Simfit

Tutorials and worked examples for simulation, curve fitting, statistical analysis, and plotting.
http://www.simfit.org.uk

Graphics files for importing into documents, visual display, or printing can code for a large number of colors by using a color scheme, such as rgb, i.e., defining three values for red green blue intensities. Consider, for instance, the definition of black, red, green, blue and white, using three integers in the range 0 to 255 in Windows, the same range in Hexadecimal for the web, and the continuous range 0 to 1 in PostScript.

Colour	Windows	Hexadecimal	Postscript
Black	0, 0, 0	000000	0, 0, 0
Red	255, 0, 0	FF0000	1, 0, 0
Green	0, 255, 0	00FF00	0, 1, 0
Blue	0, 0, 255	0000FF	0, 0, 1
White	255, 255, 255	FFFFFF	1, 1, 1

However, such a wide range of colors can be confusing in scientific graphs where generally only a few strong colors are required for titles, legends, lines, and symbols, together with some subdued colors for backgrounds or plot borders. SimFiT allows any possible color to be used for plotting by providing the following functionality.

1. **The color palette**

   72 colors are defined in w_ps.cfg in the ...Documents\Simfit\cfg folder.

2. **Editing the colors**

   Users can edit any colors in this file to change defaults.

3. **The default colors**

   The SimFiT scheme works as follows.

   (a) The first sixteen colors (0 to 15) correspond to the standard colors which would usually be sufficient for scientific graphs.
   It would not normally be necessary to edit these.

   (b) The next forty four colors (16 to 59) are variants of this scheme which includes a grey–scale selection.
   It would not normally be necessary to edit these.

   (c) The last twelve colors (60 to 71) can be adjusted by selecting the rgb numbers required, or using slider controls for color mixing available from the SimFiT color palette control. These user-defined colors are provided so that twelve personally selected colors can be used.

   (d) In Windows hardcopy files such as *.png, *.jpg, *.emf, *.pdf, these colors can not be changed retrospectively.

   (e) In SimFiT PostScript *.eps files any color can easily be changed retrospectively using a text editor, such as **notepad**.

4. **The PostScript header**

   At the start of a SimFiT *.eps file is a list of all 72 colors defined as c0 to c71 using the PostScript command x y z setrgbcolor taking the three arguments x y z, which allows easy editing by simply inserting these color–changing commands at any point in the file.

5. **Changing colors in non–PostScript graphics files**

   It should be noted that, if graphics hardcopy is always archived as SimFiT *.eps files, then the colors used in other types of files such as *.png, *.jpg, *.pdf, *.xps can be changed retrospectively, as can other features such as titles, legends, symbols, or line types, by simply editing the *.eps file in a text editor, followed by creating the type of hardcopy file required from within SimFiT.

The sixteen standard colors (c0 to c15)

As all 72 colors are defined and can be manipulated in the same way it is enough to describe just the first 16 colors. So the next section shows how the standard colors are defined in the configuration file `w_ps.cfg`.

```
 0.0000, 0.0000, 0.0000
 0.0000, 0.0000, 0.6667
 0.0000, 0.6667, 0.0000
 0.0000, 0.6667, 0.6667
 0.6667, 0.0000, 0.0000
 0.6667, 0.0000, 0.6667
 0.6667, 0.3333, 0.0000
 0.7000, 0.7000, 0.7000
 0.4500, 0.4500, 0.4500
 0.3333, 0.3333, 1.0000
 0.3333, 1.0000, 0.3333
 0.3333, 1.0000, 1.0000
 1.0000, 0.3333, 0.3333
 1.0000, 0.3333, 1.0000
 1.0000, 1.0000, 0.3333
 1.0000, 1.0000, 1.0000
```

The closing comment section of `w_ps.cfg` summarizes the named standard colors as follows.

```
    red    green  blue
0  0.0000 0.0000 0.0000 black
1  0.0000 0.0000 0.6667 blue
2  0.0000 0.6667 0.0000 green
3  0.0000 0.6667 0.6667 cyan
4  0.6667 0.0000 0.0000 red
5  0.6667 0.0000 0.6667 magenta
6  0.6667 0.3333 0.0000 brown
7  0.6667 0.6667 0.6667 white
8  0.3333 0.3333 0.3333 dark grey
9  0.3333 0.3333 1.0000 light blue
10 0.3333 1.0000 0.3333 light green
11 0.3333 1.0000 1.0000 light cyan
12 1.0000 0.3333 0.3333 light red
13 1.0000 0.3333 1.0000 light magenta
14 1.0000 1.0000 0.3333 light yellow
15 1.0000 1.0000 1.0000 bright white
```

When a *.eps file is created the current 72 color definitions are read from `w_ps.cfg` and written to the *.eps file header section. So finally, here is how these standard colors are defined in the *.eps file headers using rgb as an abbreviation for setrgbcolor and D for define.

```
/c0{0.000 0.000 0.000 rgb}D /c1{0.000 0.000 0.667 rgb}D
/c2{0.000 0.667 0.000 rgb}D /c3{0.000 0.667 0.667 rgb}D
/c4{0.667 0.000 0.000 rgb}D /c5{0.667 0.000 0.667 rgb}D
/c6{0.667 0.333 0.000 rgb}D /c7{0.700 0.700 0.700 rgb}D
/c8{0.450 0.450 0.450 rgb}D /c9{0.333 0.333 1.000 rgb}D
/c10{0.333 1.000 0.333 rgb}D /c11{0.333 1.000 1.000 rgb}D
/c12{1.000 0.333 0.333 rgb}D /c13{1.000 0.333 1.000 rgb}D
/c14{1.000 1.000 0.333 rgb}D /c15{1.000 1.000 1.000 rgb}D
```

The SɪᴍFɪᴛ color palette can be opened from the configuration option and is always made available when a color change is requested. So the next figure shows the first sixteen colors (c0 to c15) from this color palette.

The sixteen standard Simfit colours (c0 to c15)
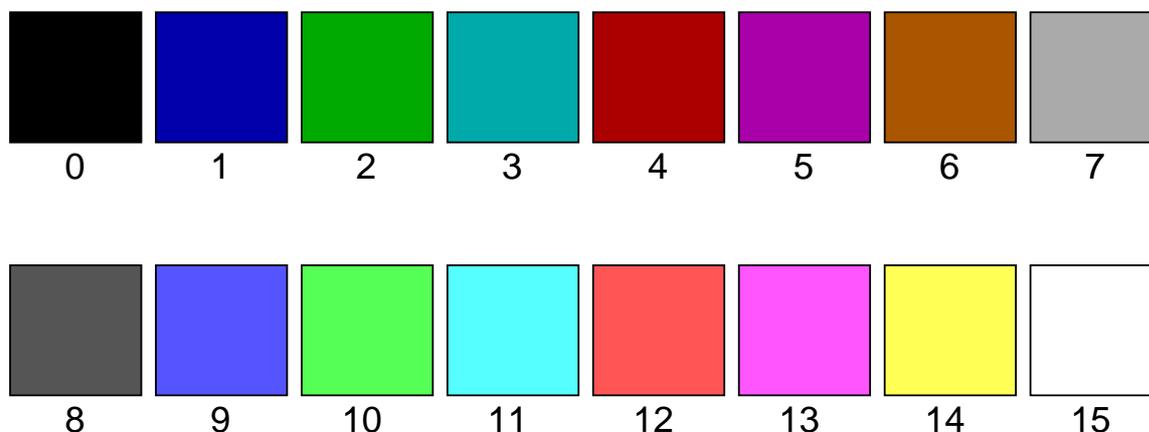
Editing PostScript files

Note that, at any stage, you can open a SɪᴍFɪᴛ *.eps file in a text editor such as **notepad** and add a new line to make that color the current color until the next time it is changed. For instance if the next line in a file

```
...
c4
...
```

is changed to

```
...
c12
...
```

then the current color will become light red instead of red.

Equally the new color command can be made explicitly as in

```
...
1.000 0.333 0.333 setrgbcolor
...
```

and, clearly, proceeding in this way any color change can be achieved.

Program **editps** provides many options for re-sizing and rotating SɪᴍFɪᴛ *.eps files and has several editing opportunities. However, in the examples that follow, it is assumed that the procedure will be as follows

1) Save the *.eps as a backup or edit a copy
2) Edit the *.eps file in a text editor
3) View the edited file in, e.g., **gsview**
4) Save the final result

as, after a bit of practise, this is the easiest way to edit SɪᴍFɪᴛ *.eps files.

Example 1: Changing colors in a title and legends

In this example, the *.eps file is opened in a text editor which is then searched for the expression `%#title` to move to the code in the file defining the title which is

```
c4
(Example: straight line plot) 3195 4467 ti%#title
(0000000000000000000000000000) fx
/ti-size ti-size   1.000 mul def
/xl-size xl-size   1.000 mul def
c1
(X Values) 3515 192 xl%#x legend
(00000000) fx
/xl-size xl-size   1.000 mul def
/yl-size yl-size   1.000 mul def
(Y values) 501 2443 yl%#y legend
(00000000) fx
/yl-size yl-size   1.000 mul def
```

and which results in the title being colored red and the legends colored blue, as in the left hand figure below.
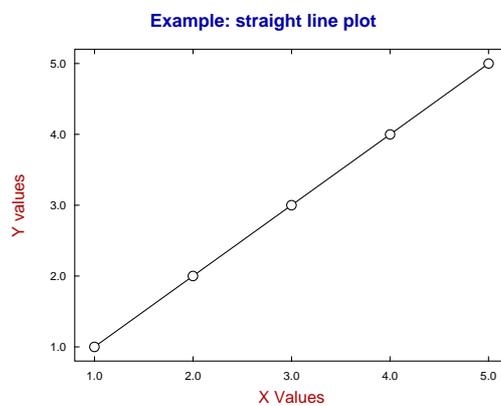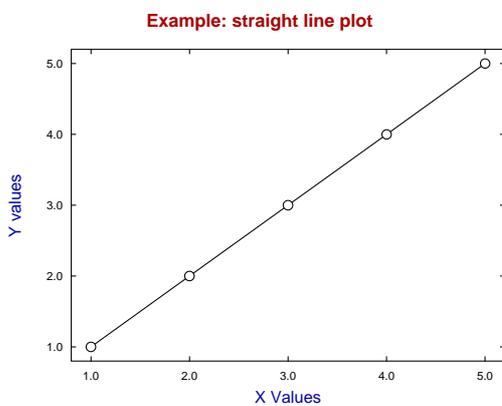
Simply interchanging the code for the red title and blue legend, i.e., replacing c4 (red) and c1 (blue) by c1 (blue) and c4 (red) as shown in the next section

```
c1
(Example: straight line plot) 3195 4467 ti%#title
(0000000000000000000000000000) fx
/ti-size ti-size   1.000 mul def
/xl-size xl-size   1.000 mul def
c4
(X Values) 3515 192 xl%#x legend
(00000000) fx
/xl-size xl-size   1.000 mul def
/yl-size yl-size   1.000 mul def
(Y values) 501 2443 yl%#y legend
(00000000) fx
/yl-size yl-size   1.000 mul def
```

results in the blue title and red legends shown in the right hand plot.

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Example 2: More extensive editing
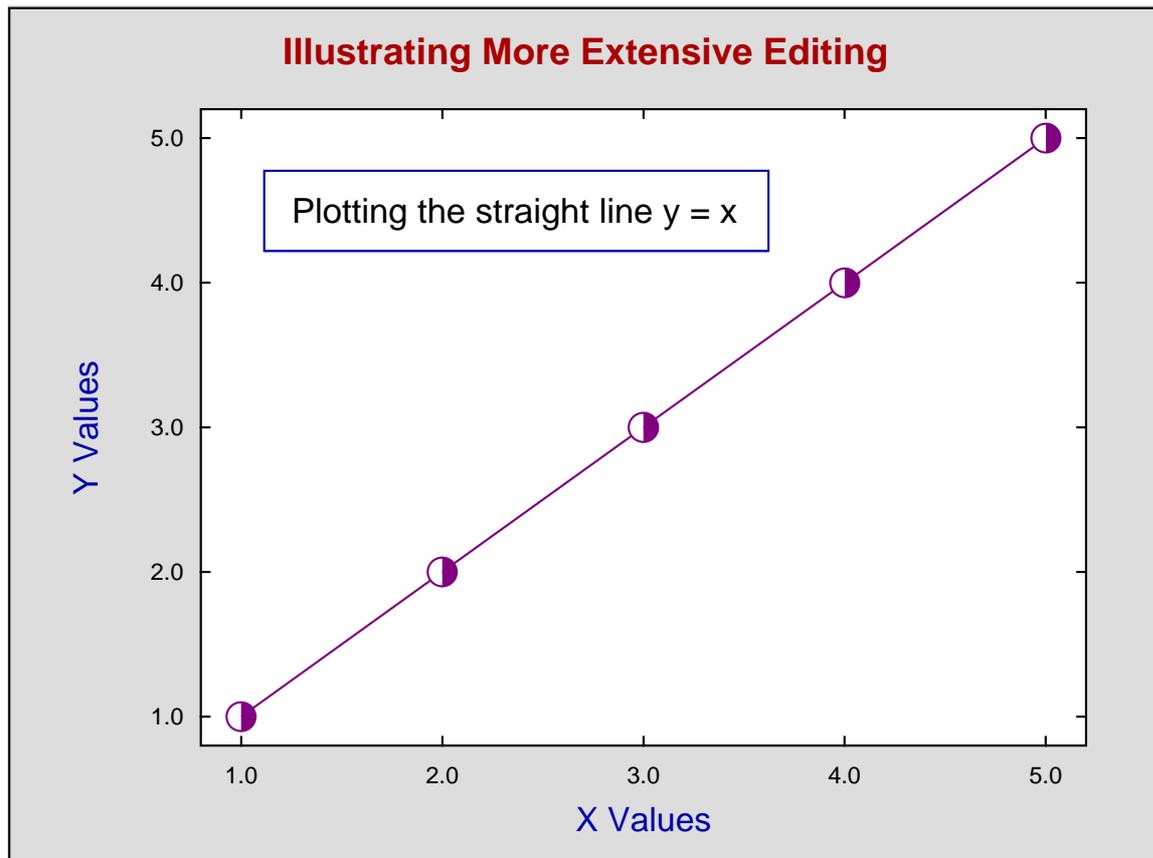
First of all consider the steps that were required to obtain the graph above from the previous plots.

1. A grey border was added to the outside of the data–plotting area.

2. A black frame was added to surround the overall graph.

3. The title was edited.

4. The line and plotting symbols were colored, and the symbol type changed.

5. An information panel was added.

With experience it is easy to perform such operations directly using a text editor. However, the following procedure could be used to appreciate how to gain such experience.

- Create the original graph in **simplot** [Advanced Editing] and save as `file_1.eps`.

- Edit the data in **simplot** [Advanced Editing] and then save as `file_2.eps`.

- Open `file_1.eps` and `file_2.eps` in a file comparison editor, e.g., **notepad++**.

- See how to color the line and alter the symbol size and type.

- Copy and paste the new code sections from `file_2.eps` into `file_1.eps`.

- Copy the new codes to the clipboard and archive to be re–used as templates.

Here are the new sections that were copied from `file_2.eps` into `file_1.eps`, but with comments (following %) removed for clarity.

Code for the border using color c22 and pf (polygon filled)

```
c22
0 0 0 4790 1070 4790 1070 0 4 pf
5959 0 5959 4790 6390 4790 6390 0 4 pf
1070 0 1070 671 5959 671 5959 0 4 pf
1070 4215 1070 4790 5959 4790 5959 4215 4 pf
```

Code for the black frame using pc (polygon closed)

```
0 setlinejoin
12 12 6378 12 6378 4778 12 4778 4 pc
1 setlinejoin
```

Code for ti (title) and fx (character keys)

```
c4
(Illustrating More Extensive Editing) 3195 4467 ti
(000000000000000000000000000000000000) fx
```

Code for the pl (polyline) line)

```
c47
1292 832 2403 1638 3514 2443 4626 3248 5737 4054 5 pl
```

Code for larger size (80) ch (circle half filled)

```
c47
1292   832 80 ch
2403 1638 80 ch
3514 2443 81 ch
4626 3248 80 ch
5737 4054 80 ch
```

Code for the information panel

```
c1
1420 3426 4205 3426 4205 3872 1420 3872 1420 3426 4205 3426 6 pl
1 setlinejoin
c0
/font /Helvetica D /size   192 D
GS font F size S   1573   3585 M    0 rotate
(Plotting the straight line y = x)
(0000000000000000000000000000000) fx
```

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