D I S L I N 9.0

A Data Plotting Extension

for the

Programming Language

Perl

by

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Contents

Chapter 1

Overview

1.1 Introduction

This manual describes a data plotting extension for the interpreted, programming language Perl. The plotting extension is based on the data plotting library DISLIN that is available for several C, Fortran 77 and Fortran 90 compilers.

DISLIN is a high-level plotting library that contains subroutines and functions for displaying data graphicallly as curves, bar graphs, pie charts, 3-D colour plots, surfaces, contours and maps. The library contains about 400 plotting and parameter setting routines which are now available from Perl.

1.2 DISLIN Features

The following features are supported by DISLIN:

- Several output formats can be selected such as X11, PostScript, PDF, CGM, Prescribe, TIFF, PNG and HPGL.
- 9 software fonts are available where each font provides 6 alphabets and special european characters. Hardware fonts for PostScript printers and X11 and Window displays can also be used.
- Plotting of two- and three-dimensional axis systems. Axes can be linearly or logarithmically scaled and labeled with linear, logarithmic, date, time, map and user-defined formats.
- Plotting of curves. Several curves can appear in one axis system and can be differentiated by colour, line style and pattern. Multiple axis systems can be displayed on one page.
- Plotting of legends.
- Elementary plot routines for lines, vectors and outlined or filled regions such as rectangles, circles, arcs, ellipses and polygons.
- Shielded regions can be defined.
- Business graphics.
- 3-D colour graphics.
- 3-D graphics.
- Elementary image routines.
- Geographical projections and plotting of maps.

- Contouring.
- A PostScript manual of DISLIN is available.

1.3 Passing Parameters from Perl to DISLIN Routines

For passing parameters from Perl to DISLIN, the following rules are applied:

- Parameters can be passed from Perl to DISLIN routines as variables, constants and expressions.
- String constants must be enclosed in a pair of either apostrophes or quotation marks.
- Floatingpoint parameters can be passed from Perl as integer and floatingpoint numbers.
- Arrays can be passed from Perl to DISLIN with the starting characters '\ @'.

Note: Normally, the number and meaning of parameters passed to DISLIN routines are identical with the syntax description of the routines in the DISLIN manual. DISLIN routines that return one scalar are implemented for Perl as functions. A short description of DISLIN routines that can be called from Perl is presented in appendix A.

1.4 FTP Sites, DISLIN Home Page

The DISLIN software is available via ftp anonymous from the following sites:

ftp://ftp.gwdg.de/pub/grafik/dislin
ftp://unix1.mpae.gwdg.de/pub/dislin

The DISLIN home page is:

http://www.dislin.de

1.5 Reporting Bugs

DISLIN is well tested by many users and should be very bug free. However, no software is perfect. If you have any problems with DISLIN, contact the author:

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Appendix A

Short Description of DISLIN Routines

This appendix presents a short description of all DISLIN routines that can be called from Perl. A complete description of the routines can be found in the DISLIN manual or via the online help of DISLIN. For parameters, the following conventions are used:

- integer variables begin with the character N or I;
- strings begin with the character C;
- other variables are floatingpoint numbers;
- scalar variables start in Perl with '$' that must be added to the variable names in the following description of DISLIN calls;
- one-dimensional arrays end with the keyword 'ray', two-dimensional arrays with the keyword 'mat'. Arrays must be passed to DISLIN routines with the preceding characters '\@'.

A.1 Initialization and Introductory Routines

Routine	Meaning
cgmbgd (xr, xg, xb)	defines the background colour for CGM files.
cgmpic (cstr)	sets the picture ID for CGM files.
disini ()	initializes DISLIN.
erase ()	clears the screen.
errdev (cdev)	defines the error device.
errfil (cfil)	sets the name of the error file.
errmod (ckey, copt)	modifies the printing of error messages.
filbox (nx, ny, nw, nh)	defines the position and size of included metafiles.
gifmod (cmod, ckey)	enables transparency for GIF files.
hworig (nx, ny)	defines the origin of the PostScript hardware page.
hwpage (nw, nw)	defines the size of the PostScript hardware page.
imgfmt (copt)	defines the format of image files.
incfil (cfil)	includes metafiles into a graphics.
metafl (cfmt)	defines the plotfile format.
newpag ()	creates a new page.
origin (nx, ny)	defines the origin.
page (nw, nh)	sets the page size.
pagera ()	plots a page border.
pagfll (iclr)	fills the page with a colour.
paghdr (c1, c2, iopt, idir)	plots a page header.
pagmod (copt)	selects a page rotation.

Routine	Meaning
pagorg (copt)	defines the origin of the page.
n = pdfbuf (cbuf, nmax)	copies a PDF file to a buffer. The memory for the buffer is allocated by pdfbuf.
pdfmod (cmod, ckey)	defines PDF options.
pdfmrk (cstr, copt)	defines kookmarks for PDF files.
pngmod (cmod, ckey)	enables transparency for PNG files.
sclfac (x)	defines a scaling factor for the entire plot.
sclmod (copt)	defines a scaling mode.
scrmod (copt)	swaps back- and foreground colours.
setfil (cfil)	sets the plotfile name.
setpag (copt)	selects a predefined page format.
setxid (id, copt)	defines an external X Window or pixmap.
symfil (cdev, cstat)	sends a plotfile to a device.
tifmod (n, cval, copt)	defines the physical resolution of TIFF files.
unit (nu)	defines the logical unit for messages.
units (copt)	defines the plot units.
wmfmod (cmod, ckey)	modifies the format of WMF files.

Figure A.1: Initialization and Introductory Routines

A.2 Termination and Parameter Resetting

Routine	Meaning
disfin ()	terminates DISLIN.
endgrf ()	terminates an axis system and sets the level to 1.
reset (copt)	resets parameters to default values.

Figure A.2: Termination and Parameter Resetting

A.3 Plotting Text and Numbers

Routine	Meaning
angle (n)	defines the character angle.
chaang (x)	defines an inclination angle for characters.
chaspc (x)	affects character spacing.
chawth (x)	affects the width of characters.
fixspc (x)	sets a constant character width.
frmess (nfrm)	defines the thickness of text frames.
height (n)	defines the character height.
messag (cstr, nx, ny)	plots text.
mixalf ()	enables control signs in character strings for plotting indices and exponents.
newmix ()	defines an alternate set of control characters for plotting indices and exponents.

Routine	Meaning
n = nlmess (cstr)	returns the length of strings in plot coordinates.
number (x, ndig, nx, ny)	plots floating-point numbers.
numfmt (copt)	determines the format of numbers.
numode (c1, c2, c3, c4)	modifies the appearance of numbers.
rlmess (cstr, x, y)	plots text.
rlnumb (x, ndig, xp, yp)	plots numbers for user coordinates.
setbas (xfac)	determines the position of indices and exponents.
setexp (xfac)	sets the height of indices and exponents.
setmix (char, cmix)	defines control signs for indices and exponents.
texmod (cmode)	enables TeX mode for plotting mathematical formulas.
texopt (copt, ctype)	defines TeX options.
txtjus (copt)	defines the alignment of text and numbers.

Figure A.3: Plotting Text and Numbers

A.4 Colours

Routine	Meaning
color (color)	defines colours.
hsvrgb (xh, xs, xv, xr, xg, xb)	converts HSV to RGB coordinates.
n = indrgb (xr, xg, xb)	calculates a coulor index.
n = indtgb (xr, xg, xb)	calculates an explicit coulor value.
myvlt (rray, gray, bray, n)	changes the current colour table.
rgbhsv (xr, xg, xb, xh, xs, xv)	converts RGB to HSV coordinates.
setclr (nclr)	defines colours.
setind (i, xr, xg, xb)	changes the current colour table.
setrgb (xr, xg, xb)	defines colours.
setvlt (cvlt)	selects a colour table.
vltfil (cfil, cmod)	stores or loads a colour table.

Figure A.4: Colours

A.5 Fonts

Routine	Meaning
bmpfnt (cfont)	defines a bitmap font.
basalf (calph)	defines the base alphabet.
chacod (copt)	defines the character coding.
complx ()	sets a complex font.
duplx ()	sets a double-stroke font.
disalf ()	sets the default font.
eushft (cnat, char)	defines a shift character for European characters.
gothic ()	sets a gothic font.
helve ()	sets a shaded font.
helves ()	sets a shaded font with small characters.
hwfont ()	sets a standard hardware font.
psfont (cfont)	sets a PostScript font.
psmode (cmode)	enables Greek and Italic characters in PostScript fonts.
serif ()	sets a complex shaded font.
simplx ()	sets a single-stroke font.
smxalf (calph, c1, c2, n)	defines shift characters for alternate alphabets.
triplx ()	sets a triple-stroke font.
winfnt (cfont)	sets a TrueType font for Windows displays.
x11fnt (cfont, copt)	sets an X11 font for X11 displays.

Figure A.5: Fonts

A.6 Symbols

Routine	Meaning
hsymbl (n)	defines the height of symbols.
mysymb (xray, yray, n, isym, iflag)	defines an user-defined symbol.
rlsymb (nsym, x, y)	plots symbols for user coordinates.
symbol (nsym, nx, ny)	plots symbols.
symrot (xang)	defines a rotation angle for symbols.

Figure A.6: Symbols

A.7 Axis Systems

Routine	Meaning
addlab (cstr, v, itic, cax)	plots additional single labels.
ax2grf ()	suppresses the plotting of the upper X- and the left Y-axis.
ax3len (nxl, nyl, nzl)	defines axis lengths for a coloured 3-D axis system.
axsbgd (iclr)	defines the background colour.
axslen (nxl, nyl)	defines axis lengths for a 2-D axis system.
axsorg (nx, ny)	determines the position of a crossed axis system.
axspos (nxp, nyp)	determines the position of axis systems.
axstyp (ctype)	select rectangular or crossed axis systems.
axgit ()	plots the lines X = 0 and Y = 0.
box2d ()	plots a border around an axis system.
center ()	centres axis systems.
cross ()	plots the lines X = 0 and Y = 0 and marks them with ticks.
endgrf ()	terminates an axis system.
frame (nfrm)	defines the frame thickness of axis systems.
frmclr (nclr)	defines the colour of frames.
grace (ngrace)	affects the clipping margin of axis systems.
graf (xa, xe, xor, xstp, ya, ye, yor, ystp)	plots a two-dimensional axis system.
graf3 (xa, xe, xor, xstp, ya, ye, yor, ystp, za, ze, zor, zstp)	plots an axis system for colour graphics.
grdpol (nx, ny)	plots a polar grid.
grid (nx, ny)	overlays a grid on an axis system.
noclip ()	suppresses clipping of user coordinates.
nograf ()	suppresses the plotting of an axis system.
polar (xe, xor, xstp, yor, ystp)	plots a polar axis system.
polmod (cpos, cdir)	modifies the appearance of polar labels.
setgrf (c1, c2, c3, c4)	suppresses parts of an axis system.
setscl (xray, n, cax)	sets automatic scaling.
title ()	plots a title over an axis system.
xaxgit ()	plots the line Y = 0.
xcross ()	plots the line Y = 0 and marks it with ticks.
yaxgit ()	plots the line X = 0.
ycross ()	plots the line X = 0 and marks it with ticks.

Figure A.7: Axis Systems

A.8 Secondary Axes

Routine	Meaning
xaxis (xa, xe, xor, xstp, nl, cstr, it, nx, ny)	plots a linear X-axis.
xaxlg (xa, xe, xor, xstp, nl, cstr, it, nx, ny)	plots a logarithmic X-axis.
yaxis (ya, ye, yor, ystp, nl, cstr, it, nx, ny)	plots a linear Y-axis.
yaxlg (ya, ye, yor, ystp, nl, cstr, it, nx, ny)	plots a logarithmic Y-axis.
zaxis (za, ze, zor, zstp, nl, cstr, it, id, nx, ny)	plots a linearly scaled colour bar.
zaxlg (za, ze, zor, zstp, nl, cstr, it, id, nx, ny)	plots a logarithmically scaled colour bar.

Figure A.8: Secondary Axes

A.9 Modification of Axes

Routine	Meaning
axclrs (nclr, copt, cax)	defines colours for axis elements.
axends (copt, cax)	suppresses certain labels.
axsscl (copt, cax)	defines the axis scaling.
hname (nh)	defines the character height of axis names.
intax ()	defines integer numbering for all axes.
labdig (ndig, cax)	sets the number of decimal places for labels.
labdis (ndis, cax)	sets the distance between labels and ticks.
labels (copt, cax)	selects labels.
labjus (copt, cax)	defines the alignment of axis labels.
labmod (ckey, cval, cax)	modifies date labels.
labpos (copt, cax)	determines the position of labels.
labtyp (copt, cax)	defines vertical or horizontal labels.
logtic (copt)	modifies the appearance of logarithmic ticks.
mylab (cstr, itic, cax)	sets user-defined labels.
namdis (ndis, cax)	sets the distance between axis names and labels.
name (cstr, cax)	defines axis titles.
namjus (copt, cax)	defines the alignment of axis titles.
noline (cax)	suppresses the plotting of axis lines.
rgtlab ()	right-justifies labels.
rvynam ()	defines an angle for Y-axis names.
ticks (ntics, cax)	sets the number of ticks.
ticlen (nmaj, nmin)	sets the length of ticks.
ticmod (copt, cax)	modifies the plotting of ticks at calendar axes.

Routine	Meaning
ticpos (copt, cax)	determines the position of ticks.
timopt ()	modifies time labels.

Figure A.9: Modification of Axes

A.10 Axis System Titles

Routine	Meaning
htitle (nh)	defines the character height of titles.
lfttit ()	left-justifies title lines.
linesp (xfac)	defines line spacing.
titjus (copt)	defines the alignment of titles.
title ()	plots axis system titles.
titlin (cstr, ilin)	defines text lines for titles.
titpos (copt)	defines the position of titles.
vkytit (nshift)	shifts titles in the vertical direction.

Figure A.10: System Titles

A.11 Plotting Data Points

Routine	Meaning
bars (xray, y1ray, y2ray, n)	plots a bar graph.
bars3d (xray, yray, z1ray, z2ray, xwray, ywray, icray, n)	plots 3-D bars.
chnatt ()	changes curve attributes.
chncrv (copt)	defines attributes changed automatically by CURVE.
color (color)	defines the colour used for text and lines.
crvmat (zmat, n, m,	plots a coloured surface.
curve (xray, yray, n)	plots curves.
curve3 (xray, yray, zray, n)	plots coloured rectangles.
curvx3 (xray, y, zray, n)	plots rows of coloured rectangles.
curvy3 (x, yray, zray, n)	plots columns of coloured rectangles.
errbar (xray, yray, e1ray, e2ray, n)	plots error bars.
field (x1ray, y1ray, x2ray, y2ray, n, ivec)	plots a vector field.
gapcrv (xgap)	defines gaps plotted by CURVE.
inccrv (ncrv)	defines the number of curves plotted with equal attributes.
incmrk (nmrk)	selects symbols or lines for CURVE.
marker (nsym)	sets the symbols plotted by CURVE.

Routine	Meaning
nochek ()	suppresses listing of out of range data points.
piegrf (cbuf, nlin, xray, n)	plots a pie chart.
polcrv (copt)	defines the interpolation method used by CURVE.
resatt ()	resets curve attributes.
setres (nx, ny)	sets the size of coloured rectangles.
shdcrv (x1ray, y1ray, n1, x2ray, y2ray, n2)	plots shaded areas between curves.
splmod (ngrad, npts)	modifies spline interpolation.
thkcrv (nthk)	defines the thickness of curves.

Figure A.11: Plotting Data Points

A.12 Legends

Routine	Meaning
frame (nfrm)	sets the frame thickness of legends.
legend (cbuf, ncor)	plots legends.
legini (cbuf, nlin, nmaxln)	initializes legends.
leglin (cbuf, cstr, ilin)	defines text for legend lines.
legopt (xf1, xf2, xf3)	modifies the appearance of legends.
legpat (ityp, ithk, isym, iclr, ipat, ilin)	stores curve attributes.
legpos (nxp, nyp)	determines the position of legends.
legtit (ctitle)	defines the legend title.
linesp (xfac)	affects line spacing.
mixleg ()	enables multiple text lines in legends.
nxl = nxlegn (cbuf)	returns the width of legends in plot coordinates.
nyl = nylegn (cbuf)	returns the height of legends in plot coordinates.

Figure A.12: Legends

A.13 Line Styles and Shading Patterns

Routine	Meaning
chndot ()	sets a dotted-dashed line style.
chndsh ()	sets a dashed-dotted line style.
color (color)	sets a colour.
dash ()	sets a dashed line style.
dashl ()	sets a long-dashed line style.
dashm ()	sets a medium-dashed line style.
dot ()	sets a dotted line style.
dotl ()	sets a long-dotted line style.
lintyp (itype)	defines a line style.
linwid (nwidth)	sets the line width.
lncap (copt)	sets the line cap parameter.
lnjoin (copt)	sets the line join parameter.
lnmlt (xfac)	sets the miter limit parameter.
myline (nray, n)	sets a user-defined line style.
mypat (iangle, itype, idens, icross)	defines a global shading pattern.
penwid (nwidth)	sets the pen width.
shdpat (ipat)	selects a shading pattern.
solid ()	sets a solid line style.

Figure A.13: Line Styles and Shading Patterns

A.14 Cycles

Routine	Meaning
clrcyc (index, iclr)	modifies the colour cycle.
lincyc (index, itype)	modifies the line style cycle.
patcyc (index, ipat)	modifies the pattern cycle.

Figure A.14: Cycles

A.15 Base Transformations

Routine	Meaning
trfres ()	resets base transformations.
trfrot (xang, nx, ny)	affects the rotation of plot vectors.
trfscl (xscl, yscl)	affects the scaling of plot vectors.
trfshf (nx, ny)	affects the shifting of plot vectors.

Figure A.15: Base Transformations

A.16 Shielding

Routine	Meaning
shield (carea, cmode)	defines automatic shielding.
shlcir (nx, ny, nr)	defines circles as shielded areas.
shldel (id)	deletes shielded areas.
shlell (nx, ny, na, nb, t)	defines ellipses as shielded areas.
id = shlind ()	returns the index of a shielded area.
shlpie (nx, ny, nr, a, b)	defines pie segments as shielded areas.
shlpol (nxray, nyray, n)	defines polygons as shielded areas.
shlrct (nx, ny, nw, nh, t)	defines rotated rectangles as shielded areas.
shlrec (nx, ny, nw, nh)	defines rectangles as shielded areas.
shlres (n)	deletes shielded areas.
shlvis (id, cmode)	enables or disables shielded areas.

Figure A.16: Shielding

A.17 Parameter Requesting Routines

Routine	Meaning
calf = getalf ()	returns the base alphabet.
n = getang ()	returns the current angle used for text and numbers.
getclp (nx, ny, nw, nh)	returns the currents clipping window.
cdsp = getdsp ()	returns the terminal type.
n = getclr ()	returns the current colour number.
getdig (nx, ny, nz)	returns the number of decimal places used in labels.
cfil = getfil ()	returns the current plotfile name.
getgrf (a, b, or, stp, cax)	returns the scaling of the current axis system.
n = gethgt ()	returns the current character height.
n = gethnm ()	returns the character height of axis titles.
getind (i, xr, xg, xb)	returns the RGB coordinates for a colour index.
getlab (cx, cy, cz)	returns the current labels.
getlen (nx, ny, nz)	returns the current axis lengths.
n = getlev ()	returns the current level.
n = getlin ()	returns the current line width.
cmfl = getmfl ()	returns the current file format.
c = getmix (copt)	returns shift characters for indices and exponents.
getor (nx, ny)	returns the current origin.
getpag (nx, ny)	returns the current page size.
n = getpat ()	returns the current shading pattern.
n = getplv ()	returns the patch level of DISLIN.
getpos (nx, ny)	returns the position of the axis system.
getran (nx, ny)	returns the range of colour bars.
getres (nx, ny)	returns the size of points used in 3-D colour graphics.
getrgb (xr, xg, xb)	returns the RGB coordinates of the current colour.

Routine	Meaning
getscl (nx, ny, nz)	returns the current axis scaling.
getscr (nwpix, nhpix)	returns the screen size in pixels.
c = getshf (copt)	returns shift characters for European characters.
getsp1 (nx, ny, nz)	returns the distance between axis ticks and labels.
getsp2 (nx, ny, nz)	returns the distance between axis labels and names.
getsym (nsym, nh)	returns the current symbol number and height.
gettcl (nmaj, nmin)	returns the current tick lengths.
gettic (nx, ny, nz)	returns the number of ticks plotted between labels.
n = gettyp ()	returns the current line style.
n = getuni ()	returns the current unit used for messages.
x = getver ()	returns the DISLIN version number.
getvk (nytit, nxbar, nybar)	returns the current lengths used for shifting.
cvlt = getvlt ()	returns the current colour table.
n = getwid ()	returns the width of colour bars.
getwin (nx, ny, nw, nh)	returns the position and size of the graphics window.
id = getxid ('WINDOW')	returns the X window ID.
n = gmxalf (copt, c1, c2)	returns shift characters for additional alphabets.

Figure A.17: Parameter Requesting Routines

A.18 Elementary Plot Routines

Routine	Meaning
arcell (nx, ny, na, nb, alpha, beta, theta)	plots elliptical arcs.
areaf (nxray, nyray, n)	plots polygons.
circle (nx, ny, nr)	plots circles.
connpt (x, y)	plots a line to a point.
ellips (nx, ny, nr1, nr2)	plots ellipses.
line (nx, ny, nu, nv)	plots lines.
noarln ()	suppresses the outline of geometric figures.
pie (nx, ny, nr, a, b)	plots pie segments.
point (nx, ny, nb, nh, nc)	plots coloured rectangles where the position is defined by the centre point.
recfll (nx, ny, nw, nh, nc)	plots coloured rectangles.
rectan (nx, ny, nw, nh)	plots rectangles.
rndrec (nx, ny, nw, nh, iopt)	plots a rectangle with rounded corners.
rlarc (x, y, r1, r2, a, b, t)	plots elliptical arcs for user coordinates.
rlarea (xray, yray, n)	plots polygons for user coordinates.
rlcirc (x, y, r)	plots circles for user coordinates.
rlell (x, y, r1, r2)	plots ellipses for user coordinates.
rline (x, y, u, v)	plots lines for user coordinates.
rlpie (x, y, r, a, b)	plots pie segments for user coordinates.

Routine	Meaning
rlpoin (x, y, nw, nh, nc)	plots coloured rectangles for user coordinates.
rlrec (x, y, xw, xh)	plots rectangles for user coordinates.
rlrnd (x, y, xw, xh, iopt)	plots for user coordinates a rectangle with rounded corners.
rlsec (x, y, r1, r2, a, b, ncol)	plots coloured pie sectors for user coordinates.
rlvec (x1, y1, x2, y2, ivec)	plots vectors for user coordinates.
rlwind (x, xp, yp, nw, a)	plots wind speed symbols for user coordinates.
sector (nx, ny, nr1, nr2, a, b, ncol)	plots coloured pie sectors.
strtpt (x, y)	moves the pen to a point.
trifll (xray, yray)	plots solid filled rectangles.
vector (nx, ny, nu, nv, ivec)	plots vectors.
windbr (x, nx, ny, nw, a)	plots wind speed symbols.
xmove (x, y)	moves the pen to a point.
xdraw (x, y)	plots a line to a point.

Figure A.18: Elementary Plot Routines

A.19 Conversion of Coordinates

Routine	Meaning
colray (zray, nray, n)	converts Z-coordinates to colour numbers.
n = nxposn (x)	converts X-coordinates to plot coordinates.
n = nyposn (y)	converts Y-coordinates to plot coordinates.
n = nzposn (z)	converts Z-coordinates to colour numbers.
trfco1 (xray, n, cfrom, cto)	converts one-dimensional coordinates.
trfco2 (xray, yray, n, cfr, cto)	converts two-dimensional coordinates.
trfco3 (xray, yray, zray, n, cfr, cto)	converts three-dimensional coordinates.
trfrel (xray, yray, n)	converts X- and Y-coordinates to plot coordinates.
x = xinvrs (nx)	converts X plot coordinates to user coordinates.
x = xposn (x)	converts X-coordinates to real plot coordinates.
y = yinvrs (ny)	converts Y plot coordinates to user coordinates.
y = yposn (y)	converts Y-coordinates to real plot coordinates.

Figure A.19: Conversion of Coordinates

A.20 Utility Routines

Routine	Meaning
bezier (xray, yray, n, xpray, ypray, np)	calculates a Bezier interpolation.
n = bitsi2 (nbits, ninp, iinp, nout, iout)	allows bit manipulation on 16 bit variables.

Routine	Meaning
n = bitsi4 (nbits, ninp, iinp, nout, iout)	allows bit manipulation on 32 bit variables.
circ3p (x1, y1, x2, y2, x3, y3 xm, ym, r)	calculates a circle specified by 3 points.
cstr = fcha (x, ndig)	converts floating-point numbers to character strings.
n = flen (x, ndig)	calculates the number of digits for floating-point numbers.
nh = histog (xray, n, xhray, yhray)	calculates a histogram.
cstr = intcha (nx)	converts integers to character strings.
n = intlen (nx)	calculates the number of digits for integers.
n = nlmess (cstr)	returns the length of character strings in plot coordinates.
n = nlnumb (x, ndig)	returns the length of numbers in plot coordinates.
sortr1 (xray, n, copt)	sorts floating-point numbers.
sortr2 (xray, yray, n, copt)	sorts points in the X-direction.
npt = spline (xray, yray, n, xsray, ysray)	returns splined points as calculated in CURVE.
swapi2 (iray, n)	swaps the bytes of 16 bit integer variables.
swapi4 (iray, n)	swaps the bytes of 32 bit integer variables.
trfmat (zmat, nx, ny, zmat2, nx2, ny2)	converts matrices.
ntri = triang (xray, yray, n, i1ray, i2ray, i3ray, nmax)	calculates the Delaunay triangulation.
n = trmlen (cstr)	calculates the number of characters in character strings.
upstr (cstr)	converts a character string to uppercase letters.

Figure A.20: Utility Routines

A.21 Date Routines

Routine	Meaning
basdat (id, im, iy)	defines the base date.
n = incdat (id, im, iy)	returns incremented days.
n = nwkday (id, im, iy)	returns the weekday of a date.
trfdat (n, id, im, iy)	converts incremented days to a date.

Figure A.21: Date Routines

A.22 Cursor Routines

Routine	Meaning
n = csrmov (nxray, nyray, nmax)	collects cursor movements.
nkey = csrpos (nx, ny)	sets and returns the cursor position.
nx,ny = csrpt1 ()	returns a pressed cursor position.

Routine	Meaning
n = csrpts (nxray, nyray, nmax)	collects cursor positions.
csrtyp (copt)	selects the cursor type.
csruni (copt)	selects the unit of returned cursor positions.
setcsr (copt)	defines the cursor type of the graphics window.

Figure A.22: Cursor Routines

A.23 Bar Graphs

Routine	Meaning
barbor (iclr)	defines the colour of bar borders.
barclr (ic1, ic2, ic3)	defines bar colours.
bargrp (ngrp, gap)	affects clustered bars.
barmod (cmod, copt)	enables variable bars.
baropt (xf, ang)	modifies the appearance of 3-D bars.
barpos (copt)	selects predefined positions for bars.
bars (xray, y1ray, y2ray, n)	plots bar graphs.
bartyp (copt)	selects vertical or horizontal bars.
chnbar (copt)	modifies the appearance of bars.
labclr (nclr, 'BARS')	defines the colour of bar labels.
labdig (ndig, 'BARS')	defines the number of decimal places in bar labels.
labels (copt, 'BARS')	defines bar labels.
labpos (copt, 'BARS')	defines the position of bar labels.

Figure A.23: Bar Graphs

A.24 Pie Charts

Routine	Meaning
chnpie (copt)	defines colour and pattern attributes for pie segments.
labclr (nclr, 'PIE')	defines the colour of segment labels.
labdig (ndig, 'PIE')	defines the number of decimal places in segment labels.
labels (copt, 'PIE')	defines pie labels.
labpos (copt, 'PIE')	defines the position of segment labels.
labtyp (copt, 'PIE')	modifies the appearance of segment labels.
piebor (iclr)	defines the colour of pie borders.
pieclr (ic1ray, ic2ray, n)	defines pie colours.
pieexp ()	defines exploded pie segments.
piegrf (cbuf, nlin, xray, n)	plots pie charts.
pielab (clab, cpos)	sets additional character strings plotted in segment labels.
pieopt (xf, ang)	modifies the appearance of 3-D pies.
pietyp (copt)	selects 2-D of 3-D pie charts.
pievec (ivec, copt)	modifies the arrow plotted between labels and segments.

Figure A.24: Pie Charts

A.25 Coloured 3-D Graphics

Routine	Meaning
ax3len (nx, ny, nz)	defines axis lengths.
colran (nx, ny)	defines the range of colour bars.
crvtri (xray, yray, zray, n, i1ray, i2ray, i3ray, ntri)	plots the coloured surface of an Delaunay triangulation.
crvmat (zmat, n, m, ixp, iyp)	plots a coloured surface.
curve3 (xray, yray, zray, n)	plots coloured rectangles.
curvx3 (xray, y, zray, n)	plots rows of coloured rectangles.
curvy3 (x, yray, zray, n)	plots columns of coloured rectangles.
erase ()	erases the screen.
graf3 (xa, xe, xor, xstp, ya, ye, yor, ystp, za, ze, zor, zstp)	plots a coloured axis system.
nobar ()	suppresses the plotting of colour bars.
nobgd ()	suppresses the plotting of points which have the same colour as the background.
n = nzposn (z)	converts a Z-coordinate to a colour number.
point (nx, ny, nb, nh, nc)	plots coloured rectangles where the position is defined by the centre point.
recfll (nx, ny, nw, nh, nc)	plots coloured rectangles.
rlpoin (x, y, nw, nh, nc)	plots coloured rectangles for user coordinates.
rlsec (x, y, r1, r2, a, b, ncol)	plots coloured pie sectors for user coordinates.
sector (nx, ny, nr1, nr2, a, b, ncol)	plots coloured pie sectors.
setres (nx, ny)	defines the size of coloured rectangles.
vkxbar (nshift)	shifts colour bars in the X-direction.
vkybar (nshift)	shifts colour bars in the Y-direction.
widbar (nw)	defines the width of colour bars.
zaxis (za, ze, zor, zstp, nl, cstr, it, id, nx, ny)	plots a linearly scaled colour bar.
zaxlg (za, ze, zor, zstp, nl, cstr, it, id, nx, ny)	plots a logarithmically scaled colour bar.

Figure A.25: Coloured 3-D Graphics

A.26 3-D Graphics

Routine	Meaning
abs3pt (x, y, z, xp, yp)	converts absolute 3-D coordinates to plot coordinates.
axis3d (x, y, z)	defines the lengths of the 3-D box.
bars3d (xray, yray, z1ray, z2ray, xwray, ywray, icray, n)	plots 3-D bars.
box3d ()	plots a border around the 3-D box.
conn3d (x, y, z)	plots a line to a point in 3-D space.
curv3d (xray, yray, zray, n)	plots curves or symbols.
flab3d ()	disables the suppression of axis labels.
nclr = getlit (xp, yp, zp, xn, yn, zn)	calculates colour values.
getmat (xray, yray, zray, n, zmat, nx, ny, zv)	calculates a function matrix from randomly distributed data points.
graf3d (xa, xe, xor, xstp, ya, ye, yor, ystp, za, ze, zor, zstp)	plots an axis system.
grffin ()	terminates a projection into 3-D space.
grfini (x1, y1, z1, x2, y2, z2, x3, y3, z3)	initializes projections in 3-D space.
grid3d (nx, ny, copt)	plots a grid.
labl3d (copt)	modifies the appearance of labels on the 3-D box.
light (cmode)	turns lighting on or off.
litmod (id, cmode)	turns single light sources on or off.
litop3 (id, xr, xg, xb, ctype)	modifies light parameters.
litopt (id, xval, ctype)	modifies light parameters.
litpos (id, xp, yp, zp, copt)	sets the position of light sources.
matop3 (xr, xg, xb, ctype)	modifies material parameters.
matopt (xval, ctype)	modifies material parameters.
mdfmat (ix, iy, w)	modifies the algorithm used in GETMAT.
mshclr (iclr)	defines the colour of surface meshes.
nohide ()	disables the hidden-line algorithm.
pos3pt (x, y, z, xp, yp, zp)	converts user coordinates to absolute 3-D coordinates.
rel3pt (x, y, z, xp, yp)	converts user coordinates to plot coordinates.
shlsur ()	protects surfaces from overwriting.
sphe3d (xm, ym, zm, r, n, m)	plots a sphere.
strt3d (x, y, z)	moves the pen to a point.
surclr (itop, ibot)	selects surface colours.
surfce (xray, nx, yray, ny, zmat)	plots the surface of a function matrix.
surfcp (cfunc, a1, a2, astp, b1, b2, bstp)	plots the surface of a parametric function.
surfun (cfunc, ixp, xdel, iyp, ydel)	plots the surface grid of a function.
suriso (xray, nx, yray, ny, zray, nz, wmat, wlev)	plots isosurfaces.

Routine	Meaning
surmat (zmat, nx, ny, ixpts, iypts)	plots the surface of a function matrix.
surmsh (copt)	enables grid lines for surfcp and surshd.
suropt (copt)	suppresses surface lines for surfce.
surshd (xray, nx, yray, ny, zmat)	plots a coloured surface.
surtri (xray, yray, zray, n, i1ray, i2ray, i3ray, ntri)	plots the surface of an Delaunay triangulation.
survis (copt)	determines the visible part of surfaces.
vang3d (ang)	defines the field of view.
vectr3 (x1, y1, z1, x2, y2, z2, ivec)	plots vectors in 3-D space.
vfoc3d (x, y, z, copt)	defines the focus point.
view3d (x, y, z, copt)	defines the viewpoint.
vup3d (ang)	defines the camera orientation.
zbffin ()	terminates the Z-buffer.
iret = zbfini ()	allocates space for a Z-buffer.
zbflin (x1, y1, z1, x2, y2, z2)	plots lines.
zbftri (xray, yray, zray, iray)	plots triangles.
zscale (zmin, zmax)	defines a Z-scaling for coloured surfaces.

Figure A.26: 3-D Graphics

A.27 Geographical Projections

Routine	Meaning
curvmp (xray, yray, n)	plots curves or symbols.
grafmp (xa, xe, xor, xstp, ya, ye, yor, ystp)	plots a geographical axis system.
gridmp (nx, ny)	plots a grid.
mapbas (copt)	defines a base map.
mapfil (cfil, copt)	defines an external map file.
maplev (copt)	specifies land or lake plotting.
mapmod (copt)	modifies the connection of points used in CURVMP.
mappol (xpol, ypol)	defines the map pole used for azimuthal projections.
mapref (ylw, yup)	defines two latitudes used for conical projections.
pos2pt (x, y, xp, yp)	converts user coordinates to plot coordinates.
projct (copt)	selects a projection.
shdafr (inray, ipray, icray, n)	shades African countries.
shdeur (inray, ipray, icray, n)	shades European countries.
shdmap (copt)	shades continents.
shdusa (inray, ipray, icray, n)	shades USA states.
world ()	plots coastlines and lakes.

Figure A.27: Geographical Projections

Routine	Meaning
xaxmap (xa, xe, xor, xstp, cstr, nt, ny)	plots a secondary X-axis.
yaxmap (ya, ye, yor, ystp, cstr, nt, nx)	plots a secondary Y-axis.

Figure A.27: Geographical Projections

A.28 Contouring

Routine	Meaning
conclr (ncray, n)	defines colours for shaded contours.
concrv (xray, yray, n, z)	plots generated contours.
confll (xray, yray, zray, n, i1ray, i2ray, i3ray, ntri, zlvray, nlev)	plots filled contours of an Delaunay triangulation.
congap (xfac)	affects the spacing between contour lines and labels.
conlab (copt)	defines a character string used for contour labels.
conmat (zmat, nx, ny, z)	plots contours.
conmod (xfac, xquot)	affects the position of contour labels.
ncrv = conpts (xray, n, yray, m, zmat, zlev, xpts, ypts, maxpts, iray, maxcrv)	generates contours.
conshd (xray, nx, yray, ny, zmat, zlray, n)	plots shaded contours.
contri (xray, yray, zray, n, i1ray, i2ray, i3ray, ntri, zlev)	plots contours of an Delaunay triangulation.
contur (xray, nx, yray, ny, zmat, zlev)	plots contours.
labclr (nclr, ’CONT’)	defines the colour of contour labels.
labdis (ndis, ’CONT’)	defines the distance between labels.
labels (copt, ’CONT’)	defines contour labels.
shdmod (copt, ’CONT’)	sets the algorithm for shaded contours.
ncrv = tripts (xray, yray, zray, n, i1ray, i2ray, i3ray, ntri, zlev, xpts, ypts, maxpts, iray, maxcrv)	generates contours from triangulated data.

Figure A.28: Contouring

A.29 Image Routines

Routine	Meaning
imgbox (nx, ny, nw, nh)	defines a rectangle for PostScript/PDF output.
imgclp (nx, ny, nw, nh)	defines a clipping rectangle.
imgfin ()	terminates transfering of image data.

Routine	Meaning
imgini ()	initializes transfering of image data.
imgmod (cmod)	selects index or RGB mode.
imgsiz (nw, nh)	defines an image size for PostScript/PDF output.
n = rbfpng (cbuf, nmax)	stores an image as PNG file in a buffer. The memory for the buffer is allocated by rbfpng.
rbmp (cfil)	stores an image as a BMP file.
rgif (cfil)	stores an image as a GIF file.
rimage (cfil)	copies an image from memory to a file.
iclr = rpixel (ix, iy)	reads a pixel from memory.
rpixls (iray, ix, iy, nw, nh)	reads image data from memory.
rpng (cfil)	stores an image as a PNG file.
rppm (cfil)	stores an image as a PPM file.
rpxrow (iray, nx, ny, n)	reads a row of image data from memory.
rtiff (cfil)	stores an image as a TIFF file.
tiforg (nx, ny)	defines the position of TIFF files copied with WTIFF.
tifwin (nx, ny, nw, nh)	defines a clipping window for TIFF files.
wimage (cfil)	copies an image from file to memory.
wpixel (ix, iy, iclr)	writes a pixel to memory.
wpixls (iray, ix, iy, nw, nh)	writes image data to memory.
wpxrow (iray, nx, ny, n)	write a row of image data to memory.
wtiff (cfil)	copies a TIFF file created by DISLIN to memory.

Figure A.29: Image Routines

A.30 Window Routines

Routine	Meaning
clswin (id)	closes a window.
opnwin (id)	opens a window for graphics output.
selwin (id)	selects a window for graphics output.
winapp (capp)	defines a window or console application.
window (nx, ny, nw, nh)	defines the position and size of windows.
id = winid ()	returns the ID of the currently selected window.
winkey (ckey)	defines a key that can be used for program continuation in DISFIN.
winmod (copt)	affects the handling of windows in the termination routine DISFIN.
winsiz (nw, nh)	defines the size of windows.
wintit (cstr)	sets the title of the currently selected window.
x11mod (copt)	enables backing store.

Figure A.30: Window Routines

A.31 Widget Routines

Routine	Meaning
ival = dwgbut (cstr, ival)	displays a message that can be answered with 'Yes' or 'No'.
cfil = dwgfil (clab, cfil, cmask)	creates a file selection box.
isel = dwglis (clab, clis, isel)	gets a selection from a list of items.
dwgmsg (cstr)	displays a message.
cstr = dwgtxt (clab, cstr)	prompts an user for input.
n = gwgatt (id, copt)	requests widget attributes.
n = gwgbox (id)	requests the value of a box widget.
n = gwgbut (id)	requests the status of a button widget.
cfil = gwgfil (id)	requests the value of a file widget.
n = gwglis (id)	requests the value of a list widget.
x = gwgscl (id)	requests the value of a scale widget.
cstr = gwgtxt (id)	requests the value of a text widget.
n = gwgxid (id)	requests the windows ID of a widget.
itmcat (clis, citem)	concatenates an element to a list string.
n = itmcnt (clis)	calculates the number of elements in a list string.
citem = itmstr (clis, n)	extracts an element from a list string.
msgbox (cstr)	displays a message.
swgatt (id, catt, copt)	sets widget attributes.
swgbox (id, isel)	changes the selection of a box widget.
swgbut (id, ival)	changes the status of a button widget.
swgcbk (id, crout)	connects a callback routine with a widget.
swgclr (xr, xg, xb, copt)	sets widget colours.
swgdrw (xf)	defines the height of draw widgets.
swgfil (id, cfil)	changes the value of a file widget.
swgfnt (cfnt, npts)	defines widget fonts.
swgfoc (id)	sets the keyboard focus.
swghlp (cstr)	sets a character string for the Help menu.
swgjus (cjus, class)	defines the alignment of label widgets.
swglis (id, isel)	changes the selection of a list widget.
swgmix (char, cmix)	defines control characters.
swgmrg (ival, cmrg)	defines widget margins.
swgopt (copt, ckey)	sets a center option for parent widgets.
swgpop (copt)	modifies the appearance of the popup menubar.
swgpos (nx, ny)	defines the position of widgets.
swgscl (id, xval)	changes the value of a scale widget.
swgsiz (nw, nh)	defines the size of widgets.
swgspc (xspc, yspc)	modifies the spaces between widgets.
swgstp (xstp)	defines a step value for scale widgets.
swgtit (cstr)	sets a title for the main widget.

Routine	Meaning
swgtxt (id, cval)	changes the value of a text widget.
swgtyp (ctype, class)	modifies the appearance of widgets.
swgwin (nx, ny, nw, nh)	defines the position and size of widgets.
swgwth (nwth)	sets the default width of widgets.
id = wgapp (ip, clab)	creates an entry in a popup menu.
id = wgbas (ip, copt)	creates a container wdiget.
id = wgbox (ip, clis, isel)	creates a list widget where the list elements are displayed as toggle buttons.
id = wgbut (ip, cval, ival)	creates a button widget.
id = wgcmd (ip, clab, cmd)	creates a push button widget for a system command.
id = wgdlis (ip, clis, isel)	creates a dropping list widget.
id = wgdraw (ip)	creates a draw widget.
id = wgfil (ip, clab, cfil, cmask)	creates a file widget.
wgfin ()	terminates widget routines.
id = wgini (copt)	creates a main widget and initalizes widget routines.
id = wglab (ip, cstr)	creates a label widget.
id = wglis (ip, clis, isel)	creates a list widget.
id = wgltxt (ip, clab, cstr, nwth)	creates a labeled text widget.
id = wgok (ip)	creates a OK push button widget.
id = wgpbut (ip, clab)	creates a push button widget.
id = wgpop (ip, cstr)	creates a popup menu.
id = wgquit (ip)	creates a Quit push button widget.
id = wgscl (ip, clab, xmin, xmax, xval, ndez)	creates a scale widget.
id = wgstxt (ip, nsize, nmax)	creates a scrolled text widget.
id = wgtxt (ip, cstr)	creates a text widget.

Figure A.31: Widget Routines

A.32 DISLIN Quickplots

Routine	Meaning
qplbar (xray, n)	plots a bar graph.
qplclr (zmat, n, m)	plots a coloured surface.
qplcon (zmat, n, m, nlv)	makes a contour plot.
qplot (xray, yray, n)	plots a curve.
qplpie (xray, yray, n)	plots a pie chart.
qplsca (xray, yray, n)	makes a scatter plot.
qplsur (zmat, n, m)	plots a surface.

Figure A.32: DISLIN Quickplots

A.33 MPS Logo

Routine	Meaning
mpslogo (nx, ny, nsize, copt)	plots the MPS logo.

Figure A.33: MPS Logo

Appendix B

Examples

This appendix presents some examples of the DISLIN manual in Perl coding. They can be found in the DISLIN subdirectory perl.

B.1 Demonstration of CURVE

```
#!/usr/bin/perl
use Dislin;

$n = 101;
$pi = 3.1415926;
$f = $pi / 180.;
$step = 360. / ($n - 1);
for ($i = 0; $i < $n; $i++) {
    $xray[$i] = $i * $step;
    $x = $xray[$i] * $f;
    $y1ray[$i] = sin ($x);
    $y2ray[$i] = cos ($x);
}

Dislin::metafl ('xwin');
Dislin::disini ();
Dislin::complx ();
Dislin::pagera ();

Dislin::axspos (450, 1800);
Dislin::axslen (2200, 1200);

Dislin::name   ('X-axis', 'X');
Dislin::name   ('Y-axis', 'Y');

Dislin::labdig (-1, 'X');
Dislin::ticks  (10, 'XY');

Dislin::titlin ('Demonstration of CURVE', 1);
Dislin::titlin ('SIN (X), COS (X)', 3);

Dislin::graf   (0., 360., 0., 90., -1., 1., -1., 0.5);
Dislin::title  ();

Dislin::color  ('red');
Dislin::curve  (\@xray, \@y1ray, $n);
Dislin::color  ('green');
Dislin::curve  (\@xray, \@y2ray, $n);

Dislin::color  ('foreground');
Dislin::dash   ();
Dislin::xaxgit ();
Dislin::disfin ();
```

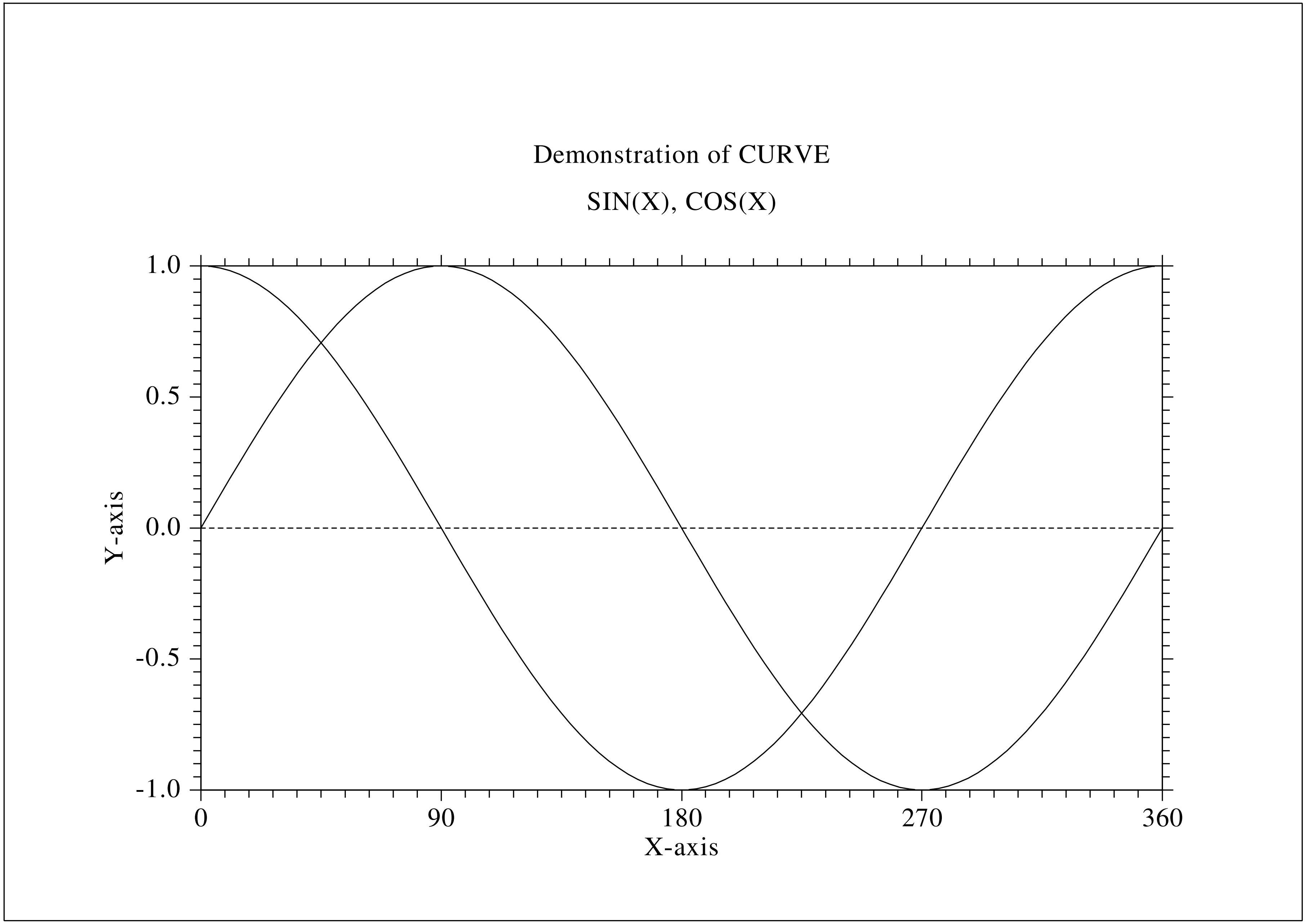

Figure B.1: Demonstration of CURVE

B.2 Polar Plots

```
#!/usr/bin/perl
use Dislin;

$n = 300;
$m = 10;
$pi = 3.1415926;
$f = $pi / 180.;
$step = 360. / ($n - 1);
for ($i = 0; $i < $n; $i++) {
    $a = ($i * $step) * $f;
    $xray[$i] = $i * $step;
    $x = $xray[$i] * $f;
    $y1[$i] = $a;
    $x1[$i] = sin (5 * $a);
}

for ($i = 0; $i < $m; $i++) {
    $x2[$i] = $i + 1;
    $y2[$i] = $i + 1;
}

Dislin::setpag ('da4p');
Dislin::metafl ('cons');
Dislin::disini ();
Dislin::hwfont ();
Dislin::pagera ();

Dislin:titlin ('Polar Plots', 2);
Dislin:ticks  (3, 'Y');
Dislin:axends ('NOENDS', 'X');
Dislin:labdig (-1, 'Y');
Dislin:axslen (1000, 1000);
Dislin:axsorg (1050, 900);

Dislin:polar  (1.,0., 0.2, 0., 30.);
Dislin:curve  (\@x1, \@y1, $n);
Dislin:htitle (50);
Dislin:title  ();
Dislin:endgrf ();

Dislin:labdig (-1, 'X');
Dislin:axsorg (1050, 2250);
Dislin:labtyp ('VERT', 'Y');
Dislin:polar  (10.,0.,2.,0.,30.);
Dislin:barwth (-5.);
Dislin:polcrv ('FBARS');
Dislin:curve  (\@x2, \@y2, $m);

Dislin::disfin ();
```

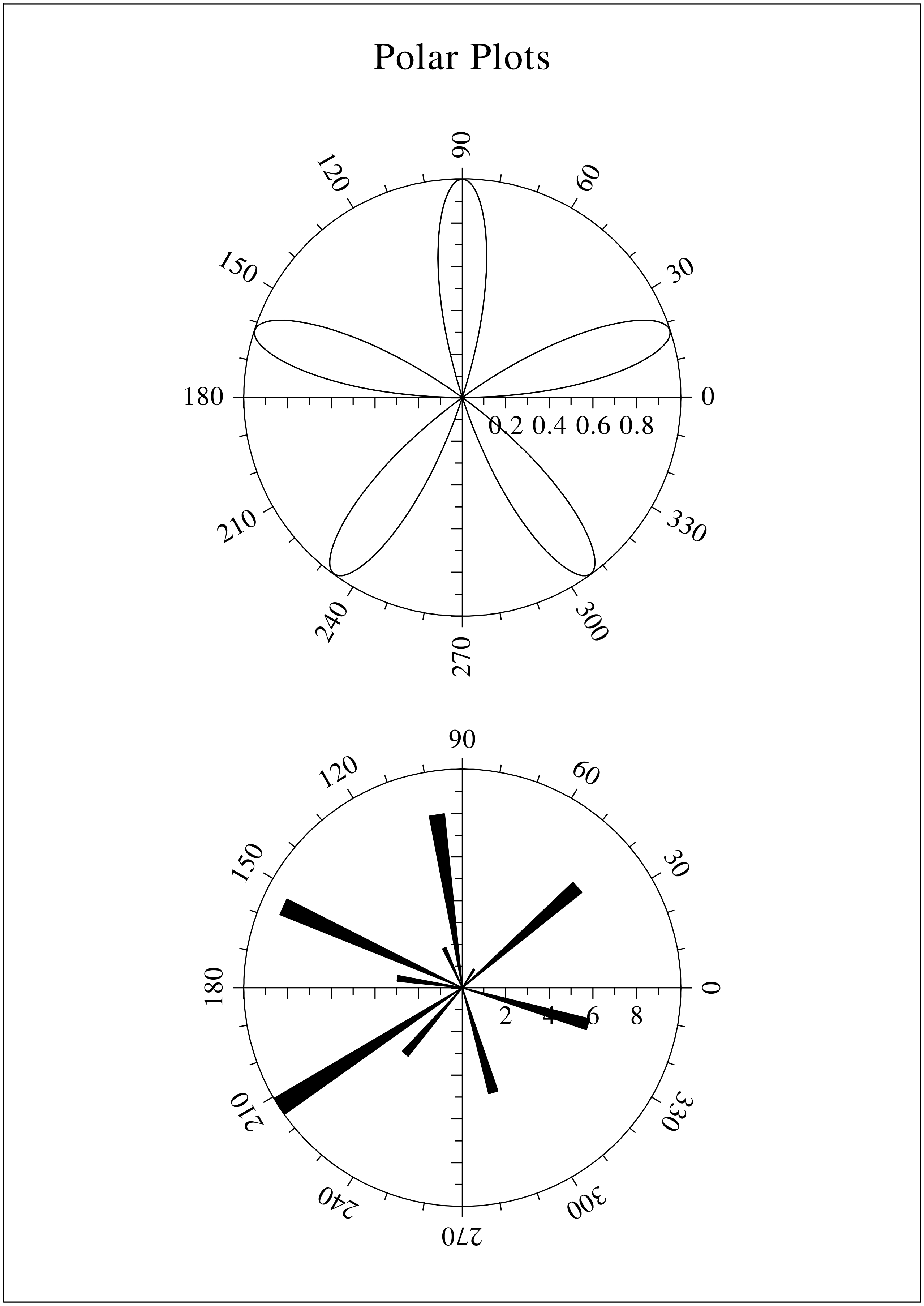

Figure B.2: Polar Plots

B.3 Symbols

```
#!/usr/bin/perl
use Dislin;

$ctit = 'Symbols';

Dislin::setpag ('da4p');
Dislin::metafl ('cons');

Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();
Dislin::paghdr ('H. Michels  (', ')', 2, 0);

Dislin::height (60);
$nl = Dislin::nlmess ($ctit);
Dislin::messag ($ctit, (2100 - $nl)/2, 200);

Dislin::height (50);
Dislin::hsymbl (120);

$ny = 150;
for ($i = 0; $i < 24; $i++) {
    if (($i % 4) == 0) {
       $ny = $ny + 400;
       $nxp = 550;
    }
    else {
       $nxp = $nxp + 350;
    }
    $nl = Dislin::nlnumb ($i, -1);
    Dislin::number ($i, -1, $nxp - $nl/2, $ny + 150);
    Dislin::symbol ($i, $nxp, $ny);
}
Dislin::disfin ();
```

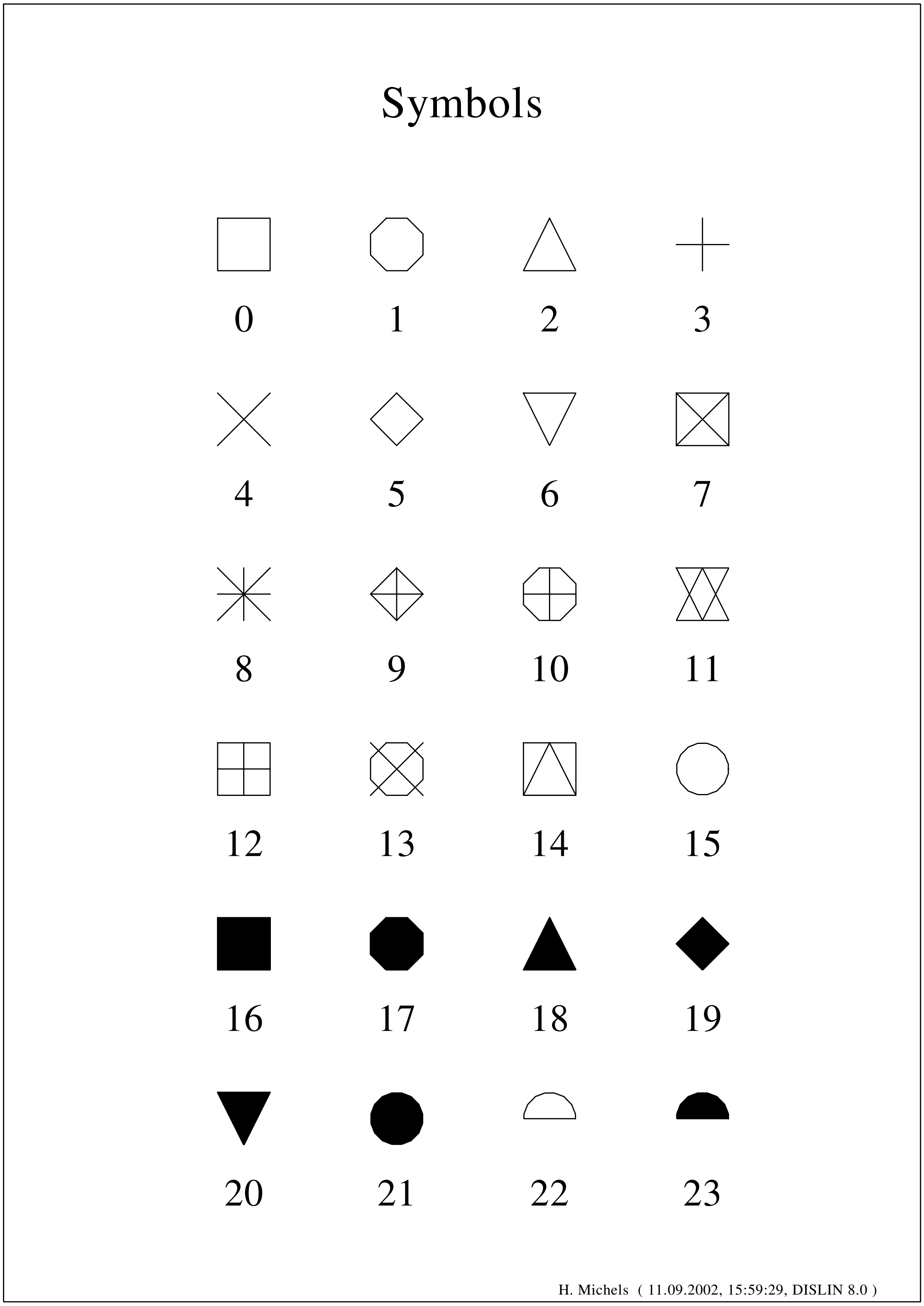

Figure B.3: Symbols

B.4 Logarithmic Scaling

```
#!/usr/bin/perl
use Dislin;

$ctit = 'Logarithmic Scaling';
@clab = ('LOG', 'FLOAT', 'ELOG');

Dislin::setpag ('da4p');
Dislin::metafl ('cons');

Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();
Dislin::axslen (1400, 500);

Dislin::name   ('X-axis', 'X');
Dislin::name   ('Y-axis', 'Y');
Dislin::axsscl ('LOG', 'XY');

Dislin::titlin ($ctit, 2);

for ($i = 0; $i < 3; $i++) {
    $nya = 2650 - $i * 800;
    Dislin::labdig (-1, 'XY');
    if (i == 1) {
       Dislin::labdig (1, 'Y');
       Dislin::name   (' ', 'X');
    }

    Dislin::axspos (500, $nya);
    $cstr = 'Labels: ' . $clab[$i];
    Dislin::messag ($cstr, 600, $nya - 400);
    Dislin::labels ($clab[$i], 'XY');
    Dislin::graf   (0., 3., 0., 1., -1., 2., -1., 1.);
    if ($i == 2) {
       Dislin::height (50);
       Dislin::title ();
    }
    Dislin::endgrf ();
}
Dislin::disfin ();
```

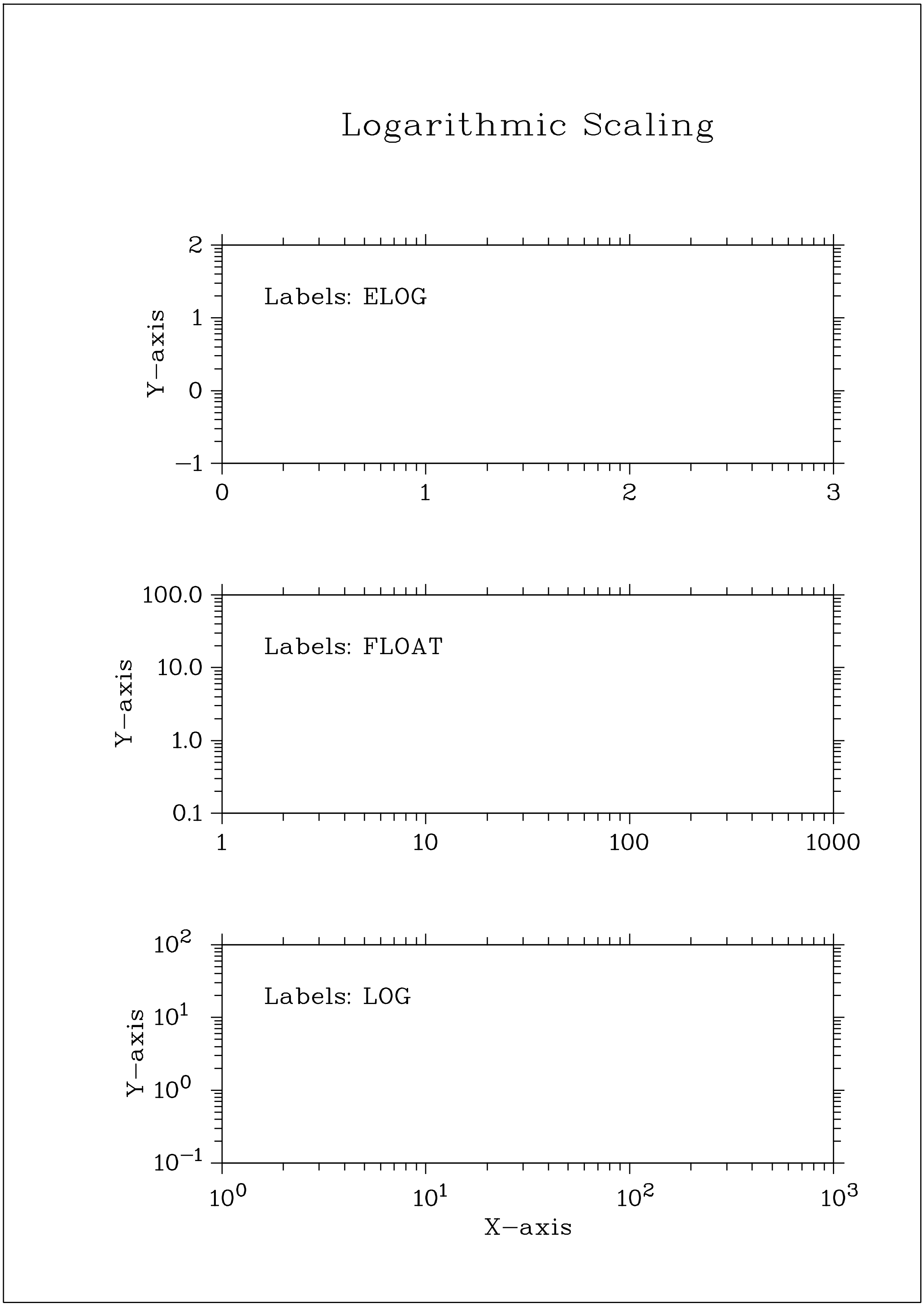

Figure B.4: Logarithmic Scaling

B.5 Interpolation Methods

```
#!/usr/bin/perl
use Dislin;

$ctit = 'Interpolation Methods';

@xray = (0., 1., 3., 4.5, 6., 8., 9., 11., 12., 12.5,
         13., 15., 16., 17., 19., 20.);
@yray = (2., 4., 4.5, 3., 1., 7., 2., 3., 5., 2., 2.5,
         2., 4., 6., 5.5, 4.);
@cpol = ('SPLINE', 'STEM', 'BARS', 'STAIRS', 'STEP', 'LINEAR');

Dislin::setpag ('da4p');
Dislin::metafl ('xwin');

Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();

Dislin::incmrk (1);
Dislin::hsymbl (25);
Dislin::titlin ($ctit, 1);
Dislin::axslen (1500, 350);
Dislin::setgrf ('LINE', 'LINE', 'LINE', 'LINE');

$nya = 2700;
for ($i = 0; $i < 6; $i++) {
    Dislin::axspos (350, $nya - $i * 350);
    Dislin::polcrv ($cpol[$i]);
    Dislin::marker (0);
    Dislin::graf   (0., 20., 0., 5., 0., 10., 0., 5.);
    $nx = Dislin::nxposn (1.);
    $ny = Dislin::nyposn (8.);
    Dislin::messag ($cpol[$i], $nx, $ny);
    Dislin::curve  (\@xray, \@yray, 16);

    if ($i == 5) {
       Dislin::height (50);
       Dislin::title ();
    }
    Dislin::endgrf ();
}
Dislin::disfin ();
```

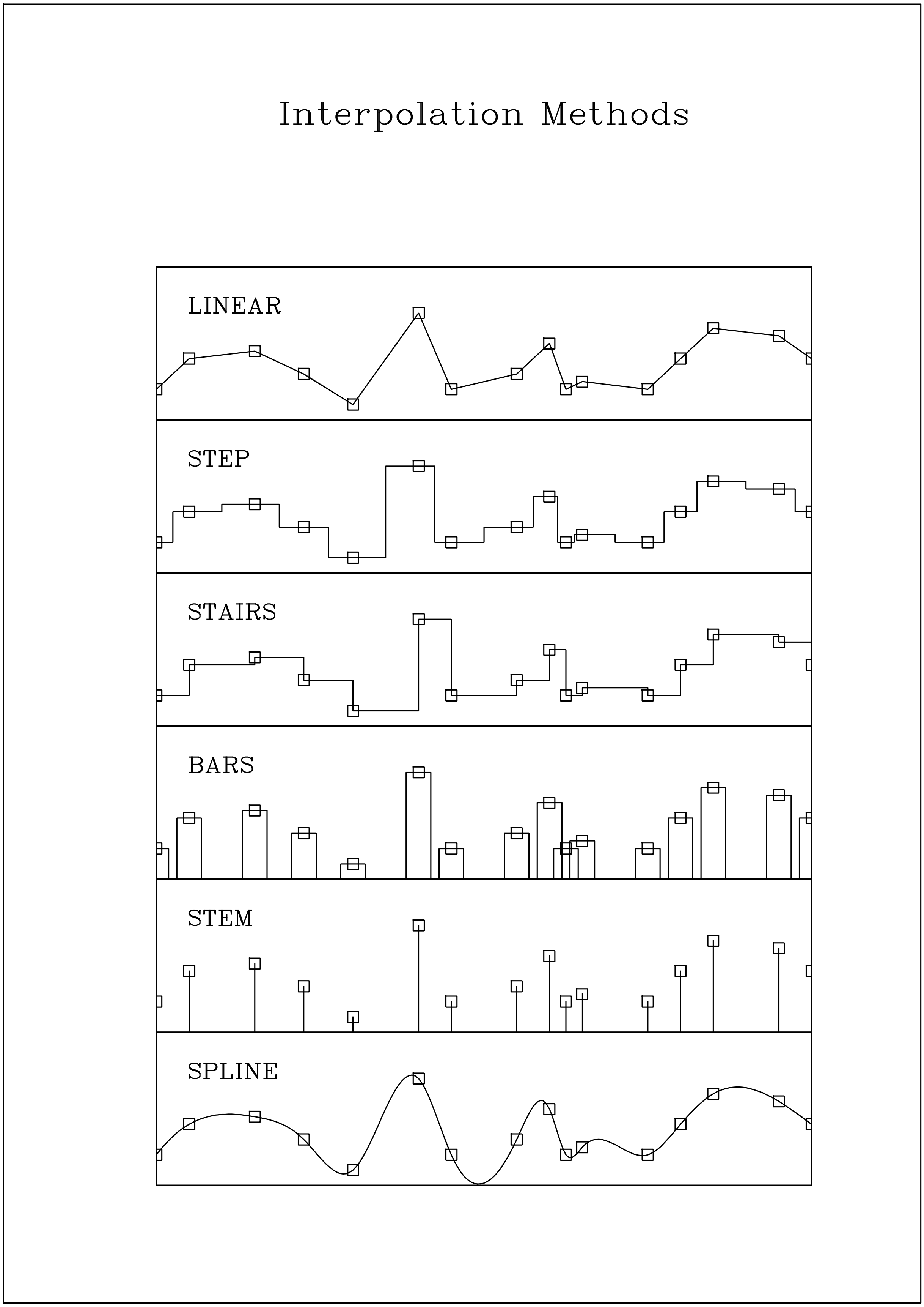

Figure B.5: Interpolation Methods

B.6 Line Styles

```
#!/usr/bin/perl
use Dislin;

$ctit1 = 'Demonstration of CURVE';
$ctit2 = 'Line Styles';

@ctyp = ('SOLID', 'DOT', 'DASH', 'CHNDSH',
         'CHNDOT', 'DASHM', 'DOTL', 'DASHL');
@x = (3., 9.);
@y = (0., 0.);

Dislin::metafl ('cons');
Dislin::setpag ('da4p');

Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();
Dislin::center ();

Dislin::chncrv ('BOTH');
Dislin::name   ('X-axis', 'X');
Dislin::name   ('Y-axis', 'Y');

Dislin::titlin ($ctit1, 1);
Dislin::titlin ($ctit2, 3);

Dislin::graf   (0., 10., 0., 2., 0., 10., 0., 2.);
Dislin::title  ();

for ($i = 0; $i < 8; $i++) {
    $y[0] = 8.5 - $i;
    $y[1] = 8.5 - $i;
    $nx = Dislin::nxposn (1.0);
    $ny = Dislin::nyposn ($y[0]);
    Dislin::messag ($ctyp[$i], $nx, $ny - 20);
    Dislin::curve  (\@x, \@y, 2);
}
Dislin::disfin ();
```

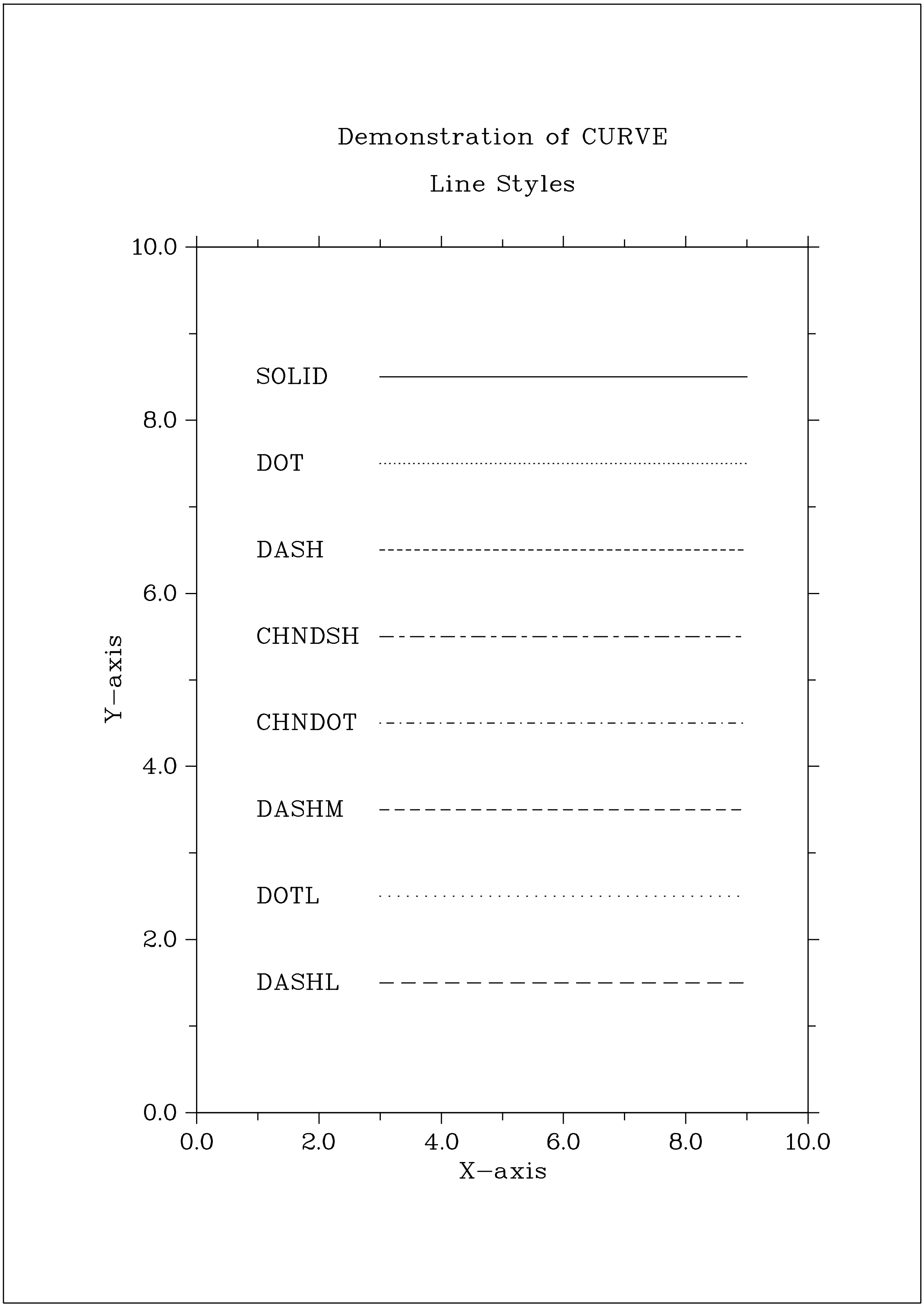

Figure B.6: Line Styles

B.7 Legends

```
#!/usr/bin/perl
use Dislin;

$n = 101;
$pi = 3.1415926;
$f = $pi / 180.;
$step = 360. / ($n - 1);
for ($i = 0; $i < $n; $i++) {
    $xray[$i] = $i * $step;
    $x = $xray[$i] * $f;
    $y1ray[$i] = sin ($x);
    $y2ray[$i] = cos ($x);
}

Dislin::metafl ('xwin');
Dislin::disini ();
Dislin::complx ();
Dislin::pagera ();

Dislin::axspos (450, 1800);
Dislin::axslen (2200, 1200);

Dislin::name   ('X-axis', 'X');
Dislin::name   ('Y-axis', 'Y');

Dislin::labdig (-1, 'X');
Dislin::ticks  (10, 'XY');

Dislin::titlin ('Demonstration of CURVE', 1);
Dislin::titlin ('Legend', 3);

Dislin::graf   (0., 360., 0., 90., -1., 1., -1., 0.5);
Dislin::title  ();

Dislin::chncrv ('LINE');
Dislin::curve  (\@xray, \@y1ray, $n);
Dislin::curve  (\@xray, \@y2ray, $n);

Dislin::legini ($cbuf, 2, 7);
$nx = Dislin::nxposn (190.);
$ny = Dislin::nyposn (0.75);
Dislin::leglin ($cbuf, 'sin (x)', 1);
Dislin::leglin ($cbuf, 'cos (x)', 2);
Dislin::legpos ($nx, $ny);
Dislin::legtit ('Legend');
Dislin::legend ($cbuf, 3);
Dislin::disfin ();
```

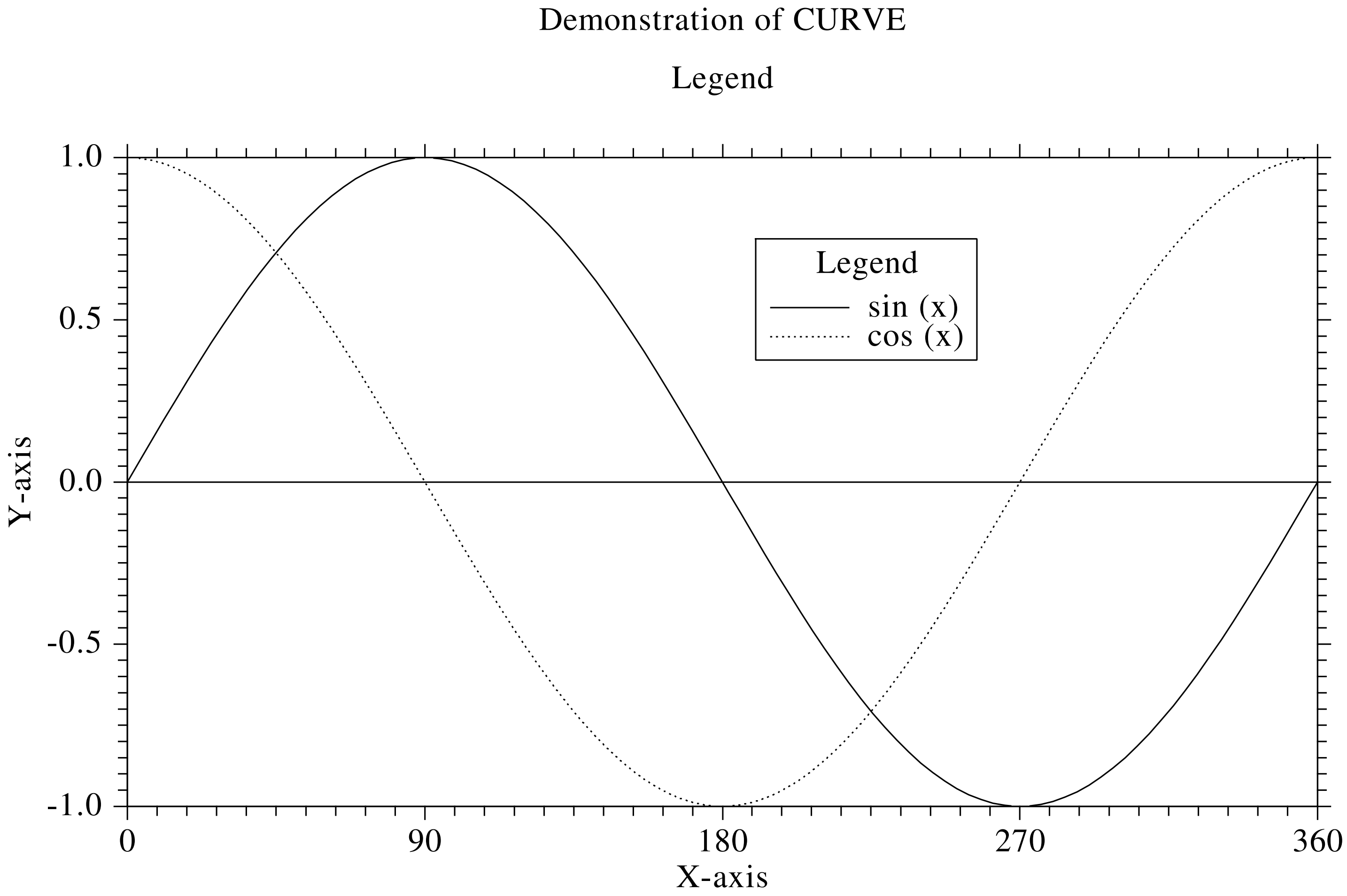

Figure B.7: Legends

B.8 Shading Patterns (AREAF)

```
#!/usr/bin/perl
use Dislin;

@ix  = (0, 300, 300,   0);
@iy  = (0,   0, 400, 400);
@ixp = (0, 0, 0, 0);
@iyp = (0, 0, 0, 0);

$ctit = 'Shading Patterns (AREAF)';

Dislin::metafl ('cons');
Dislin::disini ();
Dislin::setvlt ('small');
Dislin::pagera ();
Dislin::complx ();

Dislin::height (50);
$nl = Dislin::nlmess ($ctit);
Dislin::messag ($ctit, (2970 - $nl)/2, 200);

$nx0 = 335;
$ny0 = 350;

$iclr = 0;
for ($i = 0; $i < 3; $i++) {
    $ny = $ny0 + $i * 600;

    for ($j = 0; $j < 6; $j++) {
        $nx = $nx0 + $j * 400;
        $ii = $i * 6 + $j;
        Dislin::shdpat ($ii);
        $iclr = $iclr + 1;
        Dislin::setclr ($iclr);
        for ($k = 0; $k < 4; $k++) {
            $ixp[$k] = $ix[$k] + $nx;
            $iyp[$k] = $iy[$k] + $ny;
        }

        Dislin::areaf (\@ixp, \@iyp, 4);
        $nl = Dislin::nlnumb ($ii, -1);
        $nx = $nx + (300 - $nl) / 2;
        Dislin::color ('foreground');
        Dislin::number ($ii, -1, $nx, $ny + 460);
    }
}
Dislin::disfin ();
```

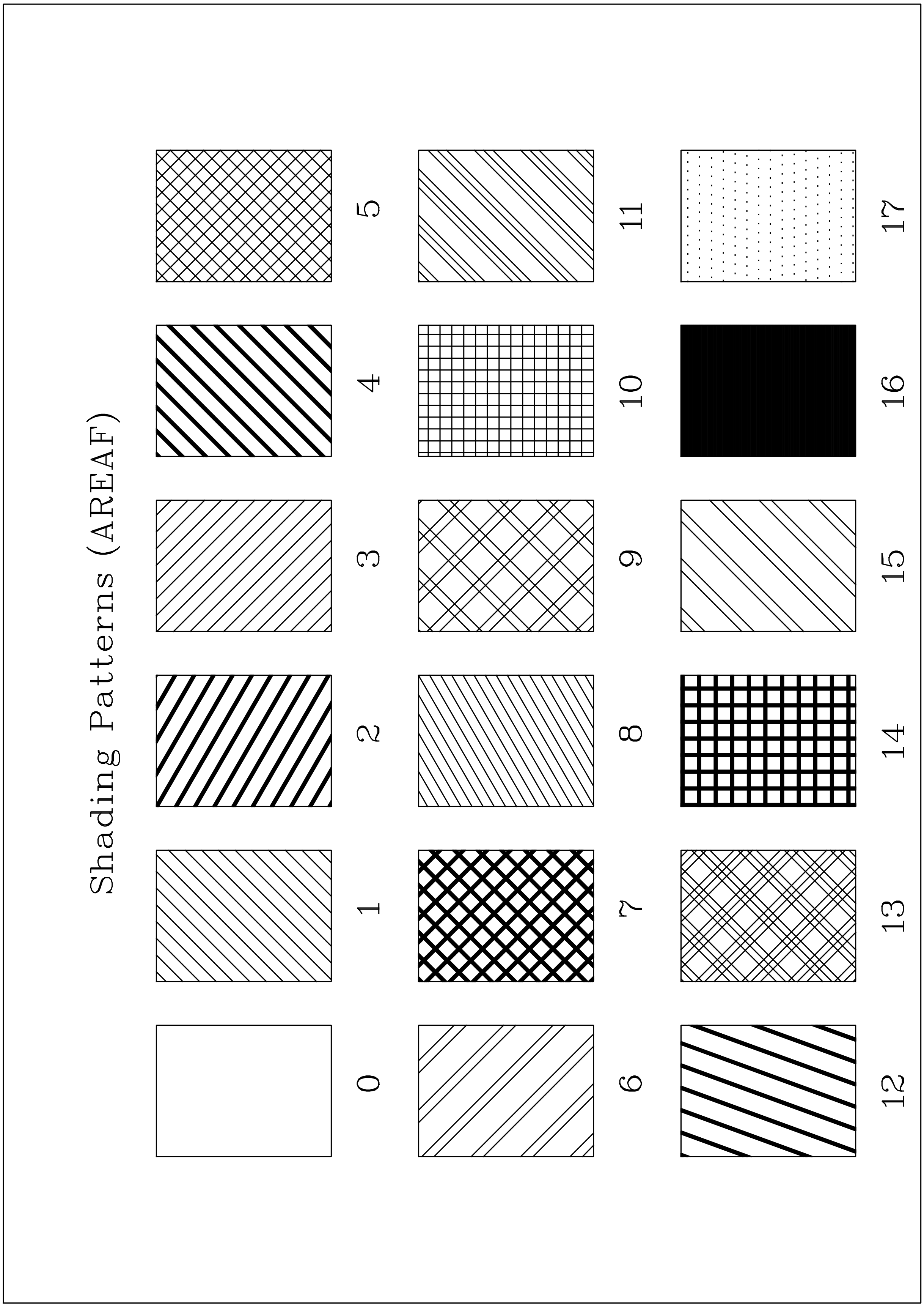

Figure B.8: Shading Patterns

B.9 Vectors

```
#!/usr/bin/perl
use Dislin;

@ivec  = (0, 1111, 1311, 1421, 1531, 1701, 1911,
          3111, 3311, 3421, 3531, 3703, 4221, 4302,
          4413, 4522, 4701, 5312, 5502, 5703);

$ctit = 'Vectors';

Dislin::metafl ('cons');
Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();

Dislin::height (60);
$nl = Dislin::nlmess ($ctit);
Dislin::messag ($ctit, (2970 - $nl)/2, 200);

Dislin::height (50);
$nx = 300;
$ny = 400;

for ($i = 0; $i < 20; $i++) {
  if ($i == 10) {
      $nx = $nx + 2970 / 2;
      $ny = 400;
  }
  $nl = Dislin::nlnumb ($ivec[$i], -1);
  Dislin::number ($ivec[$i], -1, $nx - $nl, $ny - 25);

  Dislin::vector ($nx + 100, $ny, $nx + 1000, $ny, $ivec[$i]);
  $ny = $ny + 160;
}
Dislin::disfin ();
```

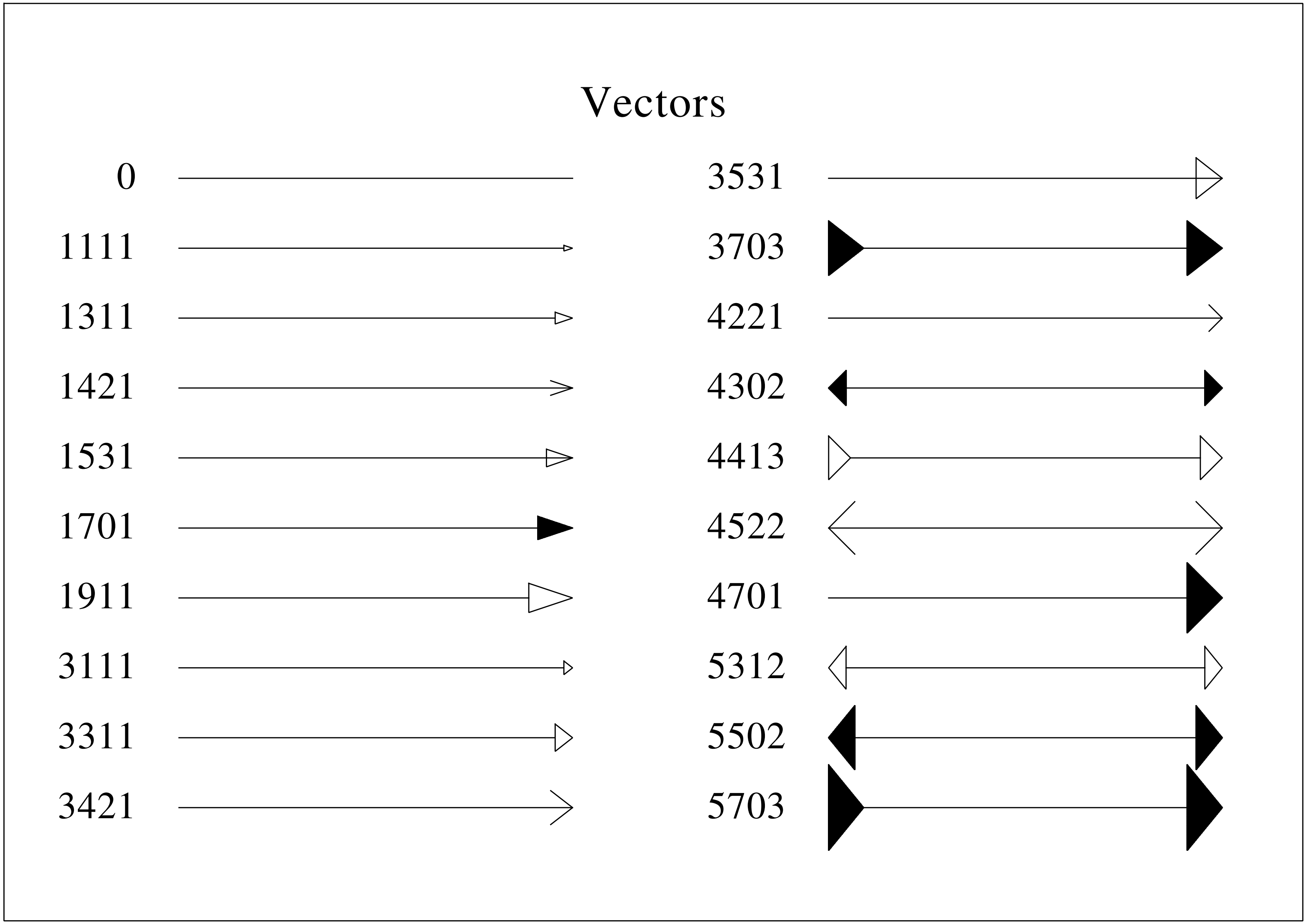

Figure B.9: Vectors

B.10 3-D Colour Plot

```
#!/usr/bin/perl
use Dislin;

$ctit1 = '3-D Colour Plot of the Function';
$ctit2 = 'F(X,Y) = 2 * SIN(X) * SIN (Y)';

$n = 50;
$m = 50;

$fpi  = 3.1415927 / 180.;
$stepx = 360. / ($n - 1);
$stepy = 360. / ($m - 1);

for ($i = 0; $i < $n; $i++) {
    $x[$i] = $i * $stepx;
    for ($j = 0; $j < $m; $j++) {
        $y[$j] = $j * $stepy;
        $zmat[$i][$j] = 2 * sin($x[$i] * $fpi)
                          * sin($y[$j] * $fpi);
    }
}

Dislin::metafl ('cons');
Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();

Dislin::titlin ($ctit1, 2);
Dislin::titlin ($ctit2, 4);

Dislin::name   ('X-axis', 'X');
Dislin::name   ('Y-axis', 'Y');
Dislin::name   ('Z-axis', 'Z');

Dislin::intax  ();
Dislin::autres ($n, $m);
Dislin::axspos (300, 1850);
Dislin::ax3len (2200, 1400, 1400);

Dislin::graf3  (0., 360., 0., 90., 0., 360., 0., 90.,
                -2., 2., -2., 1.);
Dislin::crvmat (\@zmat, $n, $m, 1, 1);
Dislin::height (50);
Dislin::title  ();
Dislin::disfin ();
```

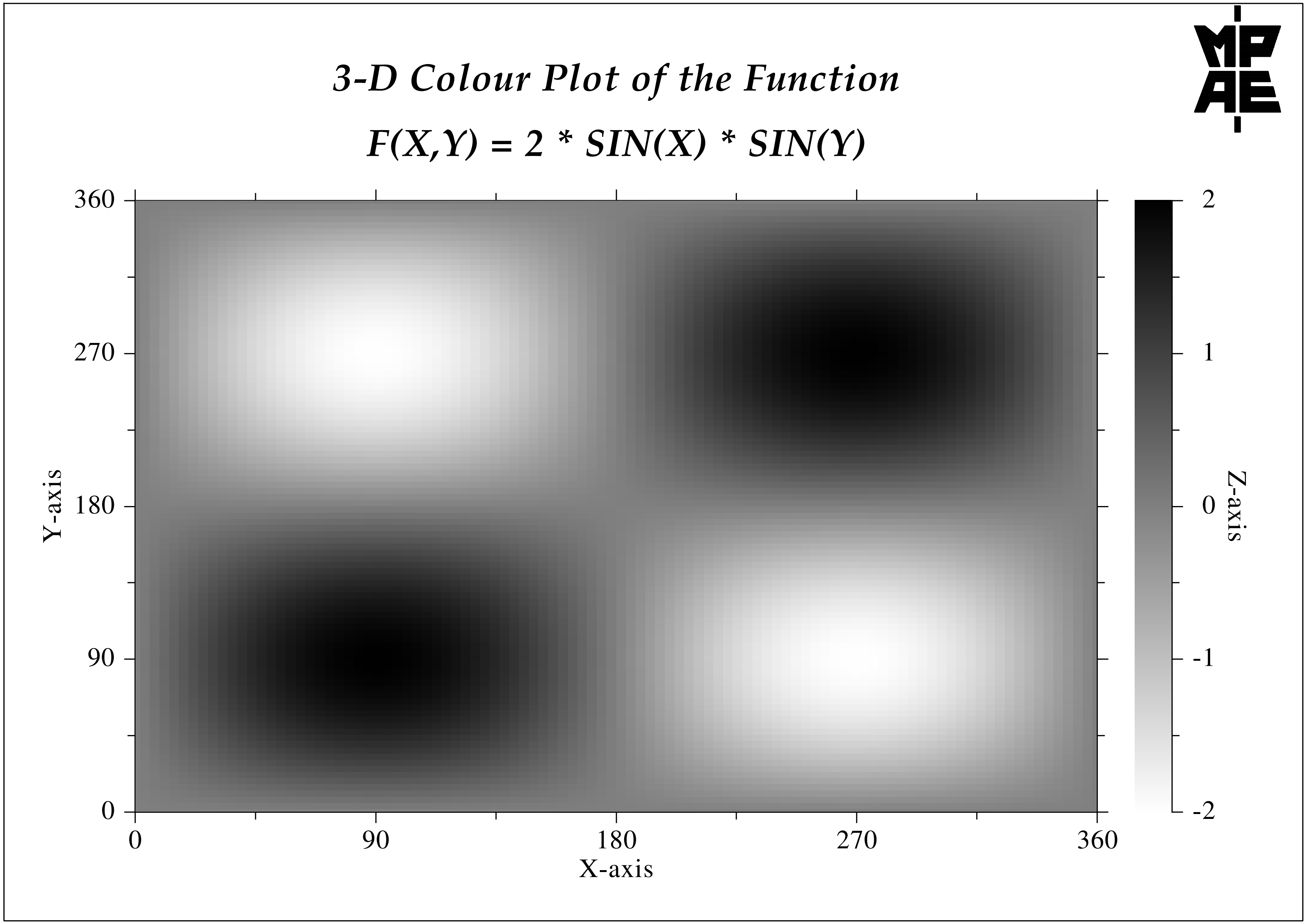

Figure B.10: 3-D Colour Plot

B.11 Surface Plot

```
#!/usr/bin/perl
use Dislin;

$ctit1 = 'Surface Plot (SURMAT)';
$ctit2 = 'F(X,Y) = 2 * SIN(X) * SIN (Y)';

$n = 50;
$m = 50;

$fpi  = 3.1415927 / 180.;
$stepx = 360. / ($n - 1);
$stepy = 360. / ($m - 1);

for ($i = 0; $i < $n; $i++) {
    $x[$i] = $i * $stepx;
    for ($j = 0; $j < $m; $j++) {
        $y[$j] = $j * $stepy;
        $zmat[$i][$j] = 2 * sin($x[$i] * $fpi)
                          * sin($y[$j] * $fpi);
    }
}

Dislin::metafl ('cons');
Dislin::setpag ('da4p');
Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();

Dislin::titlin ($ctit1, 2);
Dislin::titlin ($ctit2, 4);

Dislin::axspos (200, 2600);
Dislin::axslen (1800, 1800);

Dislin::name   ('X-axis', 'X');
Dislin::name   ('Y-axis', 'Y');
Dislin::name   ('Z-axis', 'Z');

Dislin::view3d (-5., -5., 4., 'ABS');
Dislin::graf3d  (0., 360., 0., 90., 0., 360., 0., 90.,
                 -3., 3., -3., 1.);
Dislin::height (50);
Dislin::title  ();

Dislin::color  ('green');
Dislin::surmat (\@zmat, $n, $m, 1, 1);
Dislin::disfin ();
```

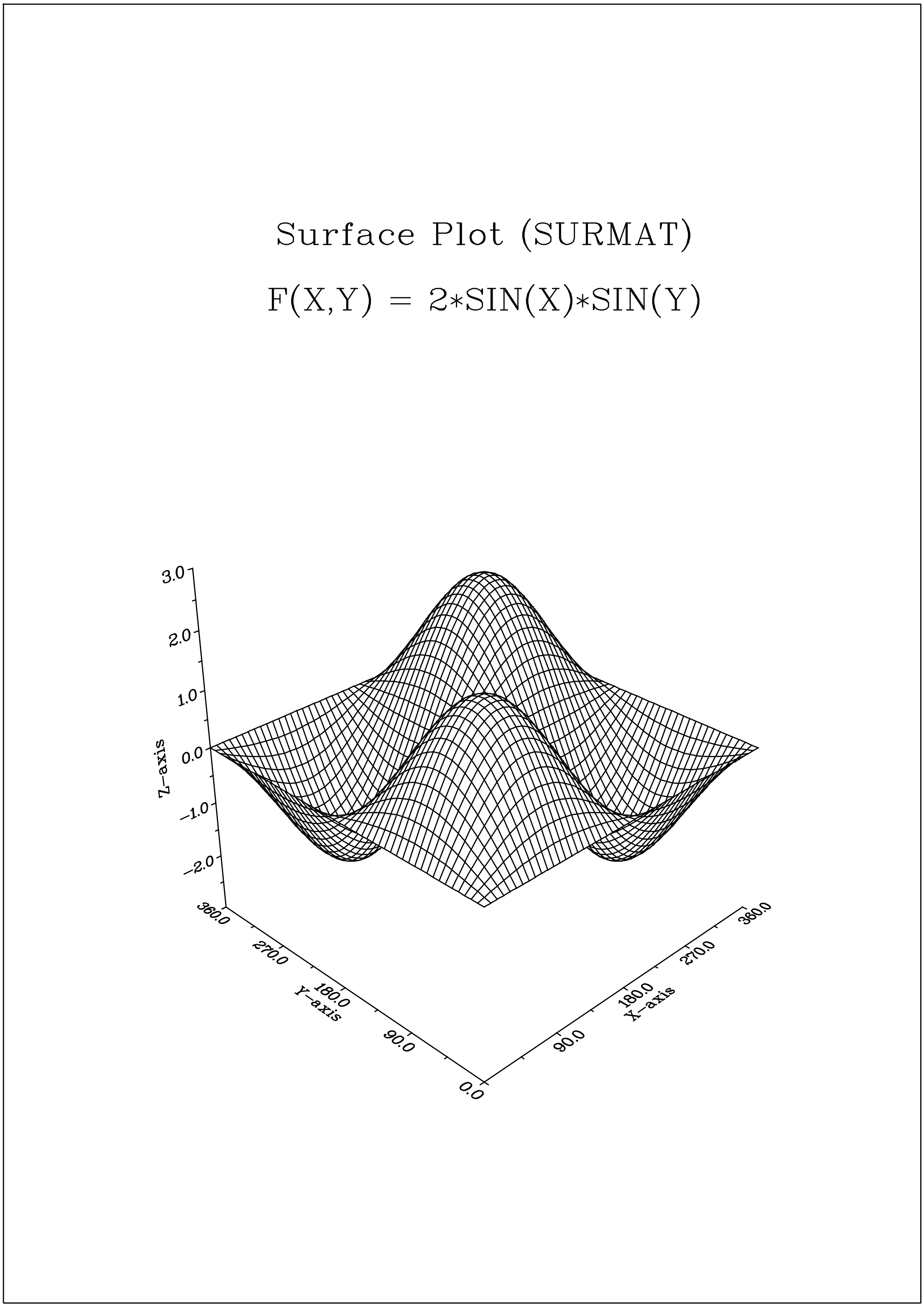

Figure B.11: Surface Plot

B.12 Contour Plot

```
#!/usr/bin/perl
use Dislin;
$ctit1 = 'Contour Plot';
$ctit2 = 'F(X,Y) = 2 * SIN(X) * SIN (Y)';

$n = 50;
$fpi  = 3.1415927 / 180.;
$step  = 360. / ($n - 1);

for ($i = 0; $i < $n; $i++) {
    $xray[$i] = $i * $step;
    for ($j = 0; $j < $n; $j++) {
        $yray[$j] = $j * $step;
        $zmat[$i][$j] = 2 * sin($xray[$i] * $fpi)
                          * sin($yray[$j] * $fpi);
    }
}

Dislin::metafl ('cons');
Dislin::setpag ('da4p');
Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();
Dislin::titlin ($ctit1, 2);
Dislin::titlin ($ctit2, 4);

Dislin::axspos (450, 2670);
Dislin::name   ('X-axis', 'X');
Dislin::name   ('Y-axis', 'Y');
Dislin::graf   (0., 360., 0., 90., 0., 360., 0., 90.);

Dislin::height (30);
for ($i = 0; $i < 9; $i++) {
    $zlev = -2. + $i * 0.5;
    Dislin::labels ('FLOAT', 'CONTUR');
    if ($i == 4) {
       Dislin::labels ('NONE', 'CONTUR');
    }
    Dislin::setclr (($i+1) * 28);
    Dislin::contur (\@xray, $n, \@yray, $n, \@zmat, $zlev);
}
Dislin::color  ('FORE');
Dislin::height (50);
Dislin::title  ();
Dislin::disfin ();
```

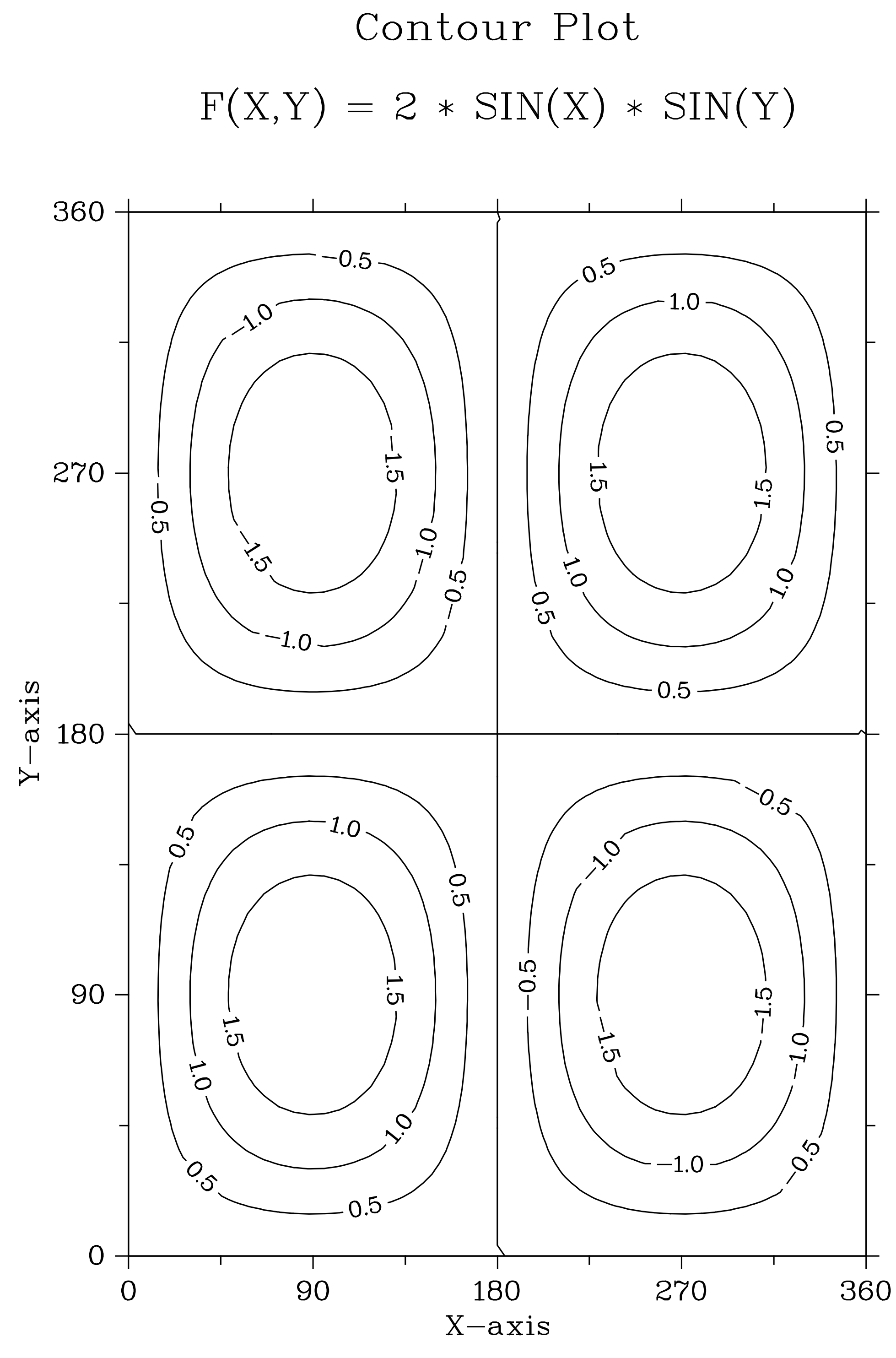

Figure B.12: Contour Plot

B.13 Shaded Contour Plot

```
#!/usr/bin/perl
use Dislin;

$ctit1 = 'Shaded Contour Plot';
$ctit2 = 'F(X,Y) = (X[2$ - 1)[2$ + (Y[2$ - 1)[2$';

$n = 50;
$step = 1.6 / ($n - 1);

for ($i = 0; $i < $n; $i++) {
    $xray[$i] = $i * $step;
    $x = $xray[$i] * $xray[$i] - 1.;
    $x2 = $x * $x;
    for ($j = 0; $j < $n; $j++) {
        $yray[$j] = $j * $step;
        $y = $yray[$j] * $yray[$j] - 1.;
        $y2 = $y * $y;
        $zmat[$i][$j] = $x2 + $y2;
    }
}

Dislin::metafl ('cons');
Dislin::setpag ('da4p');

Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();
Dislin::mixalf ();

Dislin::titlin ($ctit1, 1);
Dislin::titlin ($ctit2, 3);
Dislin::name   ('X-axis', 'X');
Dislin::name   ('Y-axis', 'Y');
Dislin::axspos (450, 2670);
Dislin::shdmod ('poly', 'contur');
Dislin::graf   (0., 1.6, 0., 0.2, 0., 1.6, 0., 0.2);

for ($i = 0; $i < 12; $i++) {
  $zlev[11-$i] = 0.1 + $i * 0.1;
}

Dislin::conshd (\@xray, $n, \@yray, $n, \@zmat, \@zlev, 12);
Dislin::height (50);
Dislin::title  ();
Dislin::disfin ();
```

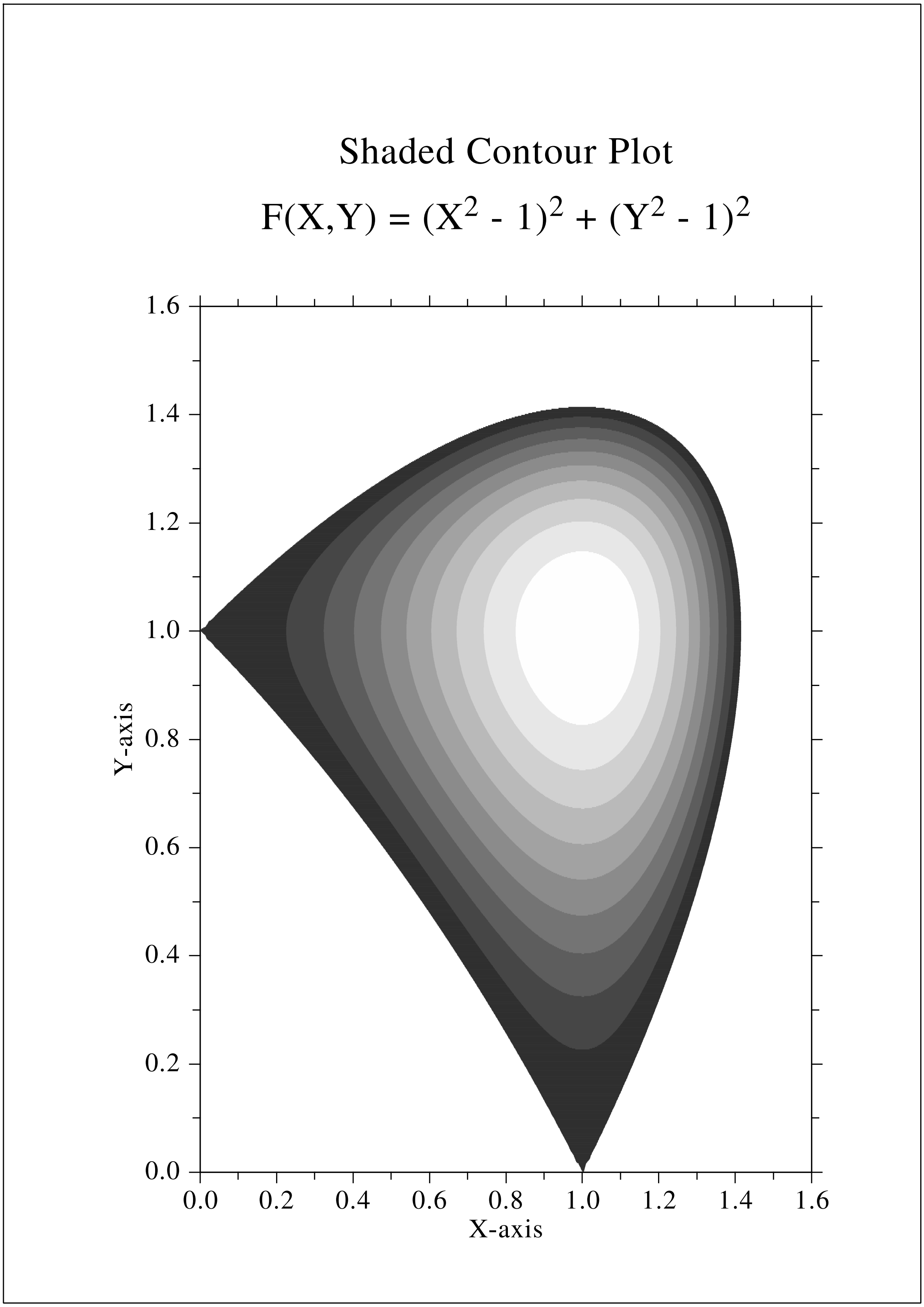

Figure B.13: Shaded Contour Plot

B.14 Pie Charts

```
#!/usr/bin/perl
use Dislin;

@xray = (1., 2.5, 2., 2.7, 1.8);

$ctit = 'Pie Charts (PIEGRF)';

Dislin::setpag ('da4p');
Dislin::metafl ('cons');
Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();
Dislin::chnpie ('BOTH');

Dislin::axslen (1600, 1000);
Dislin::titlin ($ctit, 2);

Dislin::legini ($cbuf, 5, 8);
Dislin::leglin ($cbuf, 'FIRST',  1);
Dislin::leglin ($cbuf, 'SECOND', 2);
Dislin::leglin ($cbuf, 'THIRD',  3);
Dislin::leglin ($cbuf, 'FOURTH', 4);
Dislin::leglin ($cbuf, 'FIFTH',  5);

# Selecting shading patterns
Dislin::patcyc (1, 7);
Dislin::patcyc (2, 4);
Dislin::patcyc (3, 13);
Dislin::patcyc (4, 3);
Dislin::patcyc (5, 5);

Dislin::axspos (250, 2800);
Dislin::piegrf ($cbuf, 1, \@xray, 5);
Dislin::endgrf ();

Dislin::axspos (250, 1600);
Dislin::labels ('DATA', 'PIE');
Dislin::labpos ('EXTERNAL', 'PIE');
Dislin::piegrf ($cbuf, 1, \@xray, 5);

Dislin::height (50);
Dislin::title  ();
Dislin::disfin ();
```

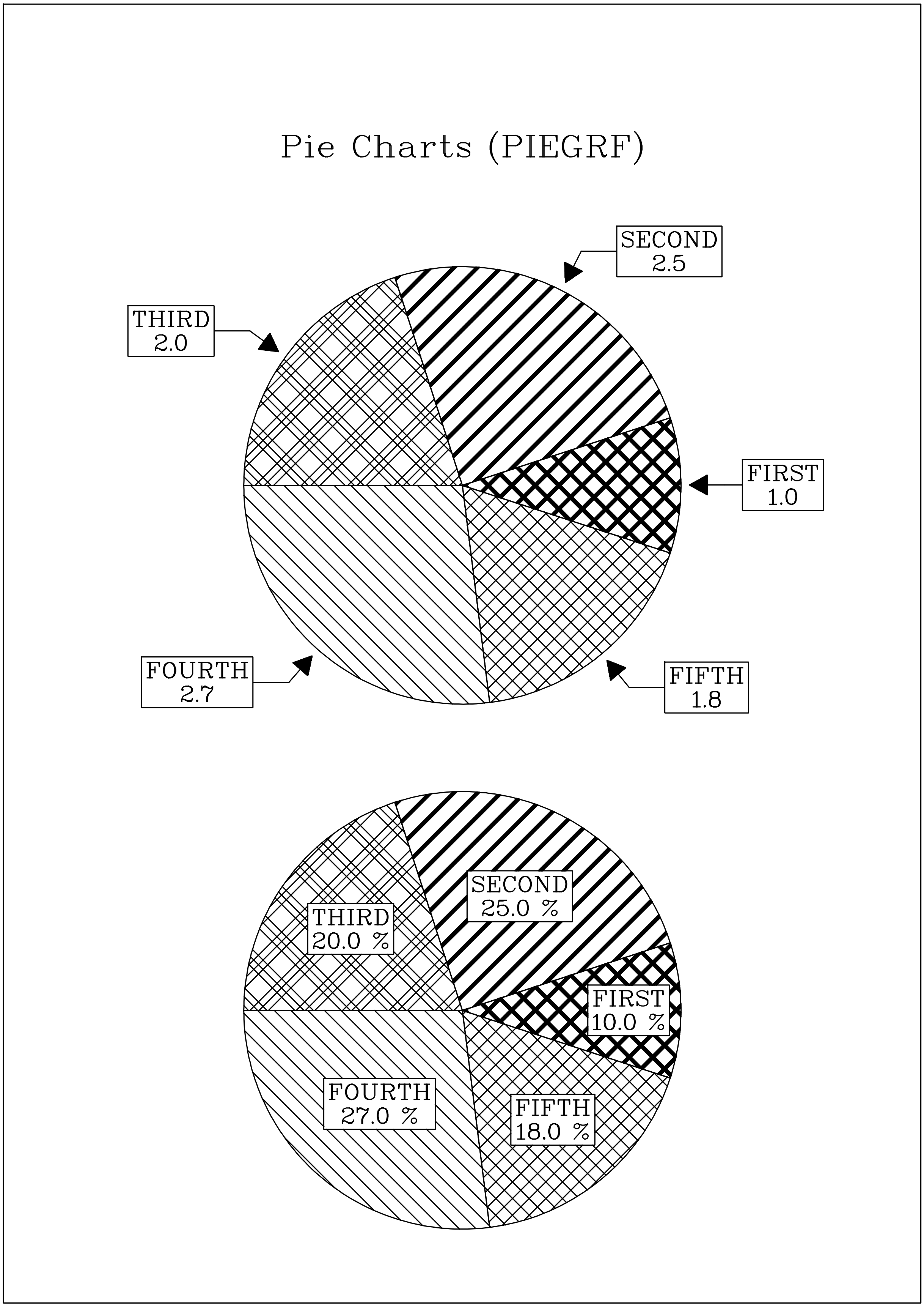

Figure B.14: Pie Charts

B.15 World Coastlines and Lakes

```
#!/usr/bin/perl
use Dislin;

Dislin::metafl ('xwin');
Dislin::disini ();
Dislin::pagera ();
Dislin::complx ();

Dislin::axspos (400, 1850);
Dislin::axslen (2400, 1400);

Dislin::name   ('Longitude', 'X');
Dislin::name   ('Latitude',  'Y');
Dislin::titlin ('World Coastlines and Lakes', 3);

Dislin::labels ('MAP', 'XY');
Dislin::labdig (-1, 'XY');
Dislin::grafmp (-180., 180., -180., 90., -90., 90., -90., 30.);

Dislin::gridmp (1, 1);
Dislin::color  ('green');
Dislin::world  ();

Dislin::color  ('foreground');
Dislin::height (50);
Dislin::title  ();
Dislin::disfin ();
```

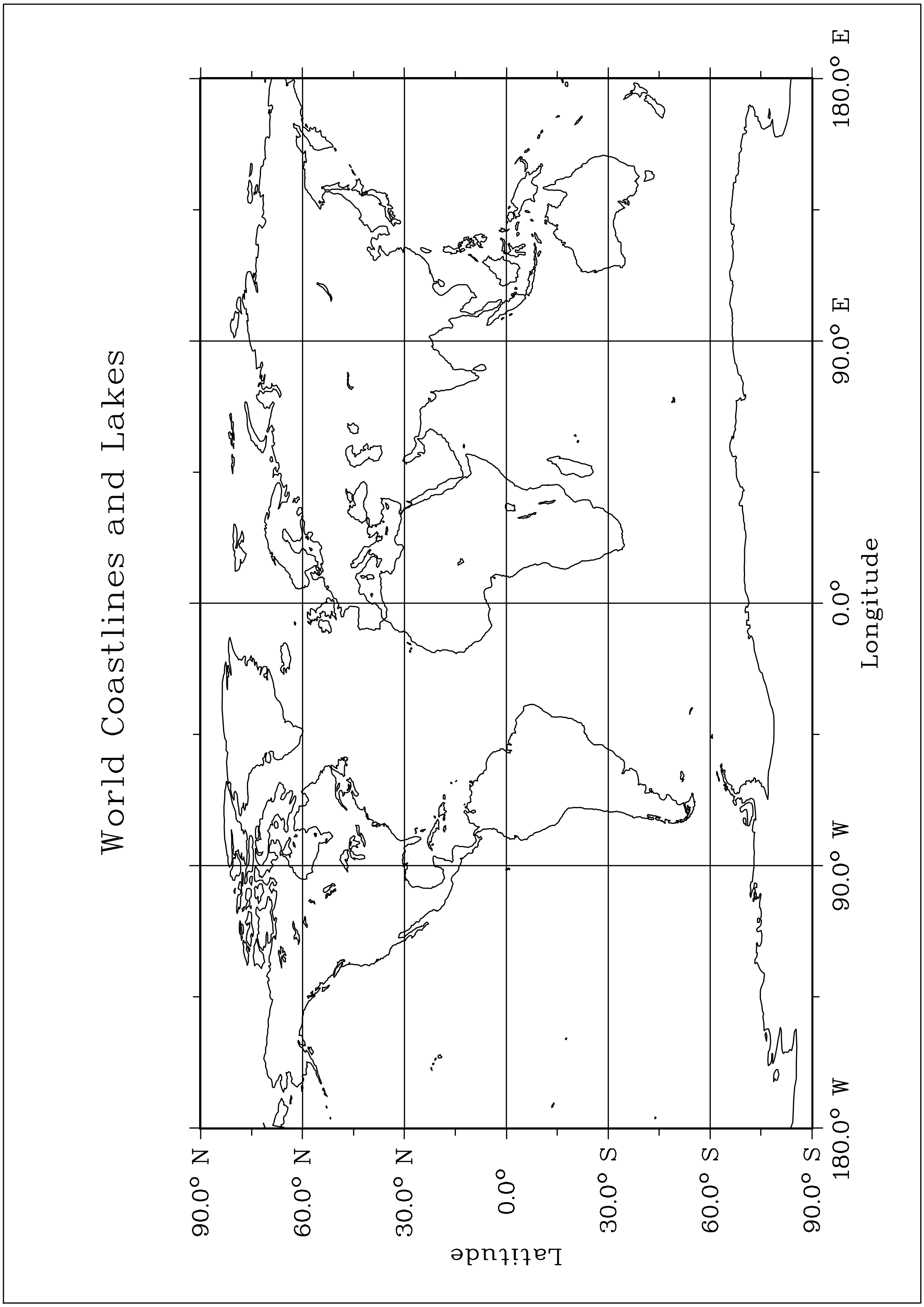

Figure B.15: World Coastlines and Lakes