLineStyleB]{\
   IdentII}
16
17 \end{NumericDataPlot}

```



It is furthermore possible to change the position and the rotation of the labels and tick labels, see the example in section 5.1.

It is also possible to put single tick labels, see the example in section 5.1.

1.3. Place “Objects” in the plot.

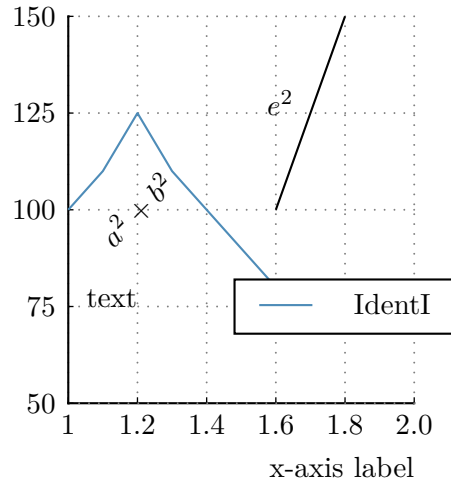
There are basically two different options to place objects in the plot. To understand the difference one has to keep in mind that the axis have two different coordinate systems. One is the system defined by `xMin`, `xMax`, `yMin` and `yMax` (referred to as “DataCoordinateSystem”), the other ist the system defined by `xCoordMin`, `xCoordMax`, `yCoordMin` and `yCoordMax` (referred to as “PictureCoordinateSystem”), see section 2.

It is now possible to place stuff in the graph with the DataCoordinates with the command `NDPput`, see the following example.

```

1 \begin{NumericDataPlot}
2   {\textwidth}{6.5cm}
3   \setxAxis
4     {xMin=1, xMax=2, Dx=0.2}
5   \setyAxis
6     {yMin=50, yMax=150, Dy=25}
7
8   \plotxAxis[LabelPos=1, LabelRefPt=
9     tr]%
10    {x-axis label}
11  \plotyAxis[NoLabel]{ }
12
13  \listplot[style=StdLineStyleA]
14    {\IdentI}
15
16  % put some stuff somewhere
17  \NDPput[x=1.2, y=75, RefPoint=br]{
18    text}
19  \NDPput[x=1.2, y=100, Rot=45]{$a
20    ^2+b^2$}
21
22  % or put nodes...
23  \NDPput[x=1.6, y=100]{\pnode{A}}
24  \NDPput[x=1.8, y=150]{\pnode{B}}
25  % ...and draw a line between them
26  \ncline{A}{B}
27  % .. with text
28  \naput{$e^2$}
29
30  % or put the legend at a specific
31  position
32  \NDPput[x=1.8, y=75]{\
33    LegendDefinition{
34      \LegLine{style=StdLineStyleA} &
35      IdentI
36    }}
37 \end{NumericDataPlot}

```

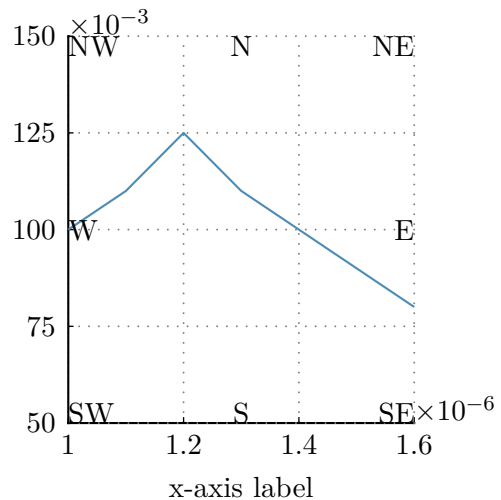


For convenience the commands `\putXX{object}` where $XX \in (N, S, E, W, NW, NE, SW, SE)$ are defined to place something in the North, South, ..., SouthEast corner of the plot. Also, the command `\putExpY{xx}` and `\putExpX{xx}` may be used to place exponents at the axes.


```

1 \putExpY{$\times 10^{-3}$}
2 \putExpX{$\times 10^{-6}$}
3
4 \putN{N}
5 \putS{S}
6 \putW{W}
7 \putE{E}
8 \putNW{NW}
9 \putNE{NE}
10 \putSW{SW}
11 \putSE{SE}

```

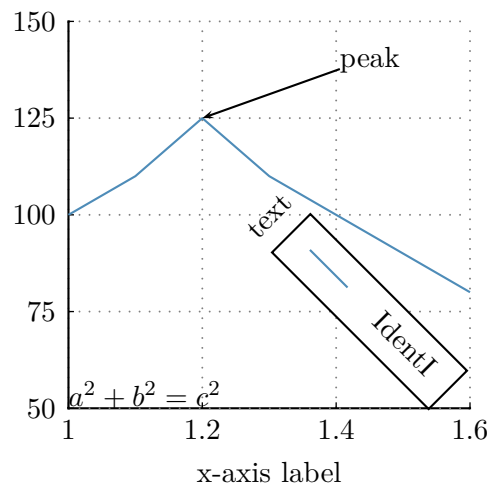


Alternatively, stuff can be placed within the plot with `\rput`.

```

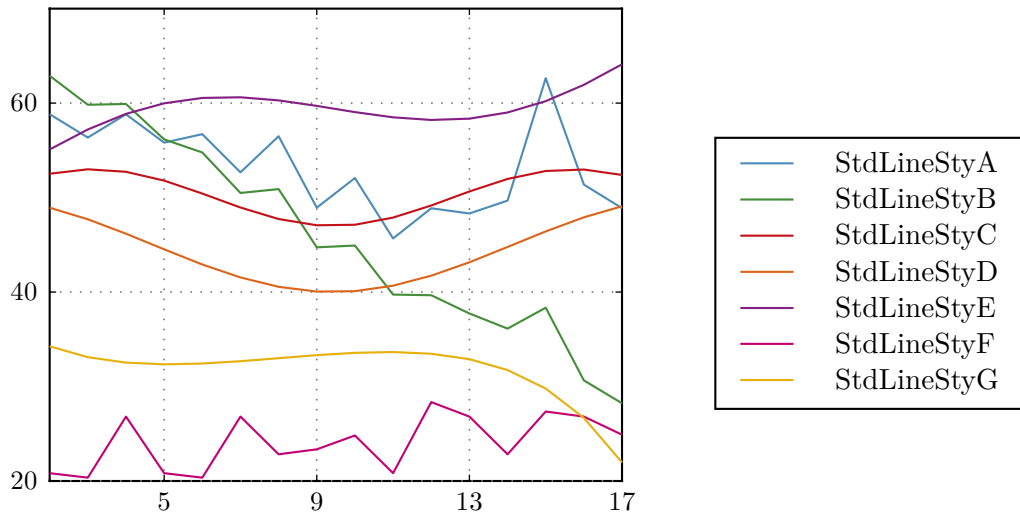
1 % put text in the middle of the plot
2 \rput{45}(500,500){text}
3 % put a formula in the lower left
  corner
4 \rput[b1](0,0){$a^2+b^2=c^2$}
5
6 % or put nodes...
7 \NDPput[x=1.2, y=125]{\pnode{A}}
8 \rput(750,900){\Rnode{B}{peak}}
9 % ...and draw a line between them
10 \ncline{<-}{A}{B}
11
12 % or put the legend at a specific
   position
13 \rput{-45}(750,250){\LegendDefinition{
14   \LegLine{style=StdLineStyleA} & IdentI
15 }}

```

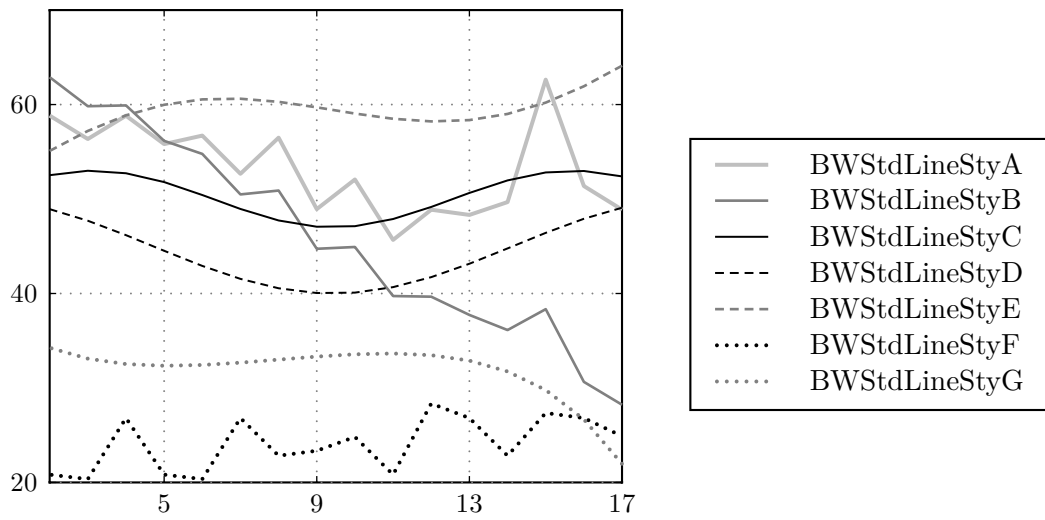


1.4. Linestyles and colors

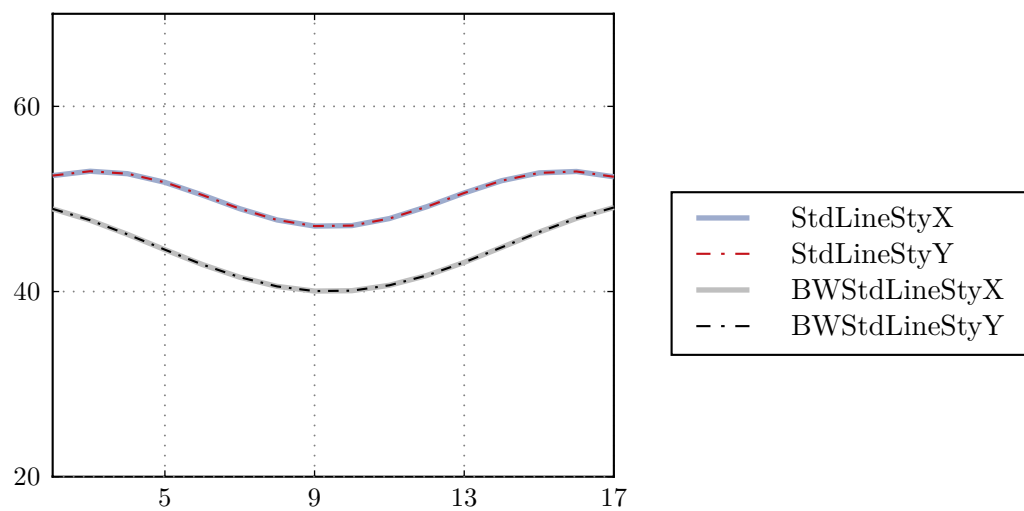
While using the package, there are predefined linestyles which may be used:



When using the package option BW the standard line styles will be replaced by their black and white counterparts:



For values which are nearly the same (reference and measurement, e.g.) the following line styles may be used:

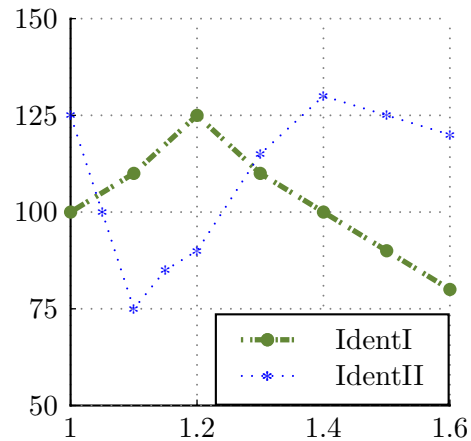


It is, of course, possible to redefine the available linestyles or to define new linestyles.

```

1  \definecolor{MyColor}{cmyk}{0.6
    0.21 1.0 0.2}
2  \newsstyle{MyLine}{linecolor=
    MyColor, linewidth=2pt,
    linestyle=dashed,
3  dash=1pt 1pt 4pt 1pt 1pt 3pt,
    dotstyle=*, showpoints=true,
    dotsize=5pt}
4  \newsstyle{MyLineA}{linecolor=blue
    , linestyle=dotted, dotstyle=
    asterisk,
5  showpoints=true}
6
7  \setxAxis
8    {xMin=1, xMax=1.6, Dx=0.2}
9  \setyAxis
10   {yMin=50, yMax=150, Dy=25}
11
12  \plotxAxis[NoLabel]{}
13  \plotyAxis[NoLabel]{}
14
15  \listplot[style=MyLine]
16    {\IdentI}
17  \listplot[style=MyLineA]
18    {\IdentII}
19
20  \putSE{\LegendDefinition{
21    \LegLine{style=MyLine} & IdentI\\
22    \LegLine{style=MyLineA} & IdentII
23  }}

```



1.5. Legend

The legend may be created with `\LegendDefinition`. The command takes the two optional arguments `nrCols` and `LabelOrientation=[l|c|r]`. The mandatory argument is the definition of a table as demonstrated in the following examples.

```

1  \LegendDefinition{
2    \LegLine{style=StdLineStyA} & IdentI\\
3    \LegLine{style=StdLineStyB, linewidth
    =3pt} & second legend
4  }



```



```

1 \newsstyle{LegendBoxStyle}%
2   {framearc=0.2, fillstyle=solid,
3     fillcolor=yellow, opacity=0.2}
4 \LegendDefinition[nrCols=2]{
5   \LegLine{style=StdLineStyA} & IdentI
6   &
7   \LegLine{style=StdLineStyB,
8     linewidth=3pt} & legend 2
9 }
10 \newsstyle{LegendBoxStyle}%
11   {fillstyle=solid, fillcolor=white}






```

	IdentI		legend 2
---	--------	---	----------

```

1 \LegendDefinition[LabelOrientation=c]{
2   \LegLine{style=StdLineStyA} & IdentI\\
3   \LegLine{style=StdLineStyB, linewidth
4     =3pt} & second legend\\
5   \LegLine{style=StdLineStyC} & whatever
6     this data is\ldots\\
7   \LegLine{style=StdLineStyD} & and more
8     data\\
9   \LegDot{style=StdLineStyC, plotstyle=
10     dots} & plotstyle=dots
11 }

```

	IdentI
	second legend
	whatever this data is...
	and more data
	plotstyle=dots

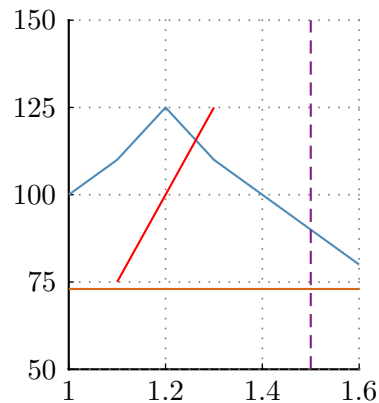
1.6. Add Lines to the Plot

Horizontal and vertical lines may be added to the plot with the commands `\NDPhline{coord}`, `\NDPvline{coord}` and `\NDPline{coord}`. It is also possible to put nodes and draw lines between them, see section 1.3.

```

1 \NDPhline[linecolor=LineColorD]{73}
2 \NDPvline[linecolor=LineColorE, %
3   linestyle=dashed]{1.5}
4 \NDPline[linecolor=red
5   ]{1.1}{75}{1.3}{125}

```



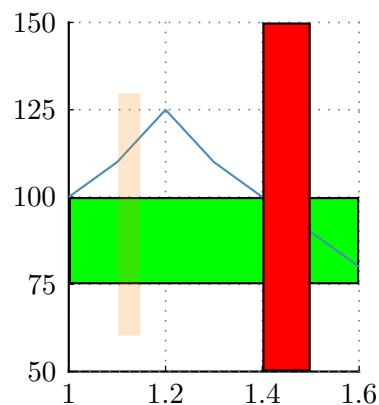
1.7. Add Boxes to the Plot

Horizontal and vertical boxes may be added to the plot with the commands `\NDPhbox{coord}`, `\NDPvbox{coord}` and `\NDPbox{coord}`. It is also possible to put nodes and draw lines between them, see section 1.3.

```

1 \NDPhbox[fillstyle=solid,fillcolor =
2   green]%
3   {75.0}{100.0}%
4 \listplot[style=StdLineStyleA] {\IdentI}
5
6 \NDPvbox[fillstyle=solid,fillcolor=red
7   ]
8   {1.4}{1.5}
9
10 \NDPbox[fillstyle=solid,%
11   fillcolor=orange, opacity=0.2,
12   linestyle=none]%
13   {1.1}{60}{1.15}{130}

```



1.8. Grid

As shown in the example below, it is possible to plot a fine grid but not have a tick label at each of the grid lines. While the options `Dx` and `Dy` define the distance between the grid lines, the options `DDx` and `DDy` define the distance between the tick labels. If `DDx`

or DDy are not set, they take the values of Dx and Dy.

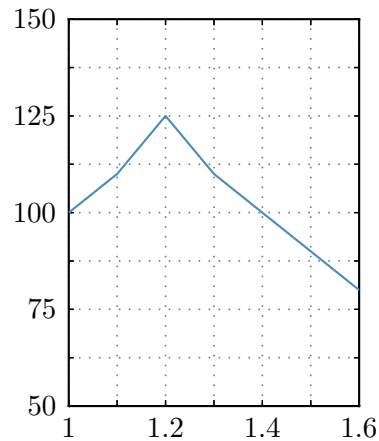
One may choose not to plot the grid with the option NoGrid for the commands `\plotxAxis` and `\plotyAxis`.

If the grid is plottet with the axis it may happen that the grid is plottet over the axis. To avoid this, plot the grid first and then plot the axis as shown.

```

1 \begin{NumericDataPlot}
2   {\textwidth}{6.5cm}
3   \setxAxis{xMin=1, xMax=1.6, Dx=0.1,
4             DDx=0.2}
5   \setyAxis{yMin=50, yMax=150, Dy=12.5,
6             DDy=25}
7   \plotxGrid
8   \plotyGrid
9   \plotxAxis[NoLabel, NoGrid, AxisStyle=
10             Boxed]{}
11  \plotyAxis[NoLabel, NoGrid, AxisStyle=
12             Boxed]{}
13  \listplot[style=StdLineStyleA]{\IdentI}
14 \end{NumericDataPlot}

```

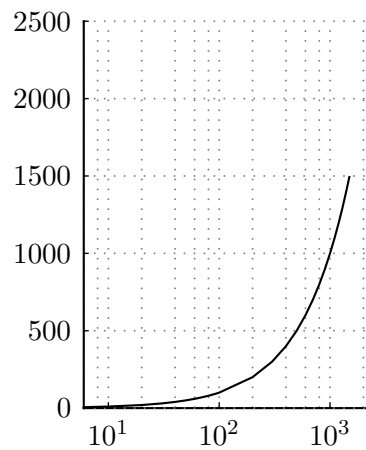


1.9. Logarithmic axes

```

1 \begin{NumericDataPlot}{\textwidth}{6.5
2   cm}
3   \setxAxis{xMin=6, xMax=2500, Dx=10,
4             xLog}
5   \setyAxis{yMin=0, yMax=2500, Dy=500}
6   \plotxAxis{}
7   \plotyAxis{}
8   \listplot{\LogData}
9 \end{NumericDataPlot}

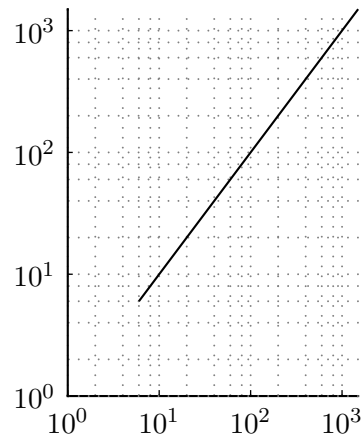
```



```

1 \begin{NumericDataPlot}{\textwidth}{6.5
   cm}
2 \setxAxis{xMin=1, xMax=1500, Dx=10,
   xLog}
3 \setyAxis{yMin=1, yMax=1500, Dy=10,
   yLog}
4 \plotxAxis{}
5 \plotyAxis{}
6
7 \listplot{\LogData}
8 \end{NumericDataPlot}

```



1.10. plots with holes

If plotting data, one might not want to plot some part of this data, e.g. if only the data in a certain y-range is interesting. If one chooses to eliminate the invalid data either by using `yStart` or `yEnd` or by eliminating the data before the export, `pstricks` will always connect the last valid point of an interval with the first valid point of the next interval. In Matlab e.g., invalid data (NaN) is just ignored. This behavior is also possible with `NumericPlots` and `export2latex`. If `export2latex` is called with data which contains NaN and with the option `NaNsplit=true`, it will split the data in several intervals and append a consecutive number to the identifier for each interval. The exported `yMax`, `yMin` values etc. will still be valid for the whole data-vector. The exported data might look like:

```

\expandafter\def\csname DataIdentNrRanges\endcsname{3}
\expandafter\def\csname DataIdent1\endcsname{
560.00 5.40
...
574.72 6.25
}

\expandafter\def\csname DataIdent2\endcsname{
588.73 4.78
...
609.53 12.09
}

```



```

\expandafter\def\csname DataIdent3\endcsname{
620.56 27.81
...
649.56 27.32
}

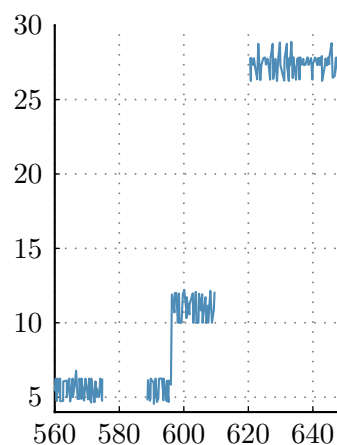
```

This data can then easily be plotted using the command `\multilistplot{<options>}{<Identifier>}`¹. The command will call `\listplot{<options>}{\<Identifier>}` for each of the intervals. The first argument is directly passed to the listplot command which is part of the pstricks package. The second argument is the identifier of the data that should be plotted.

```

1 \begin{NumericDataPlot}{\textwidth}{6.5
   cm}
2 \setxAxis{xMin=560, xMax=650, Dx=20}
3 \setyAxis{yMin=4, yMax=30, Dy=5, y0=5}
4 \plotxAxis{}
5 \plotyAxis{}
6
7 \multilistplot{style=StdLineStyleA}{
   DataIdent}
8 \end{NumericDataPlot}

```



¹Please notice, that the first argument of multilistplot is a mandatory argument. Also notice, that the second argument is only the name of the data including “Data” but not the command as it would be for the listplot command

2. Multiple plots in one picture

xPicMin, xPicMax, yPicMin and yPicMax are the inner coordinates of one picture. The position of the axes are defined in this coordinate system via xCoordMin, xCoordMax, yCoordMin and yCoordMax.

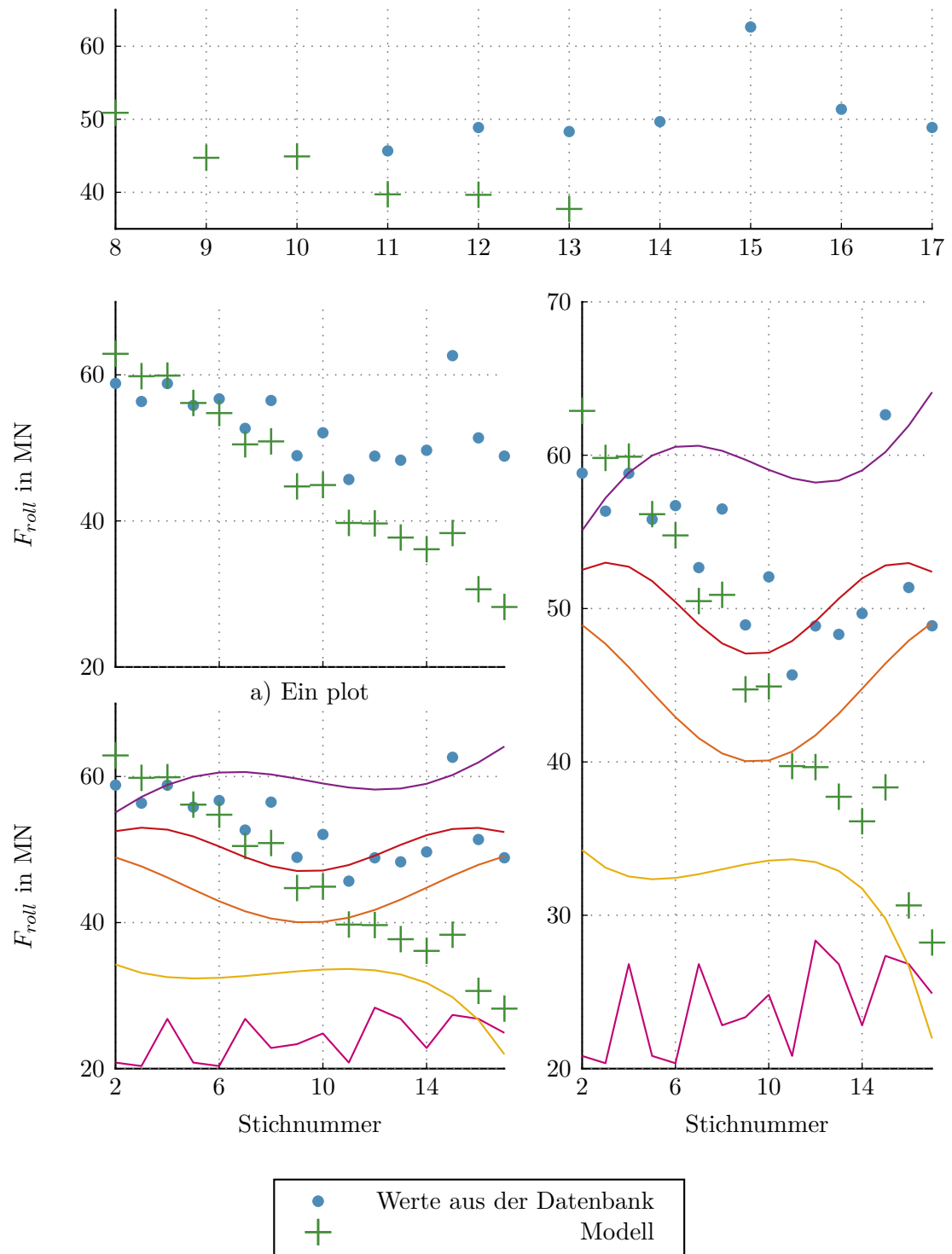
Example:

```
1 \begin{NumericDataPlot}[xPicMin=0, xPicMax=1050,
2 yPicMin=0, yPicMax=1450]{\textwidth}{0.85\textheight}
3
4 % --- definition of the axis and the grid ---
5 % set the axis of the lower left corner
6 \setxAxis{xMin=2, xMax=17, Dx=4, xCoordMin=0, xCoordMax=500}
7 \setyAxis{yMin=20, yMax=70, Dy=20, yCoordMin=0, yCoordMax=500}
8
9 % plot the axis of the lower left corner
10 \plotxAxis{Stichnummer}
11 \plotyAxis{$F_{\text{roll}}$ in $\text{si}\{\text{mega}\text{newton}\}$}
12
13 \listplot[style=Database]{\DataA}
14 \listplot[style=Result]{\DataB}
15 \listplot[style=StdLineStyleC]{\DataC}
16 \listplot[style=StdLineStyleD]{\DataD}
17 \listplot[style=StdLineStyleE]{\DataE}
18 \listplot[style=StdLineStyleF]{\DataF}
19 \listplot[style=StdLineStyleG]{\DataG}
20
21 % set the y-axis for the plot in the middle of the left side
22 % x-axis remains the same
23 \setyAxis{yMin=20, yMax=70, Dy=20, yCoordMin=550, yCoordMax=1050}
24 % plot the axis (x-axis without ticklabels)
25 \plotxAxis[NoTickLabel,LabelSep=1ex]{a) Ein plot}
26 \plotyAxis{$F_{\text{roll}}$ in $\text{si}\{\text{mega}\text{newton}\}$}
27
28 \listplot[style=Database]{\DataA}
29 \listplot[style=Result]{\DataB}
30
31 % set axis for the plot at the right side
32 \setxAxis{xMin=2, xMax=17, Dx=4, xCoordMin=600, xCoordMax=1050}
33 \setyAxis{yMin=20, yMax=70, Dy=10, yCoordMin=0, yCoordMax=1050}
34
35 % plot the axis at the right side (y-axis without label)
36 \plotxAxis{Stichnummer}
37 \plotyAxis[NoLabel]{$F_{\text{roll}}$ in $\text{mega}\text{newton}$}
38
39 \listplot[style=Database]{\DataA}
40 \listplot[style=Result]{\DataB}
```

```

45 \listplot[style=StdLineStyleC]{\DataC}
46 \listplot[style=StdLineStyleD]{\DataD}
47 \listplot[style=StdLineStyleE]{\DataE}
48 \listplot[style=StdLineStyleF]{\DataF}
49 \listplot[style=StdLineStyleG]{\DataG}
50
51 % set the axis for the plot at the top
52 \setxAxis{xMin=8, xMax=17, Dx=1, xCoordMin=0, xCoordMax=1050}
53 \setyAxis{yMin=35, yMax=65, Dy=10, y0=40, yCoordMin=1150, yCoordMax=1450}
54
55 % plot the axis for the plot at the top
56 \plotxAxis[NoLabel]{Stichnummer}
57 \plotyAxis[NoLabel]{ $F_{roll}$  in  $\text{mega\newton}$ }
58
59 % plot only part of the data
60 \listplot[style=Database, xStart=11, xEnd=17]{\DataA}
61 \listplot[style=Result, xStart=8, xEnd=13]{\DataB}
62
63 \end{NumericDataPlot}
64
65 % put legend outside of the plot
66 \LegendDefinition[nrCols=1, LabelOrientation=r]{
67   \LegLine{style=Database} & Werte aus der Datenbank \\
68   \LegLine{style=Result} & Modell}
69 \end{center}

```

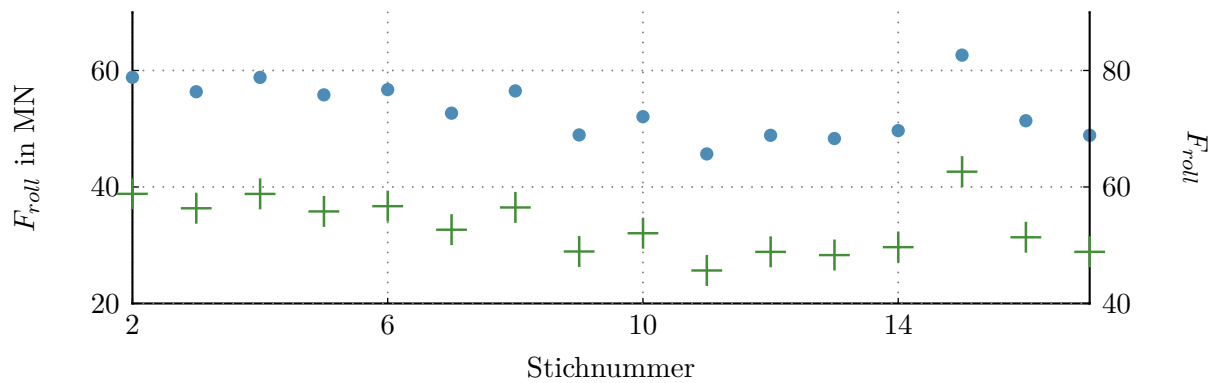


An example with different y-axes on the left and on the right side:

```

1 \newsstyle{Database}{linecolor=LineColorA, linestyle=none, dotstyle=*,
2 showpoints=true, dotsize=5pt}
3 \newsstyle{Result}{linecolor=LineColorB, linestyle=none, dotstyle=+,
4 showpoints=true, dotsize=10pt}
5
6 \begin{NumericDataPlot}{\textwidth}{0.25\textheight}
7
8   % --- definition of the axis and the grid ---
9   \setxAxis{xMin=2, xMax=17, Dx=4}
10  \setyAxis{yMin=20, yMax=70, Dy=20}
11
12  % plot the axis of the lower left corner
13  \plotxAxis{Stichnummer}
14  \plotyAxis{$F_{roll}$ in $\si{\mega\newton}$}
15
16  \listplot[style=Database]{\DataA}
17
18  % define a second y-axis
19  \setyAxis{yMin=40, yMax=90, Dy=20}
20  \plotyAxis[AxisStyle=Right, NoGrid]{$F_{roll}$}
21
22  \listplot[style=Result]{\DataA}
23
24 \end{NumericDataPlot}

```



3. Matlab Support

3.1. export2latex.m

The function `export2latex(data, filename, [options])` may be used to export data from Matlab to be used with `NumericPlots.sty`. The function takes the two parameters `data` and `filename`, where `filename` is the name of the file where the data should be stored with full path but without extension. `Data` is a structure with the three entries `x`, `y`, and `ident`, where `x` are the x-data, `y` the y-data and `ident` is an identifier to have access to the data in Latex. To access the data in Latex the command `\Data<ident>` is used.

The parameter `data` may be provided as an `1xK` array if each entry of the array is a structure with the entries `x`, `y` and `ident`. There may be an additional entry `descr`.

- `data(1,i).x = X_i`
- `data(1,i).y = Y_i`
- `data(1,i).ident = Identifier`
- `(data(1,i).descr = Description)`
- `(data(1,i).group = GroupNr)`

Identifier must be a valid Latex command name, which basically means it must be a string without numbers.

For every entry of `data`, `X` and `Y` must be arrays of the same size `MxN`. If `M > 1`, each column of the array is exported to the file and the identifier is expanded by the roman representation of the column number.

It might be useful to do a `interp1` before exporting the data to get smaller files and to use less of T_EX's memory. (→ script Patrick!?)

The optional parameter `options` might be used to control which additional information is provided in the output file.

- `options.DataBoundaries [true]` If set to true, the output file contains the commands `\DataXmin`, `\DataXmax`, `\DataYmin` and `\DataYmax` which may be used to define the axis.
- `options.AxisBoundaries [false]` If set to true, the output file contains the com-

mands `\DataXminAxis`, `\DataXmaxAxis`, `\DataYminAxis` and `\DataYmaxAxis` which may be used to define the axis. In contrary to the `DataBoundaries` the `AxisBoundaries` add an additional gap of `options.AxisBoundariesGap` [10] percent of the full scale to the data boundaries such that the plot doesn't touch the axis.

- `options.SuppressWarning` [false] suppresses the warning about max/min values being to close together
- `options.precision` [empty] how many decimal places should be printed for x and y values. Will be calculated automatically if left empty.
- `options.NaNsplit` [false] if true, the data will be split at NaN values. See `\multilistplot` for how to plot them.

3.2. `struct2latex.m`

The function

`struct2latex(data,[xname],[downsample],[filtertype],[filename],[postfix],[options])` may be used to export a Matlab struct to be used with `NumericPlots.sty`. The function is based on `export2latex` and the `options` argument is given to `export2latex`. The optional argument `xname` specifies the fieldname of the x-data. If no `xname` is given, you have to chose one via popup. All other fields are treated like y-data. Furthermore, the identifier of the y-data are equal to the fieldnames and have to be valid Latex commands (fieldnames with numbers are not supported). The `struct2latex` command only supports 1 dimensional arrays (row vectors). Column vectors are mapped for proper export without warning. With the optional argument `downsample` (integer > 0) it is possible to downsample the data for smaller files. A warning is given when data points exceed 5000. Usually 1000 data points are enough for a proper plot in latex. The optional argument `filename` specifies the outputname with path of the texfile. If no filename is given, it has to be chosen via popup. The optional argument `postfix` can be used to put a postfix after the fieldname in the identifier of the y-data. The `options` argument is also optional and equal to the options argument of the function `export2latex`.

Filter may be one of {'none','MinMax','Hull'}. The corresponding filter will be applied to the data before exporting it. See 6.3 for further details.

Matlab example.

```
% data for struct2latex should be row-vectors. anyway, column-vectors are
% mapped to row-vectors. matrices are not supported
```

```

%% export row-vectors
t = [1:0.1:10];

data.time = t;
data.sin = sin(t);
data.cos = cos(t);
data.exp = exp(t);
data.tan = tan(t);

%struct2latex(data,xname,downsample,filename,filtertype,postfix,options)
%downsample,filename,postfix,options are optional arguments
struct2latex(data,'time',1,'none','texdataA','row');

```

3.3. dspace2struct

The function `dspace2struct(dataname,version)` may be used to import `.mat` created by DSPACE to MATLAB. It returns a MATLAB struct out of the provided variables `dataname` and `version`. Thereby `dataname` is the name of the DSPACE `.mat` file and the optional string argument `version` has to be equal `version = 'NG'` if DSPACE CONTROL DESK NEXT GENERATION is used. It is convenient to chose a unique signal name in MATLAB/SIMULINK because they will be the same in DSPACE. The function `dspace2struct(dataname,version)` just adopts the names provided by DSPACE and use them as fieldnames. The time vector will always be called `.time`.

Matlab example:

```

dataOG = dspace2struct(measurements) %Old Control Desk
dataNG = dspace2struct(measurements,'NG') %Control Desk Next Generation

```

The resulting structs `dataOG` and `dataNG` differ in way of structuring. In the older versions of DSPACE it was only possible to save one time vector. The DSPACE CONTROL DESK NEXT GENERATION allows to save several time vectors. So it was necessary to save the index of the time vector with the signal name. Typical plot commands for the two data structures look as follows:

```

%Old Control Desk
plot(dataOG.time,dataOG.signalname);

%Control Desk Next Generation
plot(dataNG.time(dataNG.signalname.timeidx),dataNG.signalname.Data);

```


3.4. `dspace2latex`

The function `dspace2latex` is just a combination of `dspace2struct` and `struct2latex` with commonly used arguments. It is a simple and quick way to export measurements from DSPACE to \LaTeX without any revision of the data. However, the current implementation allows only data structures of the old version of DSPACE CONTROL DESK.

4. Options

4.1. General

These are the options for the environment `NumericDataPlot`. Note that the padding values `llx`, `lly`, `urx`, `ury` depend on the type settings.

- `xPicMin` [0], `yPicMin` [0], `xPicMax` [1000], `yPicMax` [1000]
- `TickLength` [2] defines the length of the ticks in mm
- `\origXLabelSep` [`\baselineskip+1ex`], `\origYLabelSep` [7ex]
- `\StdLLX` [7ex + `\baselineskip+2pt`] `\StdLLY` [2`\baselineskip+1ex+2pt`] `\StdURX` [2ex] `\StdURY` [0.5em]

4.2. Automatic list with `xkvview`

The following list of keys defined by the package was created with `xkvview`.

Key	Prefix	Family	Type	Default
<code>xMax</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>xMin</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>Dx</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>dx</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>xCoordMax</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>xCoordMin</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>yMax</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>yMin</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>Dy</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>dy</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>yCoordMax</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>yCoordMin</code>	<code>NumericDataPlot</code>	Axis	command	[none]
<code>xLog</code>	<code>NumericDataPlot</code>	Axis	boolean	true
<code>yLog</code>	<code>NumericDataPlot</code>	Axis	boolean	true
<code>yNearlyTight</code>	<code>NumericDataPlot</code>	Axis	boolean	false
<code>x0</code>	<code>NumericDataPlot</code>	AxisWait	command	[none]
<code>y0</code>	<code>NumericDataPlot</code>	AxisWait	command	[none]
<code>DDy</code>	<code>NumericDataPlot</code>	AxisWait	command	[none]
<code>DDx</code>	<code>NumericDataPlot</code>	AxisWait	command	[none]

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Key	Prefix	Family	Type	Default
NoGrid	NumericDataPlot	xAxis	boolean	true
NoTicks	NumericDataPlot	xAxis	boolean	true
NoLabel	NumericDataPlot	xAxis	boolean	true
NoTickLabel	NumericDataPlot	xAxis	boolean	true
NoGrid	NumericDataPlot	yAxis	boolean	true
NoTicks	NumericDataPlot	yAxis	boolean	true
NoLabel	NumericDataPlot	yAxis	boolean	true
NoTickLabel	NumericDataPlot	yAxis	boolean	true
AxisStyle	NumericDataPlot	xAxis	choice	[none]
AxisStyle	NumericDataPlot	yAxis	choice	[none]
xPicMin	NumericDataPlot	General	command	[none]
yPicMin	NumericDataPlot	General	command	[none]
xPicMax	NumericDataPlot	General	command	[none]
yPicMax	NumericDataPlot	General	command	[none]
TickLength	NumericDataPlot	General	command	[none]
llx	NumericDataPlot	General	ordinary	\StdLLX
urx	NumericDataPlot	General	ordinary	\StdURX
lly	NumericDataPlot	General	ordinary	\StdLLY
ury	NumericDataPlot	General	ordinary	\StdURY
x	NumericDataPlot	put	ordinary	[none]
y	NumericDataPlot	put	ordinary	[none]
RefPoint	NumericDataPlot	put	ordinary	c
Rot	NumericDataPlot	put	ordinary	0
LabelPos	NumericDataPlot	putxLabel	command	[none]
LabelOption	NumericDataPlot	putxLabel	command	[none]
LabelOrientation	NumericDataPlot	putxLabel	command	[none]
LabelPos	NumericDataPlot	putyLabel	command	[none]
LabelOption	NumericDataPlot	putyLabel	command	[none]
LabelOrientation	NumericDataPlot	putyLabel	command	[none]
LabelSep	NumericDataPlot	putxLabel	ordinary	\origXLabelSep
LabelSep	NumericDataPlot	putyLabel	ordinary	\origYLabelSep
ax	NumericDataPlot	putxLabel	choice	[none]
ay	NumericDataPlot	putyLabel	choice	[none]
LabelRefPt	NumericDataPlot	putxLabel	ordinary	[none]
LabelRefPt	NumericDataPlot	putyLabel	ordinary	[none]
x	NumericDataPlot	putxTickLabel	ordinary	[none]
y	NumericDataPlot	putyTickLabel	ordinary	[none]
TickLabelRefPt	NumericDataPlot	putxTickLabel	ordinary	[none]
TickLabelRefPt	NumericDataPlot	putyTickLabel	ordinary	[none]
TickLabelOption	NumericDataPlot	putxTickLabel	command	[none]
TickLabelRot	NumericDataPlot	putxTickLabel	command	[none]

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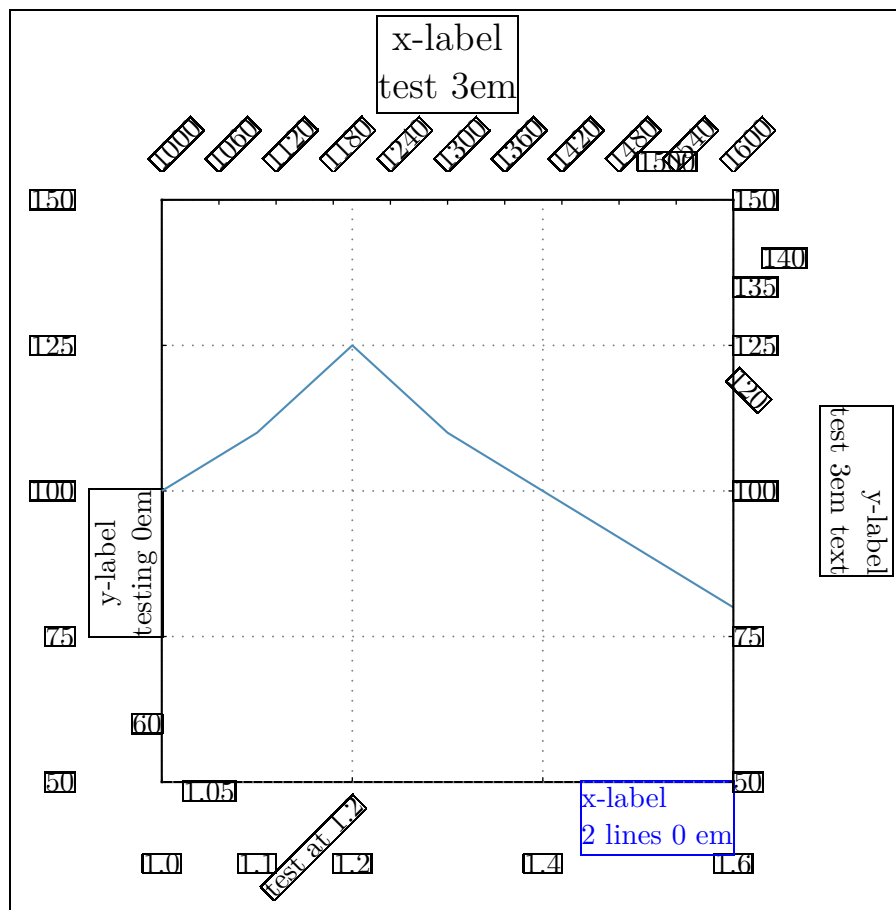
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Key	Prefix	Family	Type	Default
TickLabelOption	NumericDataPlot	putyTickLabel	command	[none]
TickLabelRot	NumericDataPlot	putyTickLabel	command	[none]
TickLabelSep	NumericDataPlot	putxTickLabel	ordinary	\origXTickLabelSep
TickLabelSep	NumericDataPlot	putyTickLabel	ordinary	\origYTickLabelSep
ax	NumericDataPlot	putxTickLabel	choice	[none]
ax	NumericDataPlot	putyTickLabel	choice	[none]
nrCols	NumericDataPlot	Legend	ordinary	1
LegLineWidth	NumericDataPlot	Legend	ordinary	20pt
LabelOrientation	NumericDataPlot	Legend	choice	[none]

5. Details

5.1. Labels and TickLabels

The following example shows some possibilities to format the axis labels and the tick labels. The example is not intended to be pretty nor useful in any other way than just showing some labels.



```

1 \begin{center}
2 \renewcommand{\testframe}[1]{\frame{#1}}
3 \testframe{
4 \begin{NumericDataPlot}%
5     [urx=2.2cm,ury=2.5cm,llx=2.0cm,lly=1.8cm]%
6     {0.8\textwidth}{12cm}
7
8     \setxAxis{xMin=1.0, xMax=1.6, Dx=0.2}

```

```

9   \setyAxis{yMin=50, yMax=150, Dy=25}
10
11   \plotxAxis%
12     [TickLabelSep=2\baselineskip, LabelSep=0em, LabelOption=\color{blue},
13     LabelPos=1, LabelRefPt=tr, LabelOrientation=l]%
14     {x-label\\2 lines 0 em}
15
16   \plotyAxis%
17     [TickLabelSep=3em, LabelSep=0em, LabelPos=0.25, %
18     LabelRefPt=bl]%
19     {y-label\\testing 0em}
20
21   \PutTickLabelYaxis[y=60,TickLabelSep=0pt]{$60$}
22   \PutTickLabelXaxis[x=1.1]{$1.1$}
23   \PutTickLabelXaxis[x=1.05,TickLabelSep=0em]{$1.05$}
24   \PutTickLabelXaxis%
25     [x=1.2,TickLabelSep=1ex,TickLabelRot=45,TickLabelRefPt=tr]%
26     {test at $1.2$}
27
28   \listplot[style=StdLineStyleA]{\IdentI}
29
30   \setxAxis{xMin=1000, xMax=1600, Dx=60}
31   \setyAxis{yMin=50, yMax=150, Dy=25}
32
33   \plotxAxis%
34     [TickLabelSep=1em, LabelSep=3em, AxisStyle=Upper, NoGrid, %
35     LabelOption=\Large,TickLabelRot=45,TickLabelRefPt=bl]%
36     {x-label\\test 3em}
37   \plotyAxis%
38     [TickLabelSep=0em, LabelSep=3em, AxisStyle=Right, NoGrid, %
39     LabelOrientation=r]%
40     {y-label\\test 3em text}
41
42   \PutTickLabelXaxis[x=1500]{$1500$}
43   \PutTickLabelYaxis[ax=right,y=135]{$135$}
44   \PutTickLabelYaxis[y=140,TickLabelSep=1em]{$140$}
45   \PutTickLabelYaxis[y=120,TickLabelSep=0em,TickLabelRot=-45]{$120$}
46 \end{NumericDataPlot}
47 }
48 %\renewcommand{\testframe}[1]{#1}
49 \end{center}

```

5.2. Coordinate Systems

This section should just give some hints how to use the different coordinate systems.

A new plot is created with the environment `NumericDataPlot`. The options are illustrated in the following example.

Consider the plot drawn below which is defined by the following code. Note that the example parameters deviate from the standard values to clarify the general possibilities.

```
\begin{NumericDataPlot}
  [xPicMin=300, xPicMax=700, yPicMin=200, yPicMax=700,
   llx=2cm, lly=1.5cm, urx=1cm, ury=1cm]
  {8cm}{6.5cm}
  ...
  % some axes and stuff
  ...
\end{NumericDataPlot}
```

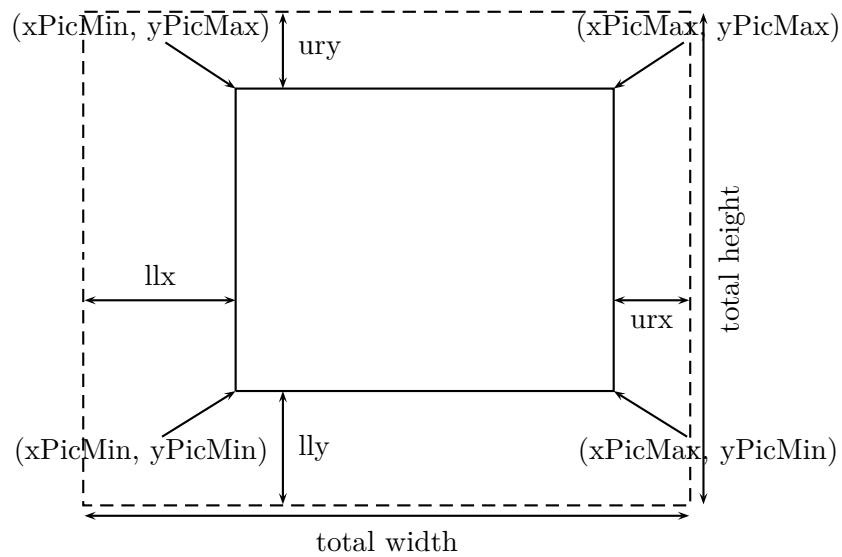
The total width and total height of the plot object are set with the mandatory arguments of `NumericDataPlot`. These dimensions define the bounding box of the plot object (dashed box in the plot below), as it is seen by the \TeX interpreter². The internal, dimensionless coordinate system, in which the actual axes will be placed, is defined by the optional `xPicMin`, `xPicMax`, `yPicMin` and `yPicMax` values. The location of the horizontal and vertical axes `x=xPicMin`, `x=xPicMax`, and `y=yPicMin`, `y=yPicMax`, respectively, relative to the bounding box is controlled by the padding values `llx`, `lly`, `urx` and `ury`. Thus, the actual length W_x of the range `xPicMax-xPicMin` on the page is calculated by

$$W_x = \text{total width} - llx - urx,$$

and alike for the y direction. Obviously, the padding values should be positive.

The standard values of the padding values are chosen such that single line axis labels and 3-4 digit tick labels should be within the bounding box.

²Because the elements inside a `NumericDataPlot` environment are set relative to an internal coordinate system, content may be placed outside the bounding box and may overlap with surrounding elements.



In the next example, the placement of multiple axes in the internal coordinate frame is illustrated. The coordinate frame settings are the same as above, but standard padding values are used.

```
\begin{NumericDataPlot}
  [xPicMin=300, xPicMax=700, yPicMin=200, yPicMax=700]
  {0.8\textwidth}{7cm}

% set and draw 1. (lower) axes
\setxAxis{xCoordMin=300, xCoordMax=600, xMin=1, xMax=1.6, Dx=0.2}
\setyAxis{yCoordMin=200, yCoordMax=400, yMin=50, yMax=150, Dy=25}

\plotxAxis{x-label}
\plotyAxis{y-label}

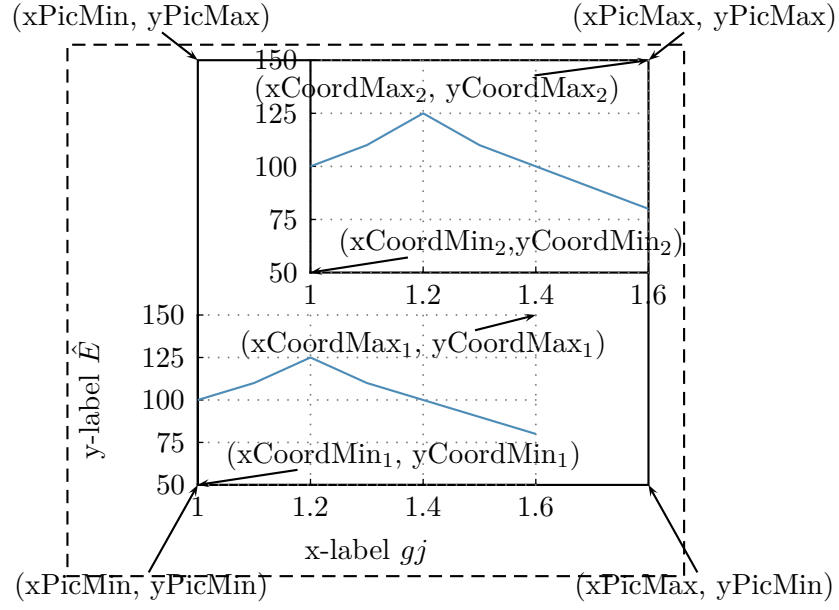
\listplot[style=StdLineStyleA]{\IdentI}

% set and draw 2. (upper) axes
\setxAxis{xCoordMin=400, xCoordMax=700, xMin=1, xMax=1.6, Dx=0.2}
\setyAxis{yCoordMin=450, yCoordMax=700, yMin=50, yMax=150, Dy=25}

\plotxAxis[NoLabel]{}
\plotyAxis[NoLabel]{}

\listplot[style=StdLineStyleA]{\IdentI}

\end{NumericDataPlot}
```

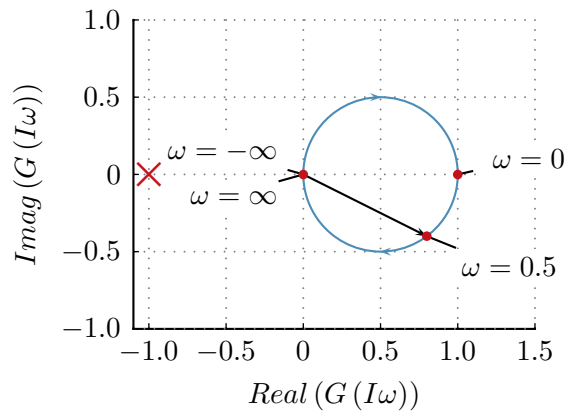
5.3. Undistorted plot

To get an undistorted plot, the following example may be helpful. The width w of the graphic is set manually. The calculation of the total height h is

$$h = \left(\frac{yMax - yMin}{xMax - xMin} \right) \left(\frac{xCoordMax - xCoordMin}{yCoordMax - yCoordMin} \right) \left(\frac{yPicMax - yPicMin}{xPicMax - yPicMin} \right) (w - llx - urx) + lly + ury,$$

which simplifies for default values ($xCoordMax = yCoordMax = xPicMax = yPicMax = 1000$, $xCoordMin = yCoordMin = xPicMin = yPicMin = 0$) to

$$h = \left(\frac{yMax - yMin}{xMax - xMin} \right) (w - llx - urx) + lly + ury$$



```

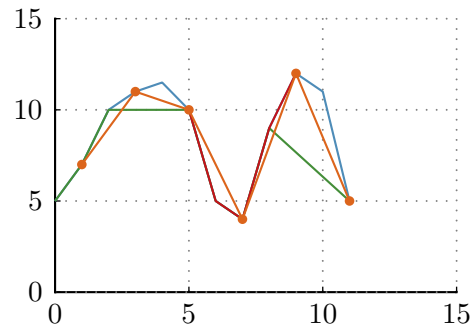
1 \newlength{\GRheight}
2 \newlength{\GRwidth}
3
4 % desired width of the graphic
5 \setlength{\GRwidth}{0.5\textwidth}
6 % calculate height:
7     % first intermediate step
8     % axis width: GRwidth - (llx+urx)
9 \setlength{\GRheight}{%
10    {\GRwidth-7ex-\baselineskip-2pt-2ex}
11    % sec. intermediate step
12    % scale with data range ration
13    % factor 0.7692 = (yMax-yMin)/(xMax-xMin)
14    \setlength{\GRheight}{0.7692\GRwidth}
15    % third intermediate step
16    % add padding values to axis height to obtain total height.
17 \begin{NumericDataPlot}%
18    {\GRwidth}{\GRheight+2\baselineskip+1ex+2pt+0.5em}
19
20 \setxAxis{xMin=-1.1, xMax=1.5, Dx=0.5, x0=0}
21 \setyAxis{yMin=-1, yMax=1, Dy=0.5, y0=0}

```

6. Further Examples

Here, some features of the pst-plot command `listplot` are illustrated. With `xStart`, `xEnd` (`yStart`, `yEnd`), the data can be truncated. Note that all visible data points are connected by a straight line which may render a misleading plot, cf. the blue and green line in the next plot below.

```
\listplot
[style=StdLineStyA]
{\MoreData}
\listplot
[style=StdLineStyB, yEnd=10]
{\MoreData}
\listplot
[style=StdLineStyC, xStart=5, xEnd=9]
{\MoreData}
\listplot
[style=StdLineStyD, showpoints=true, nStep=2]
{\MoreData}
```

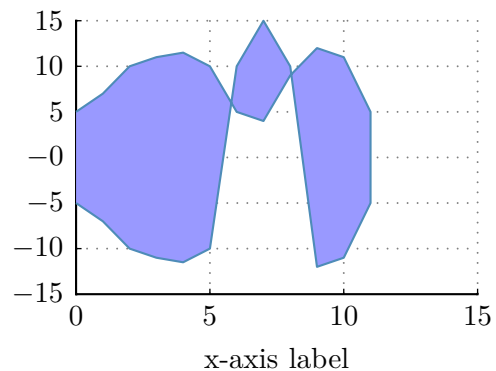


6.1. Fill area between plots

```
\begin{NumericDataPlot}%
{\textwidth}{5cm}
\setxAxis
{xMin=0, xMax=15, Dx=5, x0=0}
\setyAxis
{yMin=-15, yMax=15, Dy=5, y0=10}

\plotxAxis{x-axis label}
\plotyAxis[NoLabel]{}

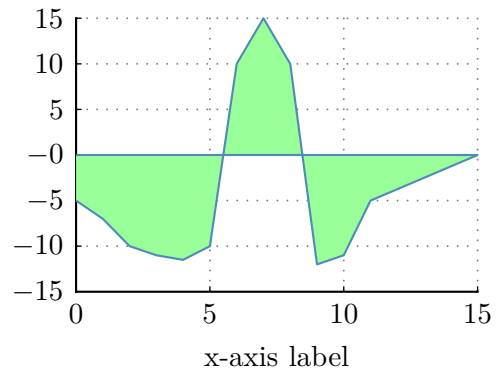
\pscustom%
[style=StdLineStyA, fillstyle=solid, %
fillcolor=blue!40]{%
\listplot{\MoreData}%
\listplot[ChangeOrder]{\MoreDataI}%
}
\end{NumericDataPlot}
```



```

...
\pscustom%
[style=StdLineStyleA, fillstyle=solid, %
fillcolor=green!40]{%
\NDPhline{0}
\listplot[ChangeOrder]{\MoreDataI}%
}
...

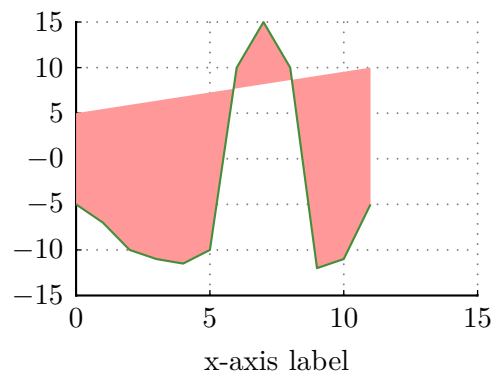
```



```

...
\pscustom%
[style=StdLineStyleA, fillstyle=solid, %
fillcolor=red!40]{%
\NDPline{0}{5}{11}{10}
\listplot[ChangeOrder]{\MoreDataI}%
}
...

```



6.2. Custom Grid

To plot a custom grid (grid-lines are not äquidistant) the following procedure may be used if working with Matlab:

Add the following code after `export2latex` (`XTick` is a vector containing the positions of the desired x-gridlines):

```

% export positions of the x-Tick-Marks
fid = fopen(TargetTexFile, 'at');
fprintf(fid, '\n\\def\\CustomXGrid{\n');
for i=1:length(XTick)
    fprintf(fid, '\\NDPvline[style=CustomXGridStyle]{%f}\n', adj.XTick(i));
end
fprintf(fid, '}\n');
fclose(fid);

```

In Latex just define the style “CustomXGridStyle” and use the command `\CustomXGrid`

after defining the axis.

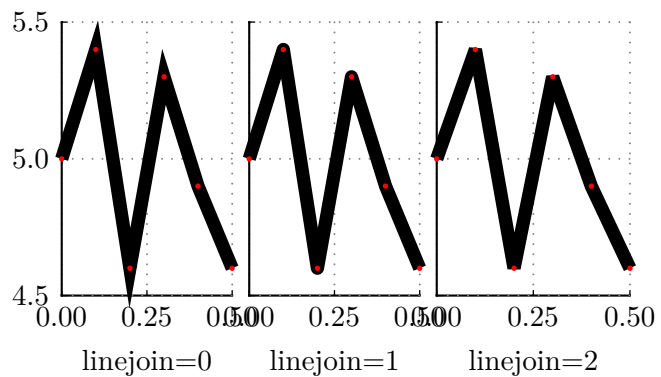
6.3. Plotting noisy data

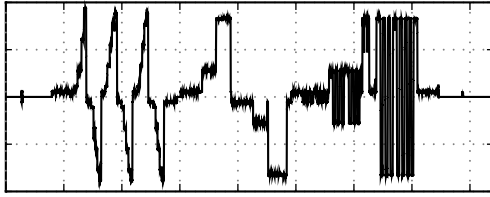
Plotting measurement data with a lot of noise may be a little tricky. First, you often have a lot of data to plot which may lead to memory problems in \TeX . When filtering the data, the appearance of the noise may change which is not what you intend to do. To solve this problem, the two Matlab-functions “`LatexFilterMinMax`” and “`LatexFilterHull`” are provided. Both take x- and y-data and divide it in `NrOfPoints` equally intervals. The filter returns the maximum and the minimum value of each interval.

The filter “`LatexFilterHull`” returns a vector which contains the minima first and then the maxima. This data may be plotted with “`fillstyle=solid`” as in section 6.1.

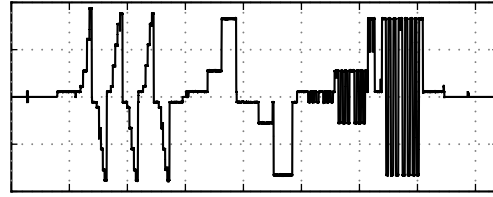
The filter “`LatexFilterMinMax`” returns maximum and minimum value of each interval (with corresponding x-data). This data may be plotted as a “normal line”. As `pstricks`-lines are normally closed lines, this may lead to a plot where the noise seems exaggerated. You may therefore use the option `linejoin` as demonstrated in the following examples. The red dots mark the actual data. Notice that the measurement data seems noisier than it is if it is plotted with `linejoin=0`. Plotting with `linejoin=2` represents the data much better. The standard for `linejoin` is 0. The `StdLineStyleXX` defined in this package are defined with `linejoin=1`.

```
...
% linejoin=0:
\listplot[linewidth=5pt]{\NoiseData}%
...
% linejoin=1:
\listplot[linejoin=1, %
linewidth=5pt]{\NoiseData}%
...
% linejoin=2:
\listplot[linejoin=1, %
linewidth=5pt]{\NoiseData}%
...
```





linejoin=0



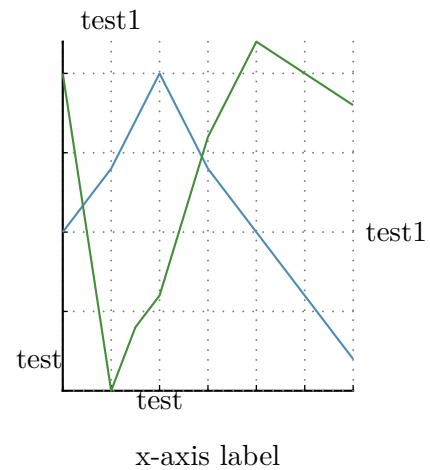
linejoin=2

6.4. Customized Tick Labels

```

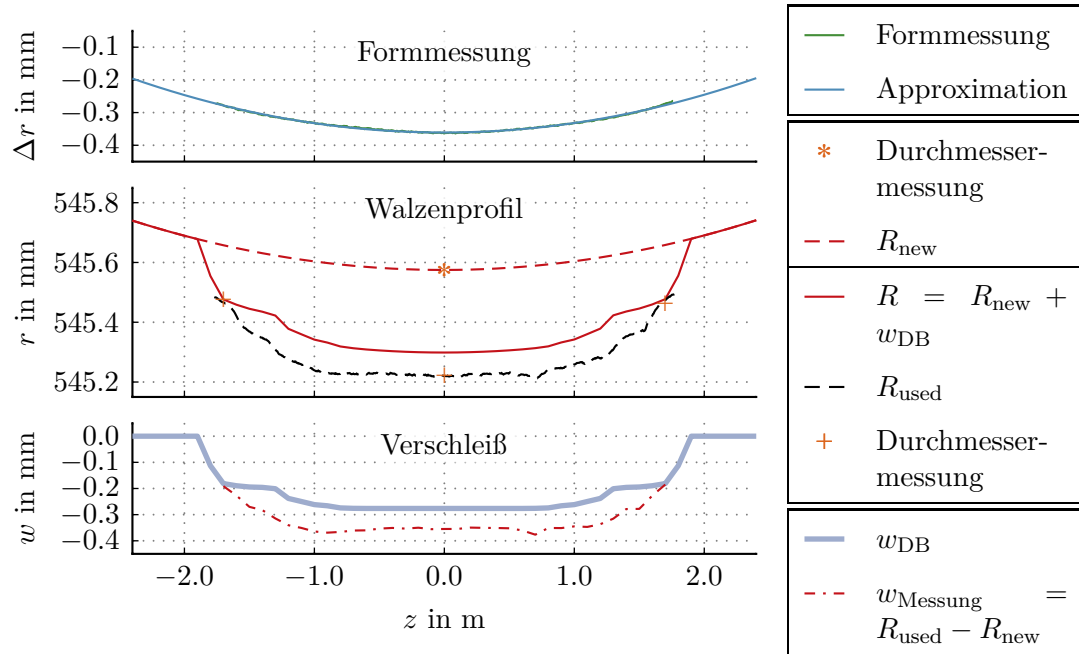
1  \plotxAxes[NoTickLabel]{x-axis label}
2  \plotyAxis[NoLabel, NoTickLabel]{y-
   axis label}
3
4  \PutTickLabelXaxis[x=1.2]{test}
5  \PutTickLabelXaxis[x=1.1, ax=upper]{
   test1}
6
7  \PutTickLabelYaxis[y=80]{test}
8  \PutTickLabelYaxis[y=100, ax=right]{
   test1}

```

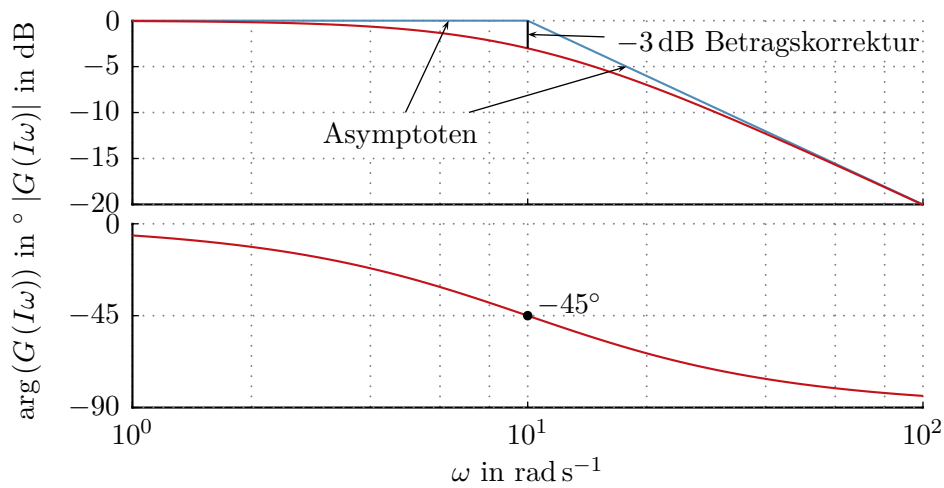


7. Some test plots

7.1. example



7.2. bode plot



```

1 \begin{NumericDataPlot}{0.85\textwidth}{6.5cm}
2

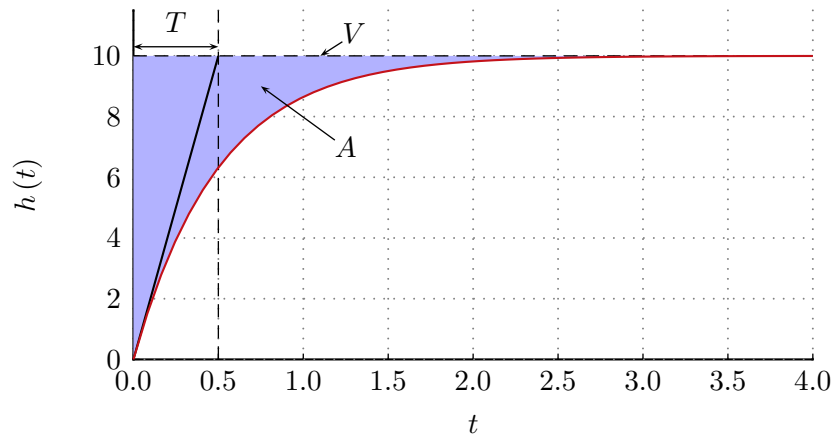
```

```

3 \setxAxis{xMin=1, xMax=100, Dx=10, xLog}
4 \setyAxis{yMin=-20, yMax=0, Dy=5, y0=0, yCoordMin=525}
5
6 \plotxAxis[NoTickLabel,NoLabel]{}
7 \plotyAxis{${\left|G\left(I\omega\right)\right|}$ in \si{decibel}}
8
9 \NDPline[style=StdLineStyleA]{0}{0}{1}{0}
10 \NDPline[style=StdLineStyleA]{1}{0}{2}{-20}
11
12 \listplot[style=StdLineStyleC]{\DataBetrag}
13
14 \NDPput[x=1, y=0]{\pnode{Pa}}
15 \NDPput[x=1, y=-3]{\pnode{Pb}}
16 \ncline{-}{Pb}{Pa}
17 \NDPput[x=1, y=-1.5]{\pnode{Pc}}
18 \NDPput[x=2, y=-2.5, RefPoint=r]%
19   {\Rnode{Pd}{
20     \psframebox[fillstyle=solid,fillcolor=white,linestyle=none,framesep=0pt]{%
21       \SI{-3}{\decibel} Betragskorrektur}}}
22 \pscustom[linewidth=0.5pt]{\ncline[angleA=0]{->}{Pd}{Pc}}
23
24 \NDPput[x=0.8, y=0]{\pnode{Pf}}
25 \NDPput[x=1.25, y=-5]{\pnode{Pg}}
26 \NDPput[x=0.9, y=-12.5, RefPoint=r]%
27   {\Rnode{Pe}{
28     \psframebox[fillstyle=solid,fillcolor=white,linestyle=none]{%
29       {Asymptoten}}}}
30 \pscustom[linewidth=0.5pt]{\ncline{->}{Pe}{Pf}}
31 \pscustom[linewidth=0.5pt]{\ncline{->}{Pe}{Pg}}
32
33
34 \setyAxis{yMin=-90, yMax=0, Dy=45, y0=0, yCoordMax=475}
35
36 \plotxAxis{${\omega}$ in \si{radian\per\second}}
37 \plotyAxis{${\arg\left(G\left(I\omega\right)\right)}$ in \si{degree}}
38
39 \listplot[style=StdLineStyleC]{\DataPhase}
40
41 \listplot[plotstyle=dots]{10 -45}
42 \NDPput[x=1, y=-45, RefPoint=lb]{ \SI{-45}{\degree}}
43
44 \end{NumericDataPlot}

```


7.3. areas in a plot



```

1  \begin{NumericDataPlot}{0.75\textwidth}{6cm}
2
3  \setxAxis{xMin=0.0, xMax=4.0, Dx=0.5}
4  \setyAxis{yMin=0, yMax=11.5, Dy=2}
5
6  \plotxAxis{$t$}
7  \plotyAxis{$h\left(t\right)$}
8
9  % Markiere Fläche
10 \pscustom[fillstyle=solid, fillcolor=blue!30, linestyle=none]{
11   \listplot{\DataSprungantwort}
12   \NDPline{4}{10}{0}{10}
13 }
14
15 % Hilfslinien
16 \NDPline{0}{0}{0.5}{10}
17 \NDPvline[linestyle=dashed, linewidth=0.5pt]{0.5}
18 \NDPhline[linestyle=dashed, linewidth=0.5pt]{10}
19
20
21 % plote Sprungantwort
22 \listplot[style=StdLineStyleC]{\DataSprungantwort}
23
24
25 % Beschriftung
26 \NDPput[x=0,y=10.3]{\pnode{A}}
27 \NDPput[x=0.5,y=10.3]{\pnode{B}}
28 \ncline[linewidth=0.5pt]{<->}{A}{B}
29 \naput{$T$}
30
31 \NDPput[x=0.75, y=9]{\pnode{F11}}
32 \NDPput[x=1.25, y=7]{\Rnode{F12}{$A$}}
33 \ncline[linewidth=0.5pt]{->}{F12}{F11}
34

```

```

35 \NDPput[x=1.1,y=10]{\pnode{V1}}
36 \NDPput[x=1.3, y=10.75]{\Rnode{V2}{V$}}
37 \ncline[linewidth=0.5pt]{->}{V2}{V1}
38
39 \end{NumericDataPlot}

```

Part III.

Version

8. History

- 18.05.2010
 - added `LabelOption` to `plotAxis`
 - added `TickLabelOption` to `plotAxis`
 - added possibility to change `StdLabelOption`
 - added possibility to change `StdTickLabelOption`
- 11.06.2010
 - expanded documentation
 - changed the command `LegLine`.
 - added the commands `plotxGrid` and `plotyGrid`. The grids may now be plotted before the axis to avoid overlapping of the grid and the axis.
- 17.06.2010
 - changed `export2latex`: check for the necessary precision before exporting the data
- 21.06.2010
 - added option for logarithmic axes
- 05.07.2010
 - added command `NDPline`
 - added instructions to fill areas between plots to documentation
- 03.08.2010

- added options to `export2latex.m`
- 05.08.2010
 - new calculation of tick lengths
 - length of the ticks may now be given in mm, see 4.1
- 14.09.2010
 - added `struct2latex` to the package
 - added `dspace2struct` to the package
 - added `dspace2latex` to the package
 - changed `struct2latex`: mapping column vectors
 - changed `struct2latex`: downsampling option added
- 15.11.2010
 - changed the lineends of the axis
- 07.01.2011
 - adjusted linestyle
 - example with the available linestyle
- 04.05.2011
 - added commands to place exponents at the axes
 - added documentation for `put North, \dots, SouthWest`
- 14.05.2011
 - added command to put a box in the graph
- 17.05.2011
 - added ps-style `LegendBoxStyle` to adjust the style of the box underlying the legend

- 12.07.2011
 - changes in documentation
 - adopted `dspace2struct` for DSPACE NEXT GENERATION
 - added `\NDPvline`, `\NDPhline`, `\NDPvbox` and `\NDPhbox`
- 01.06.2012
 - changes in documentation
 - general bug fixing
 - bug fixing for `dspace2struct`
 - suppressing notification of the calculations made by the `fp` package during the compilation.
- 14.06.2012
 - added rotation option for `\NDPput` (Rot=45)
- 03.08.2012
 - added documentation for plotting noisy data
- 23.08.2012
 - added command `\LegDot`
- 29.08.2012
 - added command `\multilistplot`
 - added `options.NaNsplit` to `export2latex`
- 30.08.2012
 - added options `DDx` and `DDy` for minor grid
 - added option `LabelBP`
- 19.03.2013

- added Customized Tick Labels
- 11.04.2013
 - Corrected calculation of bounding box
 - * removed additional horizontal phantom space
 - * Previously, the padding values lly and ury where added to the given height parameter to set the object height. Now, the given height parameter is correctly set as height of the bounding box.
 - * new standard values for padding parameters lly, llx, ury, urx, which now take into account the current font size settings (unit `em`, `\baselineskip`)
 - added more detailed documentation of the bounding box and coordinate frame behavior
- 16.04.2013
 - Changed positioning of axis labels and tick labels and added more options for customization.
 - Changed option `LabelBP` to `LabelRefPt`.
 - Changed options `xLabelSep` and `yLabelSep` to `LabelSep` (with different meaning).
 - Changed options `xTickLabelSep` and `yTickLabelSep` to `TickLabelSep` (with different meaning).
- 19.04.2013
 - added and improved documentation