D I S L I N 11.5

A Data Plotting Extension

for the

Programming Language

Tcl

by

Helmut Michels

Contents

Chapter 1

Overview

1.1 Introduction

This manual describes a data plotting extension for the interpreted, programming language Tcl. The plotting extension is based on the data plotting library Dislin that is available for several C, Fortran 77 and Fortran 90/95 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 700 plotting and parameter setting routines which are now available from Tcl.

1.2 Dislin Features

The following features are supported by Dislin:

- Several output formats can be selected such as X11, PostScript, PDF, CGM, WMF, PNG, BMP, PPM, GIF, TIFF 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 Windows 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.

1.3 Passing Parameters from Tcl to Dislin Routines

The passing of parameters from Tcl to Dislin routines is not so strict as in other programming languages. The following rules are applied:

- Parameters can be passed from Tcl to Dislin routines as variables, constants and expressions.
- A string constant must be enclosed in a pair of quotation marks if the string contains blanks. Otherwise, the quotations marks can be omitted.
- Floating point parameters can be passed from Tcl to Dislin as integer and floating point numbers.
- Integer parameters must be passed as integer values.
- Tcl lists are used for Dislin arrays. Multi-dimensional arrays should be passed as one-dimensional lists with row major ordering.

Note: Normally, the number and meaning of parameters in Dislin routines are identical with the syntax description of the routines in the Dislin manual except for those routines which modify parameters in the parameter list. Mofified parameters are implemented in Tcl as returned function values. If multiple parameters or an array must be returned by a Dislin routine, the corresponding Tcl function returns a list. Multiple arrays are also returned as a list, where each list element is a list containing an array.

1.4 FTP Site, Dislin Home Page

The Dislin software is available via ftp anonymous from the site:

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

The Dislin home page is:

https://www.dislin.de

The Tcl main site is:

https://www.tcl.tk

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:

Helmut Michels
Dislin Software
Am Hachweg 10
37083 Göttingen, Germany
Email: michels@dislin.de

Appendix A

Short Description of Dislin Routines

This appendix presents a short description of all Dislin routines that can be called from Tcl. 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 floating point numbers;
- one-dimensional arrays end with the keyword 'ray', two-dimensional arrays with the keyword 'mat'.

A.1 Initialization and Introductory Routines

Routine	Meaning
bmpmod n cval copt	defines the physical resolution of BMP files.
bufmod cmod ckey	modifies the behaviour of the output buffer.
cgmbgd xr xg xb	defines the background colour for CGM files.
cgmpic cstr	sets the picture ID for CGM files.
disenv cenv	defines the Dislin environment.
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.
filmod cmode	defines the file creation mode.
filopt copt ckey	modifies rules for creating file versions.
[nw nh iret] = filsiz cfil	returns the size on an image file.
iret = filtyp ctype	returns the type of a file.
filwin nx ny nw nh	defines a rectangle of the image that will be included by INCFIL.
gifmod cmod ckey	enables transparency for GIF files.
hpgmod cmod ckey	defines options for HPGL files.
hworig nx ny	defines the origin of the PostScript hardware page.
hwpage nw nw	defines the size of the PostScript hardware page.
hwscal xscl	modifies the scale operator in PostScript files.
imgfmt copt	defines the format of image files.
incfil cfil	includes metafiles into a graphics.

Routine	Meaning
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.
pagorg copt	defines the origin of the page.
cbuf = pdfbuf	copies a PDF file to a string.
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.
sendbf	flushes the output buffer.
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
delglb	frees space allocated for global parameters.
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.
n = nlmess cstr	returns the length of character 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.
setbas xfac	determines the position of indices and exponents.
setexp xfac	sets the height of indices and exponents.
setmix char cmix	defines global control signs for plotting indices and exponents.
texmod cmode	enables TeX mode for plotting mathematical formulas.
texopt copt ctype	defines TeX options.
texval x copt	defines TeX values.
txtbgd nclr	defines a background colour for text and numbers.
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.
[xr xg xb]= hsvrgb xh xs xv	converts HSV to RGB coordinates.
n = indrgb xr xg xb	calculates a colour index.
n = intrgb xr xg xb	calculates an explicit colour value.
myvlt rray gray bray n	changes the current colour table.
[xh xs xv] = rgbhsv xr xg xb	converts RGB to HSV coordinates.
setclr nclr	defines colours.

Routine	Meaning
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	store or loads a colour table.

Figure A.4: Colours

A.5 Fonts

Routine	Meaning
basalf calph	defines the base alphabet.
bmpfnt cfont	defines a bitmap font.
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.
helvet	sets a shaded font with thick 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.
ttfont cfont	loads a TrueType font.
winfnt cfont	sets a TrueType font.
x11fnt cfont copt	sets an X11 font.

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 left Y-axis.
ax3len nxl nyl nzl	defines axis lengths for a coloured 3-D axis system.
axsbgd iclr	defines the background colour.
axsers	erases the contents of an axis system.
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 marked with ticks.
endgrf	terminates an axis system.
frame nfrm	defines the frame thickness of axis systems.
frmclr nclr	defines the colour of frames.
[a b or stp ndig] = gaxpar v1 v2 copt cax	calculates axis parameters.
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.
grafp xe xor xstp yor ystp	plots a polar axis system.
grafr xray n yray m	plots an axis system for a Smith chart.
grdpol nx ny	plots a polar grid.
grid nx ny	overlays a grid on an axis system.
gridim zimg zre1 zre2 n	plots a grid line with a constant imaginary part in a Smith chart.
gridre zre zimg1 zimg2 n	plots a grid line with a constant real part in a Smith chart.
noclip	suppresses clipping of user coordinates.
nograf	suppresses the plotting of an 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.
ypolar ya, yb, yor, ystp, cstr, ndist	plots a polar 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.

Routine	Meaning
ticmod copt cax	modifies the plotting of ticks at calendar axes.
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 ixpts iypts	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.
fbars x1ray x2ray x3ray x4ray x5ray n	plots financial 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.
[wmat itmat] = licpts xvmat yvmat nx ny	calculates a Line Integral Convolution image of a vector field.

Routine	Meaning
incmrk nmrk	selects symbols or lines for CURVE.
licmod cmod ckey	sets modes for the LIC algorithm.
[a b r] = linfit xray yray n copt	plots a fitted line.
marker nsym	sets the symbols plotted by CURVE.
mrkclr nclr	defines the colour of symbols plotted by CURVE.
nancrv copt	enables handling of NaN values in curves.
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.
stmmod cmod ckey	sets streamline modes.
stmopt n ckey	defines integer options for streamlines.
[xray yray n] = stmpts xvmat yvmat nx ny xpray ypray x0 y0 nmax	generates a streamline.
stmtri xvray yvray xpray ypray n i1ray i2ray i3ray ntri xsray ysray nray	plots streamlines from triangulated data.
stmval x ckey	defines floating point options for streamlines.
stream xvmat yvmat nx ny xpray ypray xsray ysray n	plots streamlines.
thkcrv nthk	defines the thickness of curves.
itmat = txture nx ny	generates a texture array for LICPTS.
vecfld xvray yvray xpray ypray n ivec	plots a vector field.
vecmat xvmat yvamt nx ny xpray ypray ivec	plots a vector field on a regular grid.

Figure A.11: Plotting Data Points

A.12 Legends

Routine	Meaning
frame nfrm	sets the frame thickness of legends.
legbgd nclr	defines the background colour of legends.
legend cbuf ncor	plots legends.
legini cbuf nlin nmaxln	initializes legends. cbuf is a dummy parameter for Tcl. The text of legend lines is stored in an internal buffer.
leglin cbuf cstr ilin	defines text for legend lines.
legopt xf1 xf2 xf3	modifies the appearance of legends.

Routine	Meaning
legpat ityp ithk isym iclr ipat ilin	stores curve attributes.
legpos nxp nyp	determines the position of legends.
legsel nray n	selects legend lines.
legtbl n, copt	sets the number of columns in table legends.
legtit ctitle	defines the legend title.
legtyp ctype	defines horizontal or vertical legend lines.
legval x copt	modifies the appearance of legends.
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.
hwmode cmod ckey	enables or disables hardware features for line styles and shading patterns.
linclr nray n	defines colours for line styles.
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 iang ityp idens icross	defines a global shading pattern.
shdfac xfac	modifies the distance of scan lines for software shading.
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
tr3axs x y z a	defines a rotation about an arbitrary axis.
tr3res	resets 3-D base transformations.
tr3rot xrot yrot zrot	affects the 3-D rotation of plot vectors.
tr3scl xscl yscl zscl	affects the 3-D scaling of plot vectors.
tr3shf xshf yshf zshf	affects the 3-D shifting of plot vectors.
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.

Routine	Meaning
[nx ny nw nh] = getclp	returns the currents clipping window.
n = getclr	returns the current colour number.
[nx ny nz] = getdig	returns the number of decimal places used in labels.
cdsp = getdsp	returns the terminal type.
cfil = getfil	returns the current plotfile name.
[a b or stp] = getgrf 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.
[xr xg xb] = getind i	returns the RGB coordinates for a colour index.
[cx cy cz] = getlab	returns the current labels.
[nx ny nz] = getlen	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.
[nx ny] = getor	returns the current origin.
[nx ny] = getpag	returns the current page size.
n = getpat	returns the current shading pattern.
n = getplv	returns the patch level of Dislin.
[nx ny] = getpos	returns the position of the axis system.
[nx ny] = getran	returns the range of colour bars.
[nx ny] = getres	returns the size of points used in 3-D colour graphics.
[xr xb xg] = getrgb	returns the RGB coordinates of the current colour.
[nx ny nz] = getscl	returns the current axis scaling.
[nx,ny,nz] = getscm	informs if automatic scaling is enabled.
[nw nh] = getscr	returns the screen size in pixels.
c = getshf copt	returns shift characters for European characters.
[nx ny nz] = getsp1	returns the distance between axis ticks and labels.
[nx ny nz] = getsp2	returns the distance between axis labels and names.
[nsym nh] = getsym	returns the current symbol number and height.
[nmaj nmin] = gettcl	returns the current tick lengths.
[nx ny nz] = gettic	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.
[nytit nxbar nybar] = getvk	returns the current lengths used for shifting.
cvlt = getvlt	returns the current colour table.
n = getwid	returns the width of colour bars.
[nx ny nw nh] = getwin	returns the position and size of the graphics window.
id = getxid WINDOW	returns the X window ID.
[c1 c2 n] = gmxalf copt	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.
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.
triflc xray yray icray n	plots solid filled rectangles.
trifll xray yray	plots solid filled rectangles.
vecclr nclr	defines coulour for arrow heads.
vecopt xopt ckey	defines vector options.
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
iray = colray zray n	converts Z-coordinates to colour numbers.
[xp yp] = getico x y	converts a complex reflection factor to an impedance.
[xp yp] = getrco x y	converts a complex impedance to a reflection factor.
n = nxpixl ix iy	converts X plot coordinates to pixel.
n = nxposn x	converts X-coordinates to plot coordinates.
n = nypixl ix iy	converts Y plot coordinates to pixel.
n = nyposn y	converts Y-coordinates to plot coordinates.
n = nzposn z	converts Z-coordinates to colour numbers.
xray = trfco1 xray n cfrom cto	converts one-dimensional coordinates.
[xray yray] = trfco2 xray yray n cfrom cto	converts two-dimensional coordinates.
[xray yray zray] = trfco3 xray yray zray n cfrom cto	converts three-dimensional coordinates.
[xray yray] = 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
[xpray ypray] = bezier xray yray n np	calculates a Bezier interpolation.
n = bitsi4 nbits ninp iinp nout iout	allows bit manipulation on 32 bit variables.
[xm ym r] = circ3p x1 y1 x2 y2 x3 y3	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.
[xhray yhray nh] = histog xray n	calculates a histogram.
cstr = intcha nx	converts integers to character strings.
n = intlen nx	calculates the number of digits for integers.
cstr = intutf iray n	converts Unicode numbers to an UTF8 string.
n = nlmess cstr	returns the length of character strings in plot coordinates.
n = nlnumb x ndig	returns the length of numbers in plot coordinates.
[x2ray y2ray nn] = polclp xray yray n nmax xv cedge	clips a polygon.
xray = sortr1 xray n copt	sorts floating point numbers.

Routine	Meaning
[xray yray] = sortr2 xray yray n copt	sorts points in the X-direction.
[xpray ypray np] = spline xray yray n	returns splined points as calculated in CURVE.
iray = swapi4 iray n	swaps the bytes of 32 bit integer variables.
zmat2 = trfmat zmat nx ny nx2 ny2	converts matrices.
[i1ray i2ray i3ray ntri] = triang xray yray n nmax	calculates the Delaunay triangulation.
n = trmlen cstr	calculates the number of characters in character strings.
cstr = upstr cstr	converts a character string to uppercase letters.
iray = utfint cstr	converts an UTF8 string to Unicode numbers.

Figure A.20: Utility Routines

A.21 Binary File I/O

Routine	Meaning
istat = closfl nu	closes a file.
istat = openfl cfil, nu, irw	opens a file for binary I/O.
istat = posifl nu, nbyte	skips to a certain position relative to the start.
iray = readfl nu, nbyte	reads a given number of bytes.
istat = skipfl n, nbyte	skips a number of bytes from the current position.
n = tellfl nu	returns the file position.
n = writfl nu, iray, nbyte	writes a given number of bytes.

Figure A.21: Binary File I/O

A.22 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.
[id im iy] = trfdat n	converts incremented days to a date.

Figure A.22: Date Routines

A.23 Cursor Routines

Routine	Meaning
n = csrkey	returns a character key.
[nx1 ny1 nx2 ny2] = csrlin	returns the end points of a line.
[nxray nyray n iret] = csrmov nmax	collects cursor movements.
[nxray nyray n iret] = csrpol nmax	returns collected cursor positions.
nkey = csrpos nx ny	sets and returns the cursor position.
[nx ny] = csrpt1	returns a pressed cursor position.
[nxray nyray n iret] = csrpts nmax	collects cursor positions.
[nx1 ny1 nx2 ny2] = csrrec	returns opposite corners of a rectangle.
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.23: Cursor Routines

A.24 Transparency

Routine	Meaning
tprfin	terminates alpha blending.
tprini	initializes alpha blending.
tprmod cmode ckey	modifies alpha blending.
tprval x	sets the alpha value.

Figure A.24: Transparency

A.25 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 copt ckey	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.25: Bar Graphs

A.26 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.
piecbk Routine	defines a callback routine for PIEGRF.
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.
pierot angle	sets a rotation angle for 2-D pie charts.
pietyp copt	selects 2-D of 3-D pie charts.
pieval x ckey	modifies parameters for pie charts.
pievec ivec copt	modifies the arrow plotted between labels and segments.

Figure A.26: Pie Charts

A.27 Coloured 3-D Graphics

Routine	Meaning
ax3len nx ny nz	defines axis lengths.
colran nx ny	defines the range of colour bars.
crvmat zmat n m ixp iyp	plots a coloured surface.
crvqdr xray yray zray n	plots coloured quadrangles.
crvtri xray yray zray n i1ray i2ray i3ray ntri	plots the coloured surface of an Delaunay triangulation.
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.
frmbar nfrm	defines the thickness of frames around colour bars.
graf3 xa xe xor xstp ya ye yor ystp za ze zor zstp	plots a coloured axis system.
jusbar copt	defines the alignment of colour bars.
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.
posbar copt	sets the position of colour bars.
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.
spcbar nspc	sets the space between colour bars and axis systems.
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.27: Coloured 3-D Graphics

A.28 3-D Graphics

Routine	Meaning
[xp yp] = abs3pt x y z	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.
cone3d xm ym zm r h1 h2 n m	plots a cone.
conn3d x y z	plots a line to a point in 3-D space.
conshd3d xray n yray m zmat zlvray nlev	plots 3-D contours.
curv3d xray yray zray n	plots curves or symbols.
curv4d xray yray zray wray n	plots coloured 3-d symbols.
cyli3d xm ym zm r h n m	plots a cylinder.
dbffin	terminates a depth sort.
iret = dbfini	initializes a depth depth sort.
dbfmod cmod	can disable the depth sort.
disk3d xm ym zm r1 r2 n m	plots a disk.
field3d x1ray y1ray z1ray x2ray y2ray z2ray n ivec	plots a vector field.
flab3d	disables the suppression of axis labels.
nclr = getlit xp yp zp xn yn zn	calculates colour values.
zmat = getmat xray yray zray n 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.
grfimg cfil	includes an image 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.
hsym3d xh	sets the height of 3-D symbols.
[xtray ytray ztray ntri] = isopts xray nx yray ny zray nz wmat wlev nmax	calculates isosurfaces.
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.

Routine	Meaning
mshclr iclr	defines the colour of surface meshes.
mshcrv n	sets the resolution of meshes for 3-D curves.
nohide	disables the hidden-line algorithm.
pike3d x1 y1 z1 x2 y2 z2 r nsk1 nsk2)	plots a cone.
plat3d xm ym zm xl copt	plots a Platonic solid.
plyfin cfil cobj	terminates output of polygons to a PLY format.
plyini copt	initializes output of polygons to a PLY format.
pos3pt x y z xp yp zp	converts user coordinates to absolute 3-D coordinates.
pyra3d xm ym zm xl h1 h2 n	plots a pyramid.
quad3d xm ym zm xl yl zl	plots a quad.
[xp yp] = rel3pt x y z	converts user coordinates to plot coordinates.
rot3d a b c	defines rotation angles for symbols and solids.
setfce copt	sets a face side for defining material parameters.
shlsur	protects surfaces from overwriting.
sphe3d xm ym zm r n m	plots a sphere.
[xray yray zray n] = stmpts3d xv yv zv nx ny nz xpray ypray zpray x0 y0 z0 nmax	generates a streamline.
stream3d xv yv zv nx ny nz xpray ypray zpray xsray ysray n	plots streamlines.
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.
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.
surshc xray nx yray ny zmat wmat	plots a coloured surface.
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.
symb3d n xm ym zm	plots a 3-D symbol.
thkc3d nthk	defines the thickness of 3-D curves.
torus3d xm ym zm r1 r2 h a1 a2 n m	plots a torus.
tube3d x1 y1 z1 x2 y2 z2 r n m	plots a tube.

Routine	Meaning
vang3d ang	defines the field of view.
vecf3d xvray yvray zvray xpray ypray zpray n ivec	plots a vector field.
vectr3 x1 y1 z1 x2 y2 z2 ivec	plots vectors in 3-D space.
vecmat3d xv yv zv nx ny nz xpray ypray zpray ivec	plots a vector field on a regular grid.
vfoc3d x y z copt	defines the focus point.
view3d x y z copt	defines the viewpoint.
vscl3d xfac	sets a scaling factor for orthographic view.
vtx3d xray yray zray n copt	plots faces from vertices.
vtxc3d xray yray zray icray n copt	plots faces from vertices.
vtxn3d xray yray zray xnray ynray znray n copt	plots faces from vertices.
vup3d ang	defines the camera orientation.
zbfers	erases the frame buffer of a Z-buffer.
zbffin	terminates the Z-buffer.
iret = zbfini	allocates space for a Z-buffer.
zbflin x1 y1 z1 x2 y2 z2	plots lines.
zbfmod cmod	can disable the Z-buffer.
zbfres	resets the Z-buffer.
zbfscl x	scales the internal image for PDF output.
zbftri xray yray zray iray	plots triangles.
zscale zmin zmax	defines a Z-scaling for coloured surfaces.

Figure A.28: 3-D Graphics

A.29 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.
mapimg cfil x1 x2 x3 x4 x5 x6	plots a BMP or GIF map image.
maplab copt ckey	defines label options.
maplev copt	specifies land or lake plotting.
mapmod copt	modifies the connection of points used in CURVMP.
mapopt copt ckey	defines map options.
mappol xpol ypol	defines the map pole used for azimuthal projections.
mapref ylw yup	defines two latitudes used for conical projections.
[xp yp] = pos2pt x y	converts user coordinates to plot coordinates.
projct copt	selects a projection.

Routine	Meaning
[xp yp] = pt2pos x y	converts plot coordinates to user coordinates.
shdafr inray ipray icray n	shades African countries.
shdasi inray ipray icray n	shades Asiatic countries.
shdaus inray ipray icray n	shades Oceanic countries.
shdeur inray ipray icray n	shades European countries.
shdmap copt	shades continents.
shdnor inray ipray icray n	shades states of North and Central America.
shdsou inray ipray icray n	shades states of South America.
shdusa inray ipray icray n	shades USA states.
world	plots coastlines and lakes.
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.29: Geographical Projections

A.30 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.
[xpray ypray iray ncrv] = conpts xray n yray m zmat maxpts maxcrv	generates contours.
conshd xray nx yray ny zmat zlray n	plots shaded contours.
conshd2 xmat ymat zmat nx ny 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.
contur2 xmat ymat zmat nx ny zlev	plots contours.

Routine	Meaning
labclr nclr CONTUR	defines the colour of contour labels.
labdis ndis CONTUR	defines the distance between labels.
labels copt CONTUR	defines contour labels.
shdmod copt CONTUR	sets the algorithm for shaded contours.
[xpray ypray iray ncrv] = tripts xray yray zray n i1ray i2ray i3ray ntri zlev maxpts maxcrv	generates contours from triangulated data.

Figure A.30: Contouring

A.31 Image Routines

Routine	Meaning
expimg cfil copt	copies an image from memory to a file.
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.
imgini	initializes transfering of image data.
imgmod cmod	selects index or RGB mode.
imgsiz nw nh	defines an image size for PostScript/PDF output.
imgtpr nclr	defines a transparency colour for images.
cbuf = rbfpng	stores an image as PNG file in a buffer.
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.
cray = rpixls 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.
cray = rpxrow 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 cray ix iy nw nh	writes image data to memory.
wpxrow cray nx ny n	write a row of image data to memory.
wtiff cfil	copies a TIFF file created by Dislin to memory.

Figure A.31: Image Routines

A.32 Window Routines

Routine	Meaning
clswin id	closes a window.
hidwin id copt	defines whether a window is visible or not.
opnwin id	opens a window for graphics output.
pagwin nxp nyp	defines page formats for windows.
selwin id	selects a window for graphics output.
winapp capp	defines a window or console application.
wincbk crout copt	defines a callback routine for the windows size.
window nx ny nw nh	defines the position and size of windows.
winico cstr	loads an icon for the windows title bar.
id = winid	returns the ID of the currently selected window.
winjus copt	defines the position of the graphics window.
winkey ckey	defines a key that can be used for program continuation in DISFIN.
winmod copt	affects the handling of windows in DISFIN.
winsiz nw nh	defines the size of windows.
wintit cstr	sets the title of the currently selected window.
wintyp copt	sets the type of the graphics window.
x11mod copt	enables backing store.

Figure A.32: Window Routines

A.33 Widget Routines

Routine	Meaning
doevnt	processes pending events.
ival = dwgbut cstr ival	displays a message that can be answered with 'Yes' or 'No'.
iret = dwgerr	returns a status for dialog widget routines.
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.
x = gwgflt id	requests the value of a text widget as real number.
n = gwggui	returns the used GUI.
n = gwgint id	requests the value of a text widget as integer.
n = gwglis id	requests the value of a list widget.
x = gwgscl id	requests the value of a scale widget.

Routine	Meaning
[nw nh] = gwgsiz id	returns the size of widgets.
x = gwgtbf id irow icol	requests the value of a table cell as real number.
ix = gwgtbi id irow icol	requests the value of a table cell as integer.
xray = gwgtbl id n idx copt	requests the values of table cells.
cstr = gwgtbs id irow icol	requests the value of a table cell as a string.
cstr = gwgtxt id	requests the value of a text widget.
n = gwgxid id	requests the windows ID of a widget.
clis = itmncat clis n 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.
swgbgd id xr xg xb	changes the background colour of widgets.
swgbox id isel	changes the selection of a box widget.
swgbut id ival	changes the status of a button widget.
swgcb2 id routine	connects a callback routine with a table widget.
swgcbk id routine	connects a callback routine with a widget.
swgclr xr xg xb copt	sets widget colours.
swgdrw xf	defines the height of draw widgets.
swgfgd id xr xg xb	changes the foreground colour of widgets.
swgfil id cfil	changes the value of a file widget.
swgflt id x ndig	changes the value of text widgets.
swgfnt cfnt npts	defines widget fonts.
swgfoc id	sets the keyboard focus.
swghlp cstr	sets a character string for the Help menu.
swgint id n	changes the value of text widgets.
swgiop i copt	sets integer options for widgets.
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.
swgray xray n copt	defines the width of columns in table 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.
swgtbf id x ndig i j copt	changes the values of table cells.
swgtbi id ix i j copt	changes the values of table cells.
swgtbl id xray n ndig idx copt	changes the values of table cells.

Routine	Meaning
swgtbs id cstr i j copt	changes the values of table cells.
swgtit cstr	sets a title for the main widget.
swgtxt id cval	changes the value of a text widget.
swgtyp ctype class	modifies the appearance of widgets.
swgval id xval	changes the value of progress bars.
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 = wgappb ip cray nw nh	uses an image as 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 = wgicon ip clab nw nh cfl	creates a label widget with an icon as label.
id = wgimg ip clab iray nw nh	creates a label widget with an image as label.
id = wgini (copt)	creates a main widget and initalizes 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 an OK push button widget.
id = wgpbar ip x1 x2 xstp	creates a progress bar.
id = wgpbut ip clab	creates a push button widget.
id = wgpicon ip clab nw nh cfl	creates a push button with an icon as label.
id = wgpimg ip clab iray nw nh	creates a push button with an image as label.
id = wgpop ip cstr	creates a popup menu.
id = wgpopb ip cray nw nh	uses an image as 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 = wgsep ip	creates a separator widget.
id = wgstxt ip nsize nmax	creates a scrolled text widget.
id = wgtbl ip nrows ncols	creates a table widget.
id = wgtxt ip cstr	creates a text widget.

Figure A.33: Widget Routines

A.34 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.
qplcrv xray yray n copt	plots multiple curves.
qplot xray yray n	plots a curve.
qplpie xray yray n	plots a pie chart.
qplsca xray yray n	makes a scatter plot.
qplscl a e or step copt	sets a user-defined scaling.
qplsur zmat n m	plots a surface.

Figure A.34: Dislin Quickplots

A.35 Using Threads

Routine	Meaning
thrfin	terminates threads.
thrini n	enables threads.

Figure A.35: Using Threads

A.36 Reading FITS Files

Routine	Meaning
fitscls	closes a FITS file.
x = filtsflt ckey	returns the floatingpoint value of a key.
n = fitsimg iray	copies a FITS image to an array.
istat = fitsopn cfil	opens a FITS file for reading.
cval = fitsstr ckey	returns the string value of a key.
n = fitstyp ckey	returns the type of a key.
n = fitsval ckey	returns the integer value of a key.

Figure A.36: Reading FITS Files

A.37 MPS Logo

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

Figure A.37: MPS Logo

Appendix B

Examples

This appendix presents some examples of the Dislin manual in Tcl coding. They can be found in the Dislin subdirectory tcl.

B.1 Demonstration of CURVE

```
load dislin.so

set n 101
set pi 3.1415926
set f [expr $pi / 180]
set step [expr 360.0 / ($n - 1)]

for { set i 0 } { $i < $n } { incr i } {
    lappend xray [expr $i * $step]
    set x [expr $i * $step * $f]
    lappend y1ray [expr sin ($x)]
    lappend y2ray [expr cos ($x)]
}

Dislin::metafl cons
Dislin::scrmod revers
Dislin::disini

Dislin::complx
Dislin::pagera

Dislin::name X-axis  X
Dislin::name Y-axis  Y

Dislin::axspos 450 1800
Dislin::axslen 2200 1200

Dislin::labdig -1 X
Dislin::ticks 10 XY

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

set ic [Dislin::intrgb 0.95 0.95 0.95]
Dislin::axsbgd $ic
Dislin::graf 0 360 0 90 -1 1 -1 0.5
Dislin::setrgb 0.7 0.7 0.7
Dislin::grid 1 1

Dislin::color fore
Dislin::box2d
Dislin::height 50
Dislin::title

Dislin::color red
Dislin::curve $xray $y1ray $n
Dislin::color green
Dislin::curve $xray $y2ray $n
Dislin::disfin
```

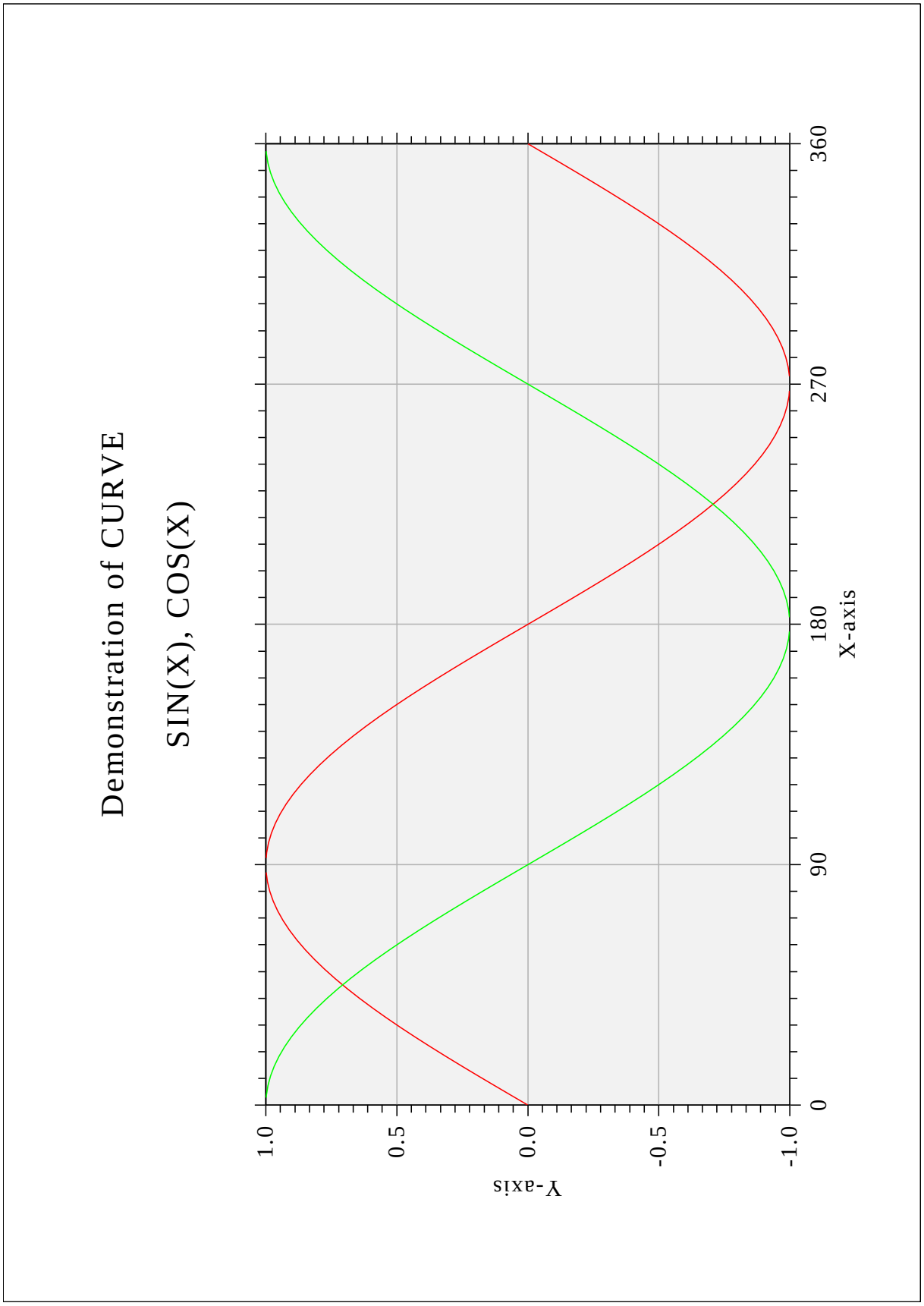

Figure B.1: Demonstration of CURVE

B.2 Symbols

```
load dislin.so

set ctit Symbols

Dislin::setpag da4p
Dislin::metafl cons

Dislin::disini
Dislin::pagera
Dislin::complx
Dislin::paghdr "H. Michels ("  ")" 2 0

Dislin::height 60
set nl [Dislin::nlmess $ctit]
Dislin::messag $ctit  [expr (2100 - $nl) / 2] 200

Dislin::height 50
Dislin::hsymbl 120

set ny 150

for { set i 0 } { $i < 24 } { incr i } {
  set nl [Dislin::nlnumb $i -1]
  set j [expr $i % 4]
  if {$j == 0} {
    set ny [expr $ny + 400]
    set nxp 550
  } else {
    set nxp [expr $nxp + 350]
  }

  Dislin::number $i -1 [expr $nxp - $nl/2] [expr $ny + 150]
  Dislin::symbol $i $nxp $ny
}
Dislin::disfin
```

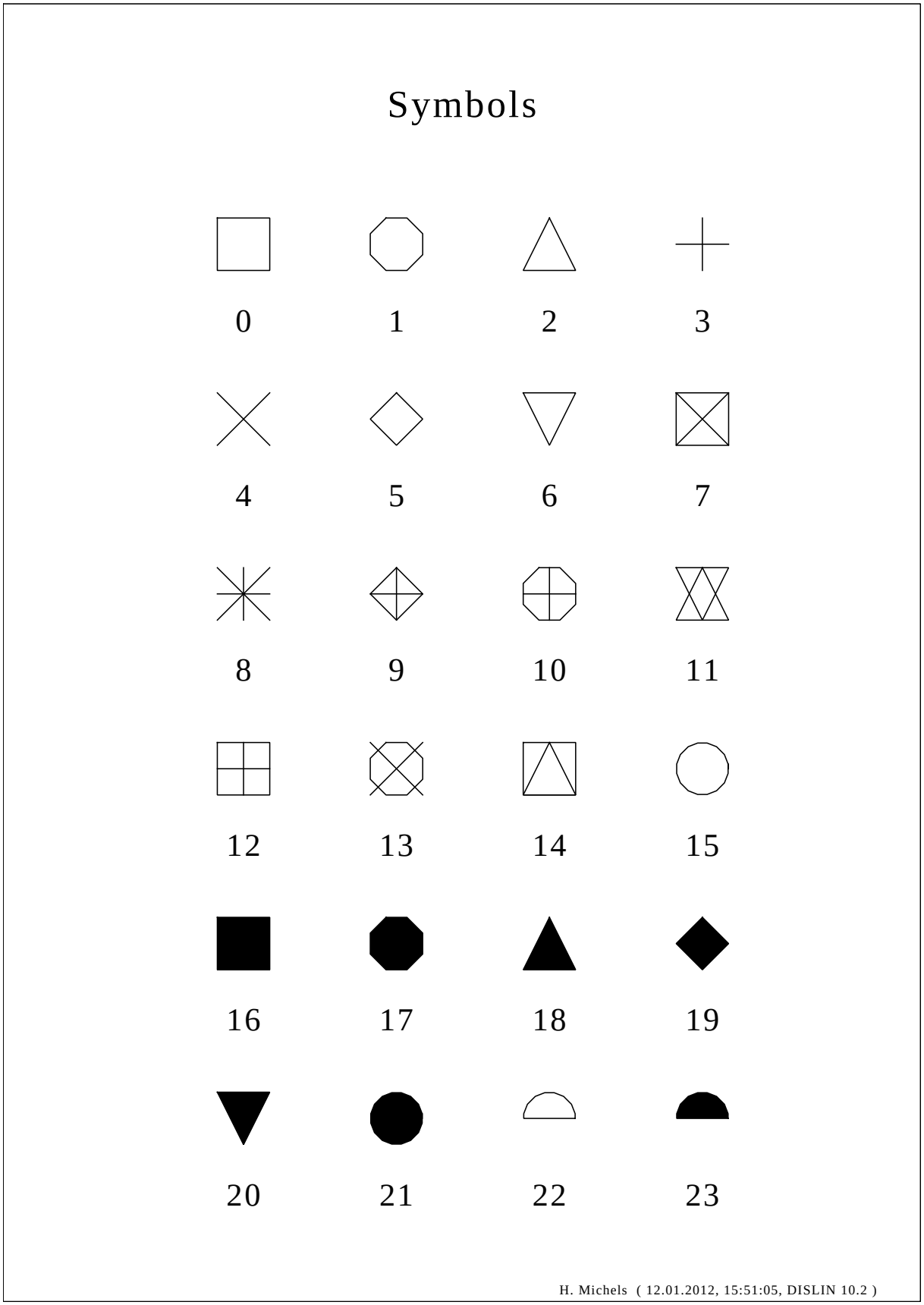

Figure B.2: Symbols

B.3 Logarithmic Scaling

```
load dislin.so

set ctit "Logarithmic Scaling"
set clab [list 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 { set i 0 } { $i < 3 } { incr i } {
    set nya [expr 2650 - $i * 800]
    Dislin::labdig -1 XY
    if {$i == 1} {
      Dislin::labdig 1 Y
      Dislin::name  " " X
    }

    Dislin::axspos 500 $nya
    set s "Labels: "
    Dislin::messag [append s [lindex $clab $i]] 600 [expr $nya - 400]
    Dislin::labels [lindex $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
```

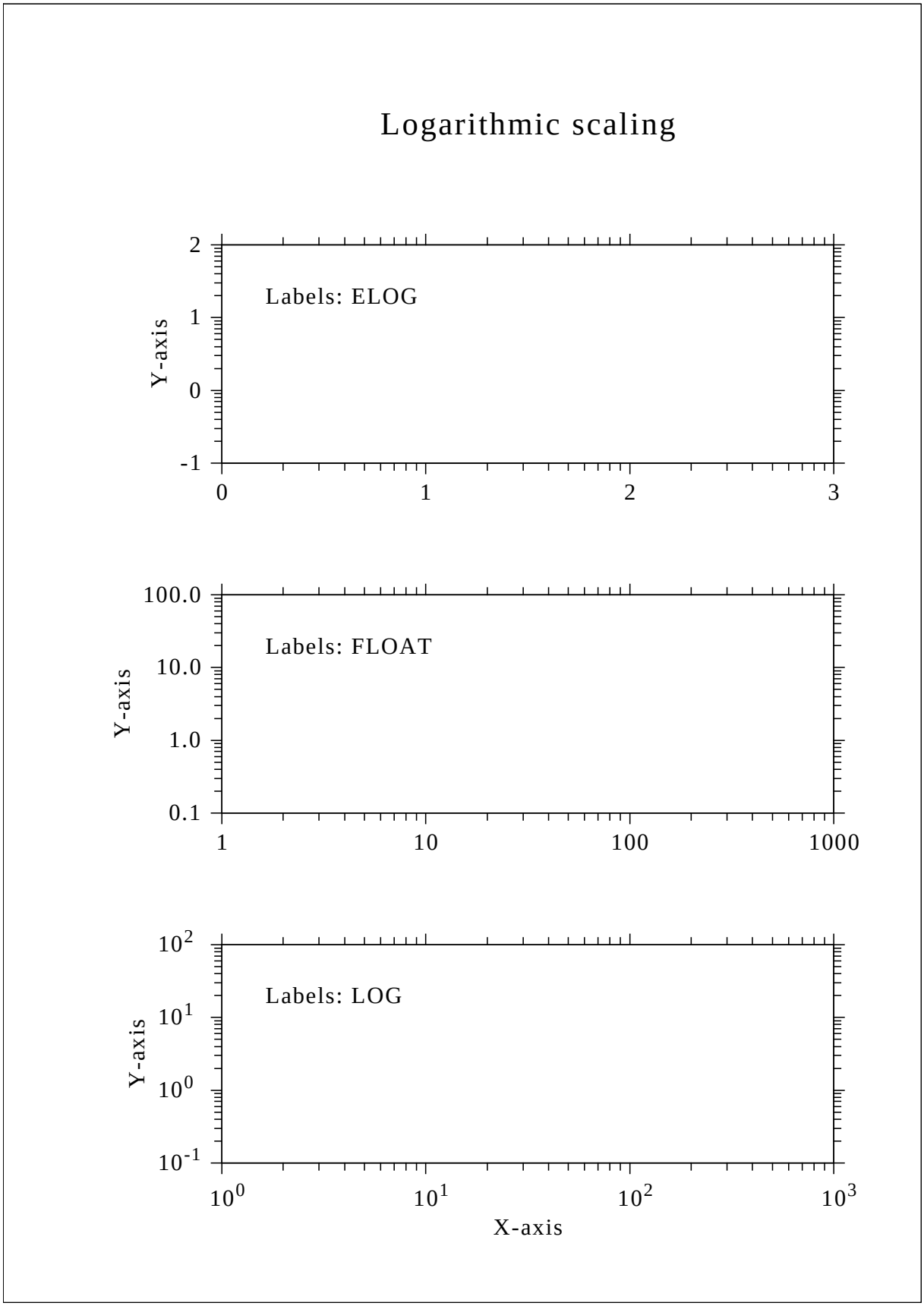

Figure B.3: Logarithmic Scaling

B.4 Interpolation Methods

```
load dislin.so

set ctit "Interpolation Methods"

set xray [list 0. 1. 3. 4.5 6. 8. 9. 11. 12. 12.5 13. 15. 16. 17. 19. 20.]
set yray [list 2. 4. 4.5 3. 1. 7. 2. 3. 5. 2. 2.5  2. 4. 6. 5.5 4.]
set cpol [list SPLINE STEM BARS STAIRS STEP LINEAR]

Dislin::setpag da4p
Dislin::metafl cons

Dislin::disini
Dislin::pagera
Dislin::complx

Dislin::incmrk 1
Dislin::hsymbl 20
Dislin::titlin $ctit 1
Dislin::axslen 1500 350
Dislin::setgrf LINE LINE LINE LINE

set nya 2700
for { set i 0 } { $i < 6 } { incr i } {
    Dislin::axspos 350 [expr $nya - $i * 350]
    Dislin::polcrv [lindex $cpol $i]
    Dislin::marker 0
    Dislin::graf   0 20 0 5 0 10 0 5
    set nx [Dislin::nxposn 1.0]
    set ny [Dislin::nyposn 8.0]
    Dislin::messag [lindex $cpol $i] $nx $ny
    Dislin::curve  $xray $yray 16

    if {$i == 5} {
      Dislin::height 50
      Dislin::title
    }

    Dislin::endgrf
}
Dislin::disfin
```

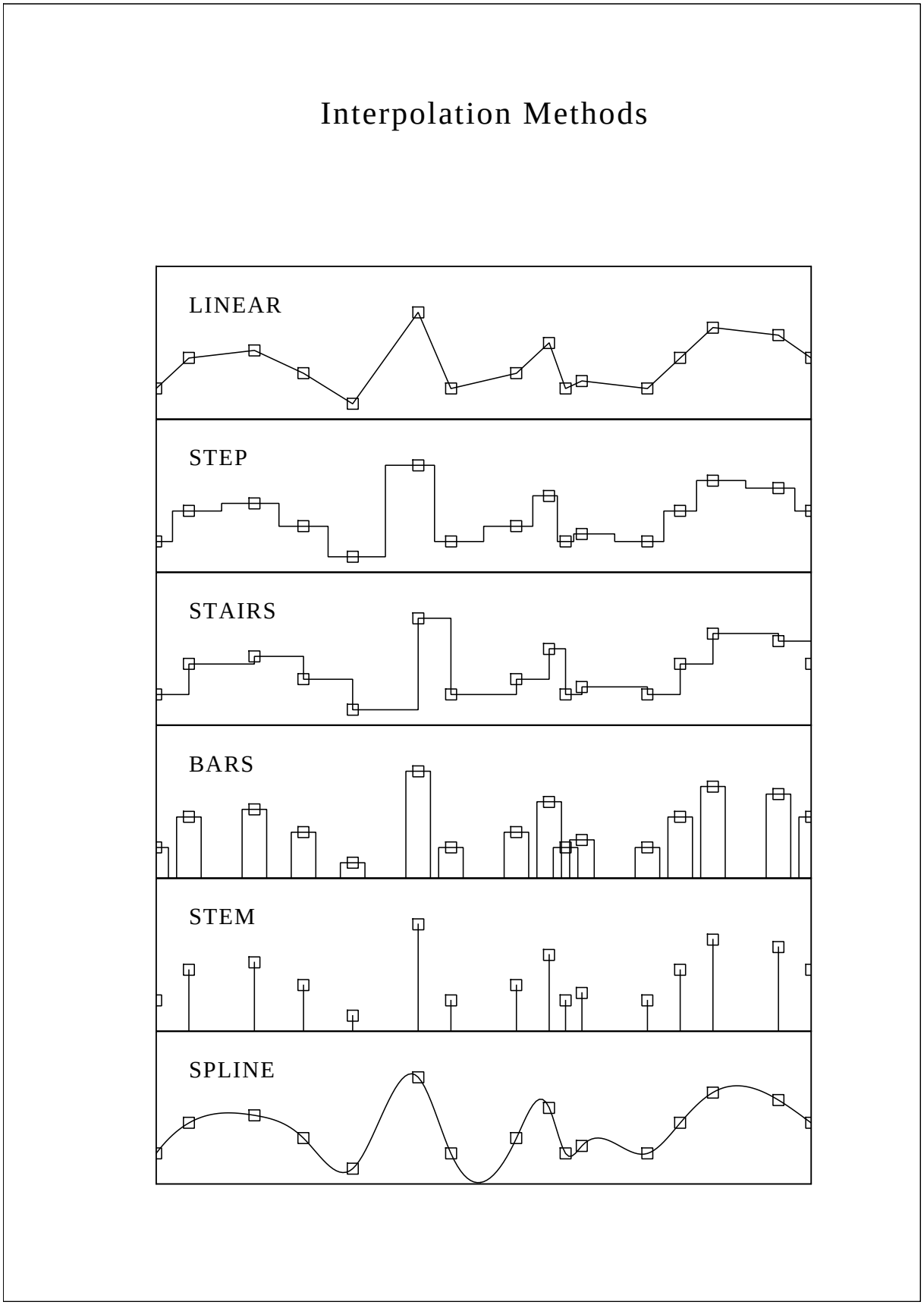

Figure B.4: Interpolation Methods

B.5 Line Styles

```
load dislin.so

set ctit1 "Demonstration of CURVE"
set ctit2 "Line Styles"

set ctyp  [list "SOLID"   "DOT"    "DASH"  "CHNDSH" \
                "CHNDOT"  "DASHM"  "DOTL"  "DASHL"]
set x  [list 3.0  9.0]

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 { set i 0 } { $i < 8 } { incr i } {
    set y [list [expr 8.5 - $i] [expr 8.5 - $i]]
    set nx [Dislin::nxposn 1.0]
    set ny [Dislin::nyposn [lindex $y 0]]
    Dislin::messag [lindex $ctyp $i] $nx [expr $ny - 20]
    Dislin::curve $x $y 2
}
Dislin::disfin
```

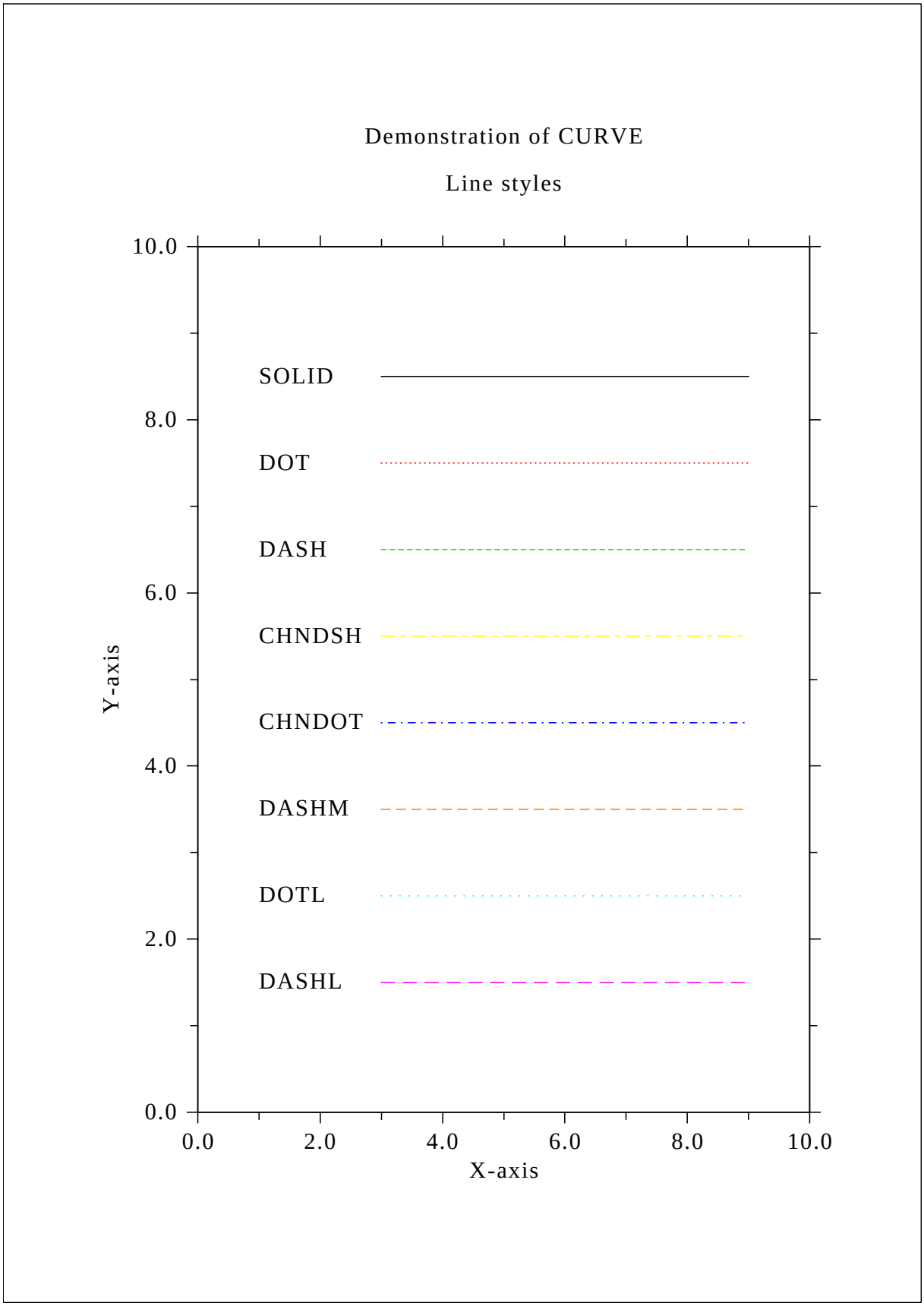

Figure B.5: Line Styles

B.6 Legends

```
load dislin.so

set n 101
set pi 3.1415926
set f [expr $pi / 180]
set step [expr 360.0 / ($n - 1)]

for { set i 0 } { $i < $n } { incr i } {
    lappend xray [expr $i * $step]
    set x [expr $i * $step * $f]
    lappend y1ray [expr sin ($x)]
    lappend y2ray [expr cos ($x)]
}

Dislin::metafl xwin
Dislin::disini
Dislin::complx

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 BOTH
Dislin::curve $xray $y1ray $n
Dislin::curve $xray $y2ray $n

set cbuf " "
Dislin::legini $cbuf 2 7

set nx [Dislin::nxposn 190]
set 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
```

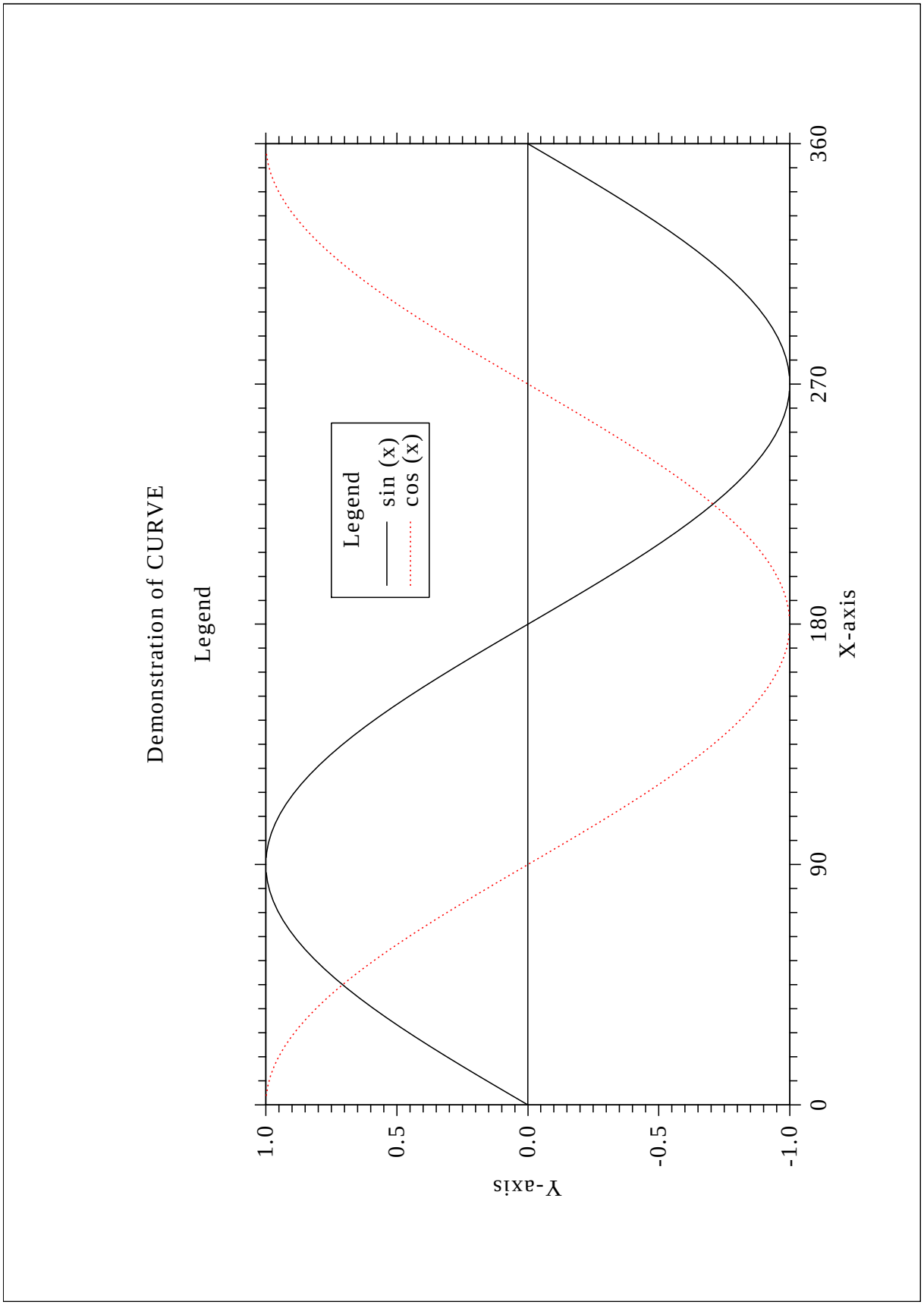

Figure B.6: Legends

B.7 Shading Patterns (AREAF)

```
load dislin.so

set ctit "Shading Patterns (AREAF)"

Dislin::metafl cons
Dislin::disini
Dislin::setvlt small
Dislin::pagera
Dislin::complx

Dislin::height 50
set nl [Dislin::nlmess ($ctit)]
Dislin::messag $ctit [expr (2970 - $nl) / 2] 200

set nx0 335
set ny0 350

set iclr 0
for { set i 0 } { $i < 3 } { incr i } {
    set  ny [expr $ny0 + $i * 600]
    for { set j 0 } { $j < 6 } { incr j } {
set nx  [expr $nx0 + $j * 400]
        set ii [expr $i * 6 + $j]
        Dislin::shdpat $ii
        set iclr [expr $iclr + 1]
        Dislin::setclr $iclr

        set ixp [list $nx [expr $nx + 300] [expr $nx + 300] $nx]
        set iyp [list $ny $ny [expr $ny + 400] [expr $ny + 400]]
        Dislin::areaf $ixp $iyp 4
        set nl [Dislin::nlnumb $ii -1]
        set nx [expr $nx + (300 - $nl) / 2]
        Dislin::color foreground
        Dislin::number $ii -1 $nx [expr $ny + 460]
    }
}
Dislin::disfin
```

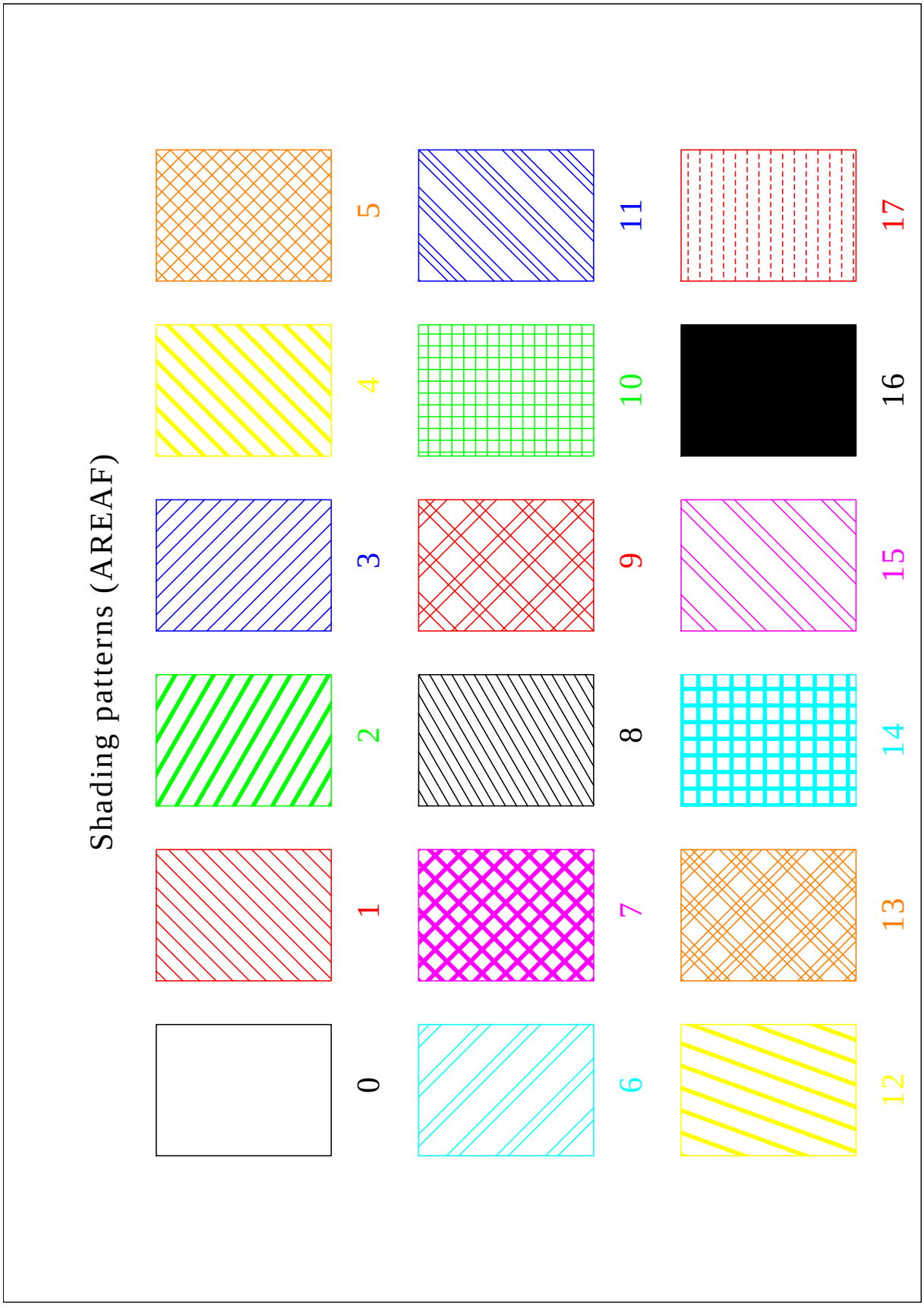

Figure B.7: Shading Patterns

B.8 Vectors

```
load dislin.so

set ivec [list 0 1111 1311 1421 1531 1701 1911 \
            3111 3311 3421 3531 3703 4221 4302 \
            4413 4522 4701 5312 5502 5703]

set ctit Vectors

Dislin::metafl cons
Dislin::disini
Dislin::pagera
Dislin::complx

Dislin::height 60
set nl [Dislin::nlmess $ctit]
Dislin::messag $ctit [expr (2970 - $nl)/2] 200

Dislin::height 50
set nx 300
set ny 400

for { set i 0 } { $i < 20 } { incr i } {
    set nvec [lindex $ivec $i]
    if {$i == 10} {
set nx [expr $nx + 2970 / 2]
        set ny 400
    }
    set nl [Dislin::nlnumb $nvec -1]
    Dislin::number $nvec -1 [expr $nx - $nl] [expr $ny - 25]
    Dislin::vector [expr $nx + 100] $ny [expr $nx + 1000] $ny $nvec
    set ny [expr $ny + 160]
}
Dislin::disfin
```

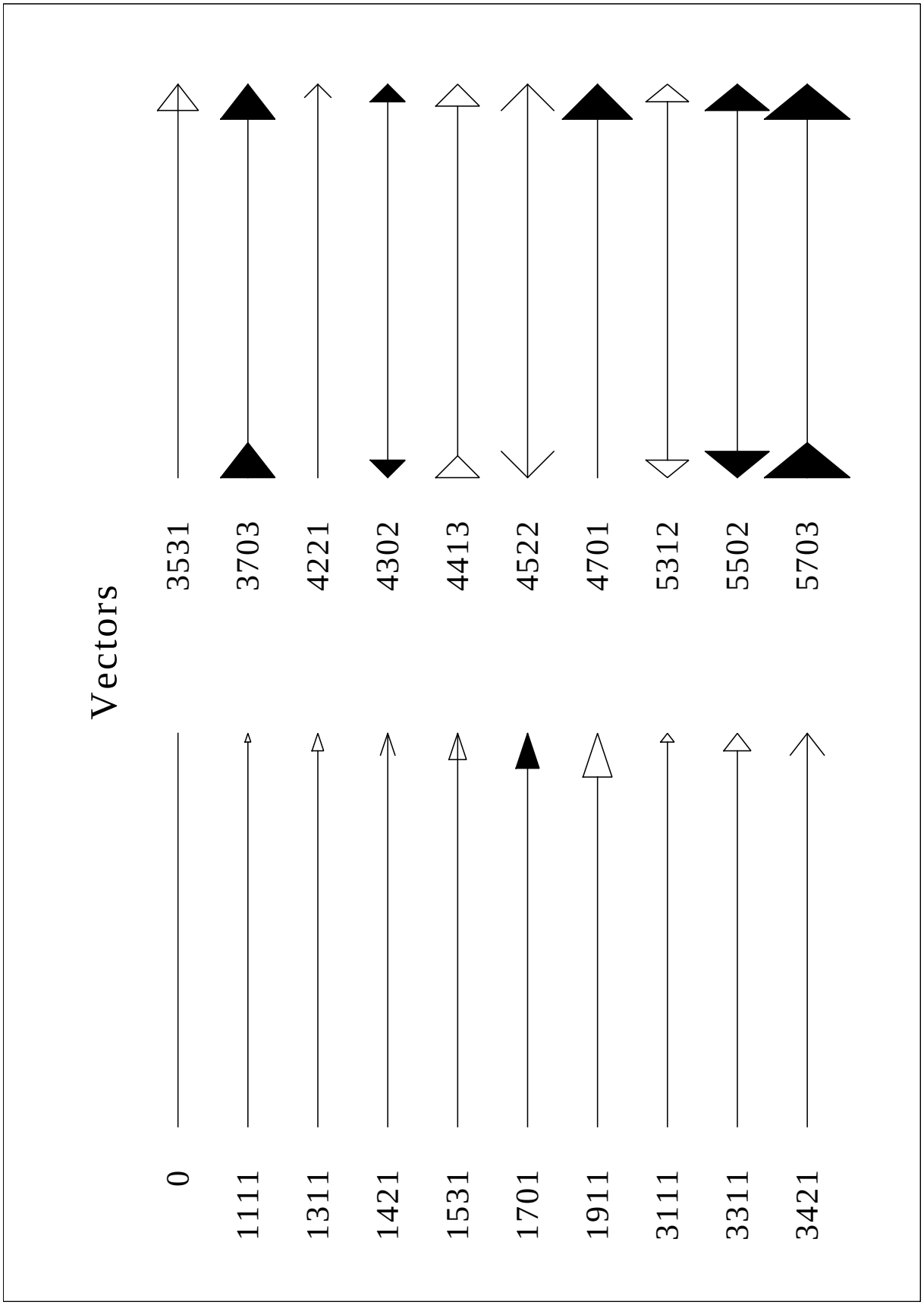

Figure B.8: Vectors

B.9 3-D Colour Plot

```
load dislin.so

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

set n 50
set m 50

set fpi  [expr 3.1415927 / 180]
set stepx [expr 360. / ($n - 1)]
set stepy [expr 360. / ($m - 1)]

for { set i 0 } { $i < $n } { incr i } {
    set x [expr $i * $stepx * $fpi]
    for { set j 0 } { $j < $m } { incr j } {
set y  [expr $j * $stepy * $fpi]
        lappend zmat [expr 2 * sin ($x) * sin ($y)]
    }
}

Dislin::metafl xwin
Dislin::disini
Dislin::pagera
Dislin::complx

Dislin::titlin $ctit1 1
Dislin::titlin $ctit2 3

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
```

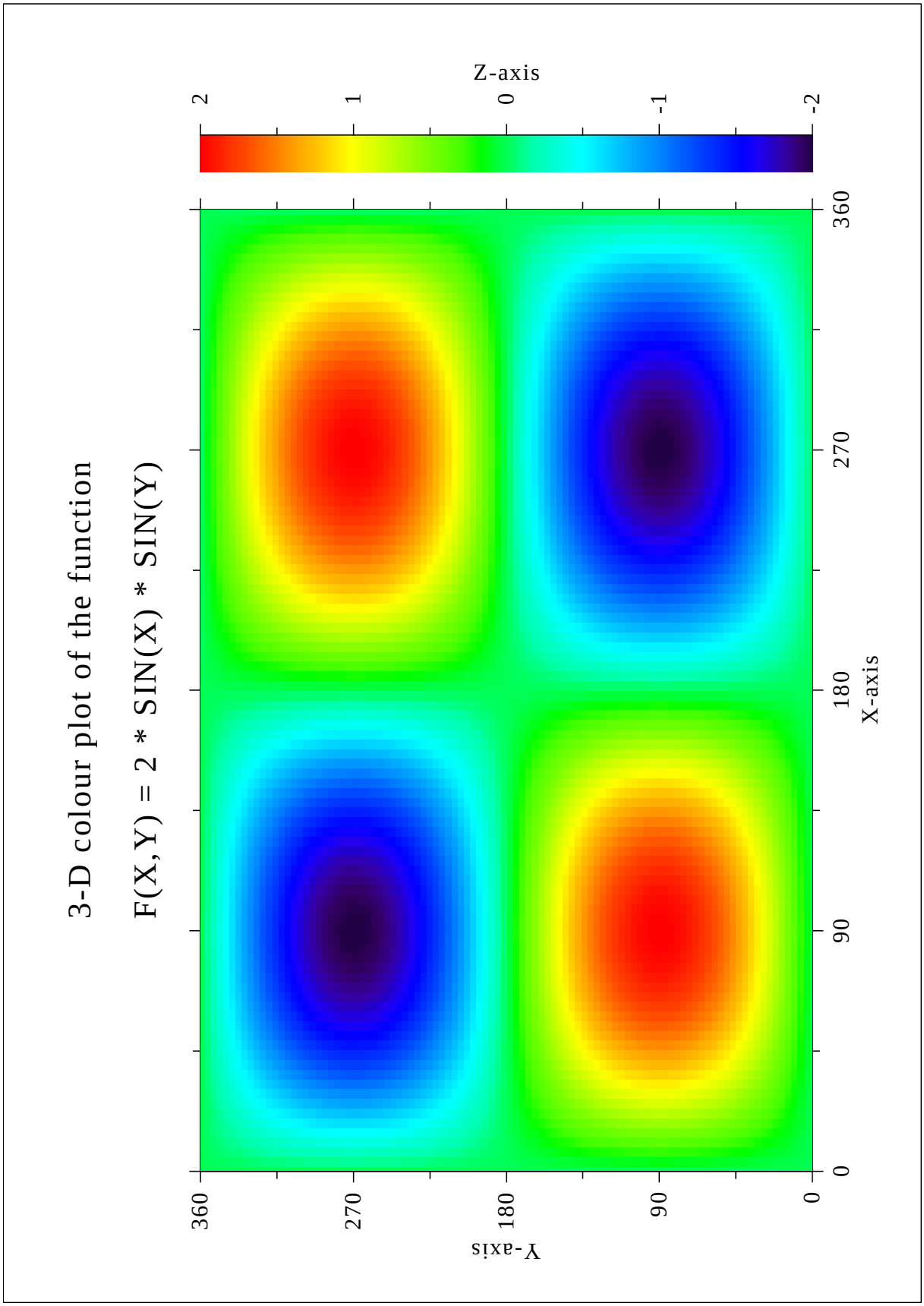

Figure B.9: 3-D Colour Plot

B.10 Surface Plot

```
load dislin.so

set ctit1 "Surface Plot of the Function"
set ctit2 "F(X,Y) = 2 * SIN(X) * SIN (Y)"

set n 50
set m 50

set fpi  [expr 3.1415927 / 180]
set stepx [expr 360. / ($n - 1)]
set stepy [expr 360. / ($m - 1)]

for { set i 0 } { $i < $n } { incr i } {
    set x [expr $i * $stepx * $fpi]
    for { set j 0 } { $j < $m } { incr j } {
set y  [expr $j * $stepy * $fpi]
        lappend zmat [expr 2 * sin ($x) * sin ($y)]
    }
}

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
```

Surface plot (SURMAT)

F(X,Y) = 2*SIN(X)*SIN(Y)

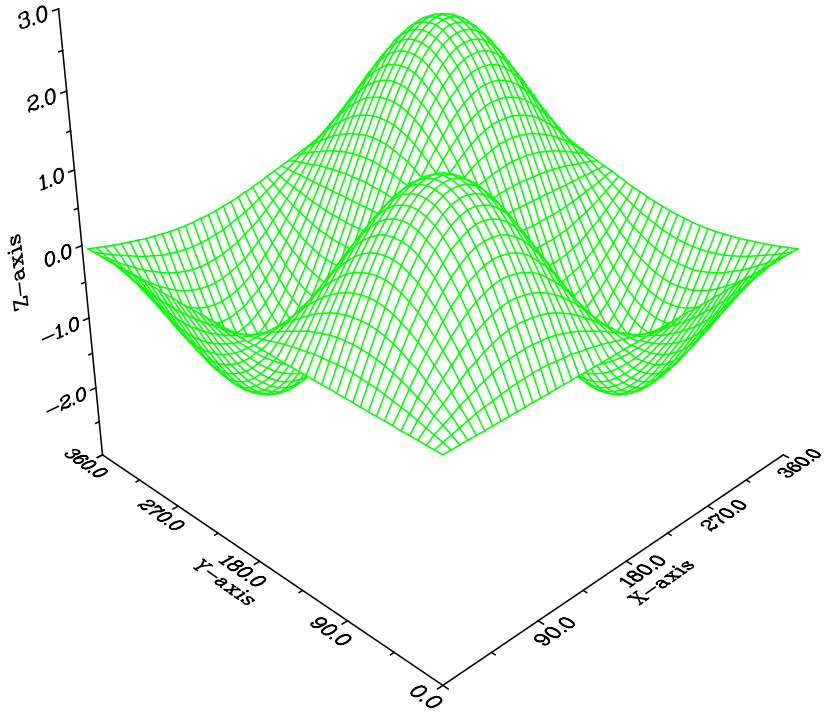

Figure B.10: Surface Plot

B.11 Surface Plot

```
load dislin.so

proc myfunc {x y iopt} {
  if {$iopt == 1} {
    set result [expr cos ($x) * (3 + cos ($y))]
  } elseif {$iopt == 2} {
    set result [expr sin ($x) * (3 + cos ($y))]
  } else {
    set result [expr sin ($y)]
  }
  return $result
}

set ctit1 "Surface Plot of the Parametric Function"
set ctit2 "COS(t)*(3+COS(u)), SIN(t)*(3+COS(u)), SIN(u)"
set pi 3.1415927

Dislin::scrmod revers
Dislin::metafl cons
Dislin::setpag da4p
Dislin::disini
Dislin::pagera
Dislin::complx

Dislin::titlin $ctit1 2
Dislin::titlin $ctit2 4

Dislin::axspos 200 2400
Dislin::axslen 1800 1800

Dislin::name  X-axis X
Dislin::name  Y-axis Y
Dislin::name  Z-axis Z
Dislin::intax

Dislin::vkytit -300
Dislin::zscale -1 1
Dislin::surmsh on

Dislin::graf3d -4 4 -4 1 -4 4 -4 1 -3  3  -3  1
Dislin::height 40
Dislin::title

set step [expr 2 * $pi / 30]
set pi2 [expr $pi + $pi]
Dislin::surfcp myfunc 0 $pi2 $step 0 $pi2 $step
Dislin::disfin
```

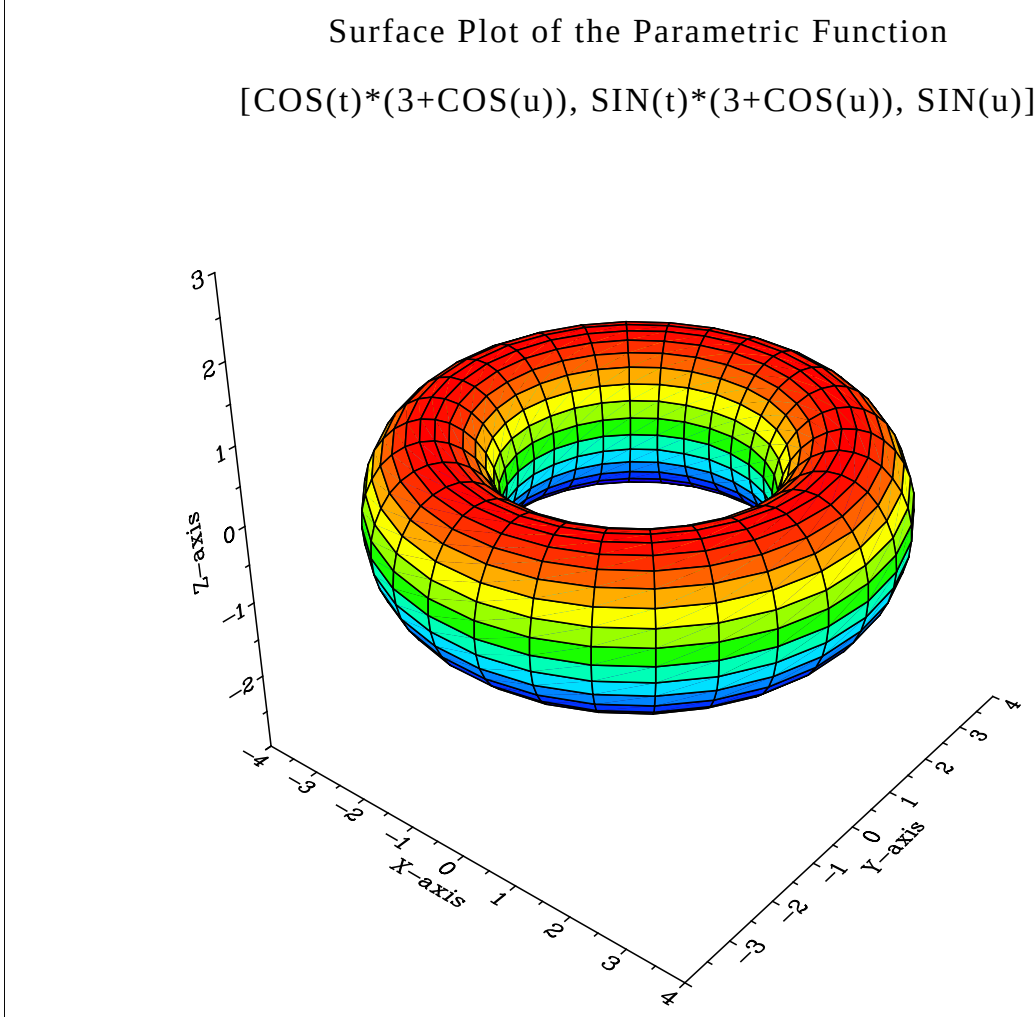

Figure B.11: Surface Plot of a Parametric Function

B.12 Polar Plots

```
load dislin.so

set n 300
set m 10
set f [expr 3.1415927 / 180.]
set step [expr 360. / ($n - 1)]

for { set i 0 } { $i < $n } { incr i } {
    set a [expr ($i * $step) * $f]
    lappend y1 $a
    set a [expr 5 * $a]
    lappend x1 [expr sin ($a)]
}

for { set i 1 } { $i <= $m } { incr i } {
    lappend x2 $i
    lappend y2 $i
}

Dislin::setpag da4p
Dislin::metafl cons
Dislin::disini
Dislin::complx
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::grafp  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::grafp  10 0 2 0 30
Dislin::barwth -5
Dislin::polcrv FBARS
Dislin::curve  $x2 $y2 $m

Dislin::disfin
```

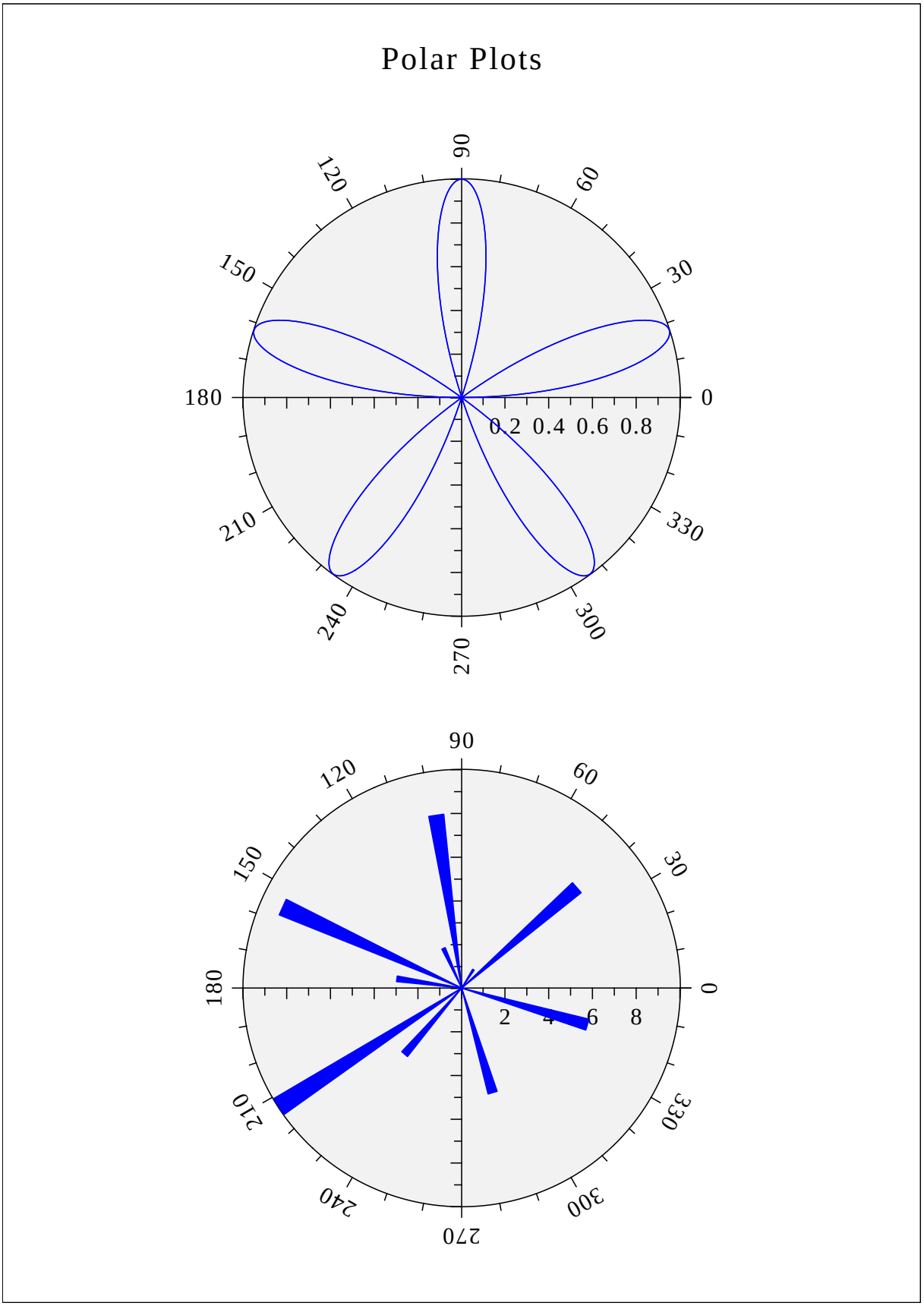

Figure B.12: Polar Plots

B.13 Contour Plot

```
load dislin.so

set ctit1 "Contour Plot"
set ctit2 "F(X,Y) = 2 * SIN(X) * SIN (Y)"

set n 50
set m 50

set fpi  [expr 3.1415927 / 180]
set stepx [expr 360. / ($n - 1)]
set stepy [expr 360. / ($m - 1)]

for { set i 0 } { $i < $n } { incr i } {
    lappend xray [expr $i * $stepx]
}

for { set i 0 } { $i < $m } { incr i } {
    lappend yray [expr $i * $stepy]
}

for { set i 0 } { $i < $n } { incr i } {
    set x [expr [lindex $xray $i] * $fpi]
    for { set j 0 } { $j < $m } { incr j } {
        set y [expr [lindex $yray $j] * $fpi]
        lappend zmat [expr 2 * sin ($x) * sin ($y)]
    }
}

Dislin::metafl cons
Dislin::setpag da4p
Dislin::disini
Dislin::pagera
Dislin::complx

Dislin::titlin $ctit1 1
Dislin::titlin $ctit2 3

Dislin::intax
Dislin::axspos 450 2650

Dislin::name  X-axis X
Dislin::name  Y-axis Y

Dislin::graf   0 360 0 90 0 360 0 90
Dislin::height 50
Dislin::title

Dislin::height 30
for { set i 0 } { $i < 9 } { incr i } {
    set zlev [expr -2. + $i * 0.5]
```

```
    if {$i == 4} {
       Dislin::labels NONE CONTUR
    } else {
       Dislin::labels FLOAT CONTUR
    }
    Dislin::setclr [expr ($i + 1) * 28]
    Dislin::contur $xray $n $yray $m $zmat $zlev
}
Dislin::disfin
```

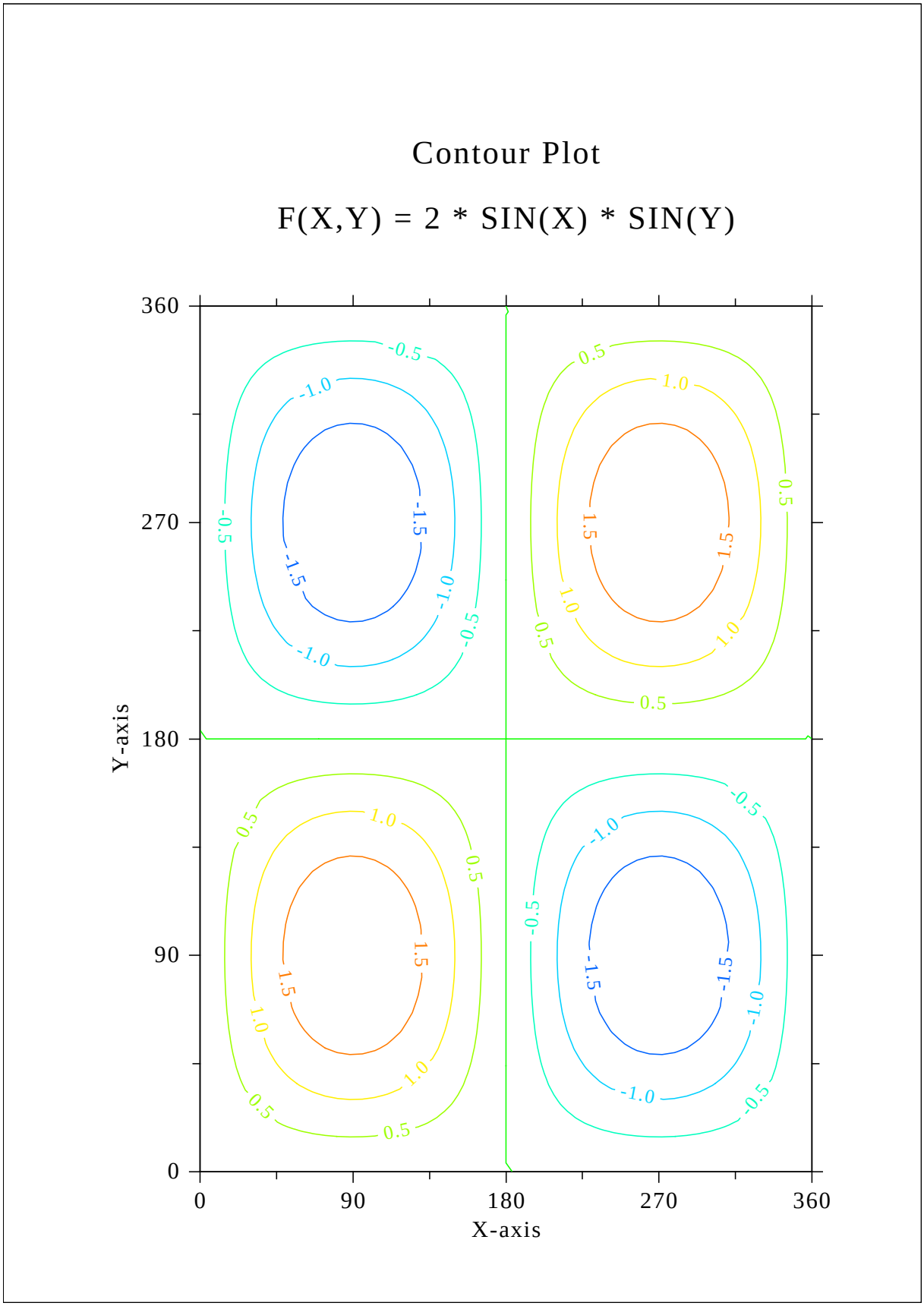

Figure B.13: Contour Plot

B.14 Shaded Contour Plot

```
load dislin.so

set ctit1 "Shaded Contour Plot"
set ctit2 "F(X,Y) = (X^2% - 1)^2% + (Y^2% - 1)^2%"

set n 50
set m 50
set stepx [expr 1.6 / ($n - 1)]
set stepy [expr 1.6 / ($m - 1)]

for { set i 0 } { $i < $n } { incr i } {
    lappend xray [expr $i * $stepx]
}

for { set i 0 } { $i < $m } { incr i } {
    lappend yray [expr $i * $stepy]
}

for { set i 0 } { $i < $n } { incr i } {
    set x [lindex $xray $i]
    set x [expr $x * $x - 1]
    set x [expr $x * $x]
    for { set j 0 } { $j < $m } { incr j } {
        set y [lindex $yray $j]
        set y [expr $y * $y - 1]
        set y [expr $y * $y]
        lappend zmat [expr $x + $y]
    }
}

Dislin::metafl cons
Dislin::setpag da4p

Dislin::disini
Dislin::pagera
Dislin::complx
Dislin::mixalf
Dislin::newmix

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 { set i 0 } { $i < 12 } { incr i } {
```

```
    lappend zlev [expr 0.1 + (11 - $i) * 0.1]
}
Dislin::conshd $xray $n $yray $m $zmat $zlev 12

Dislin::height 50
Dislin::title
Dislin::disfin
```

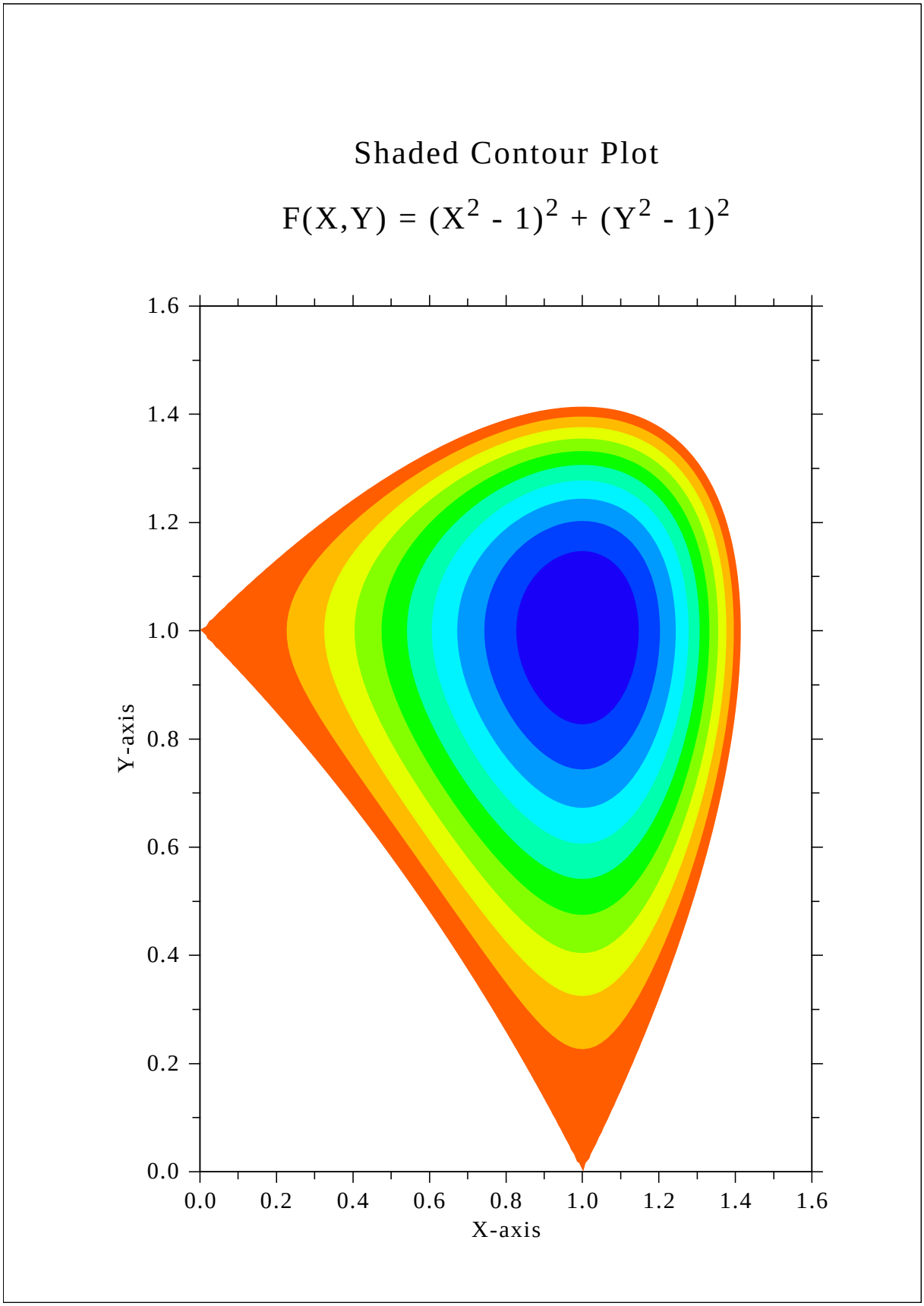

Figure B.14: Shaded Contour Plot

B.15 Pie Charts

```
load dislin.so

set xray [list 1. 2.5 2. 2.7 1.8]

set 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

set cbuf " "
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

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
```

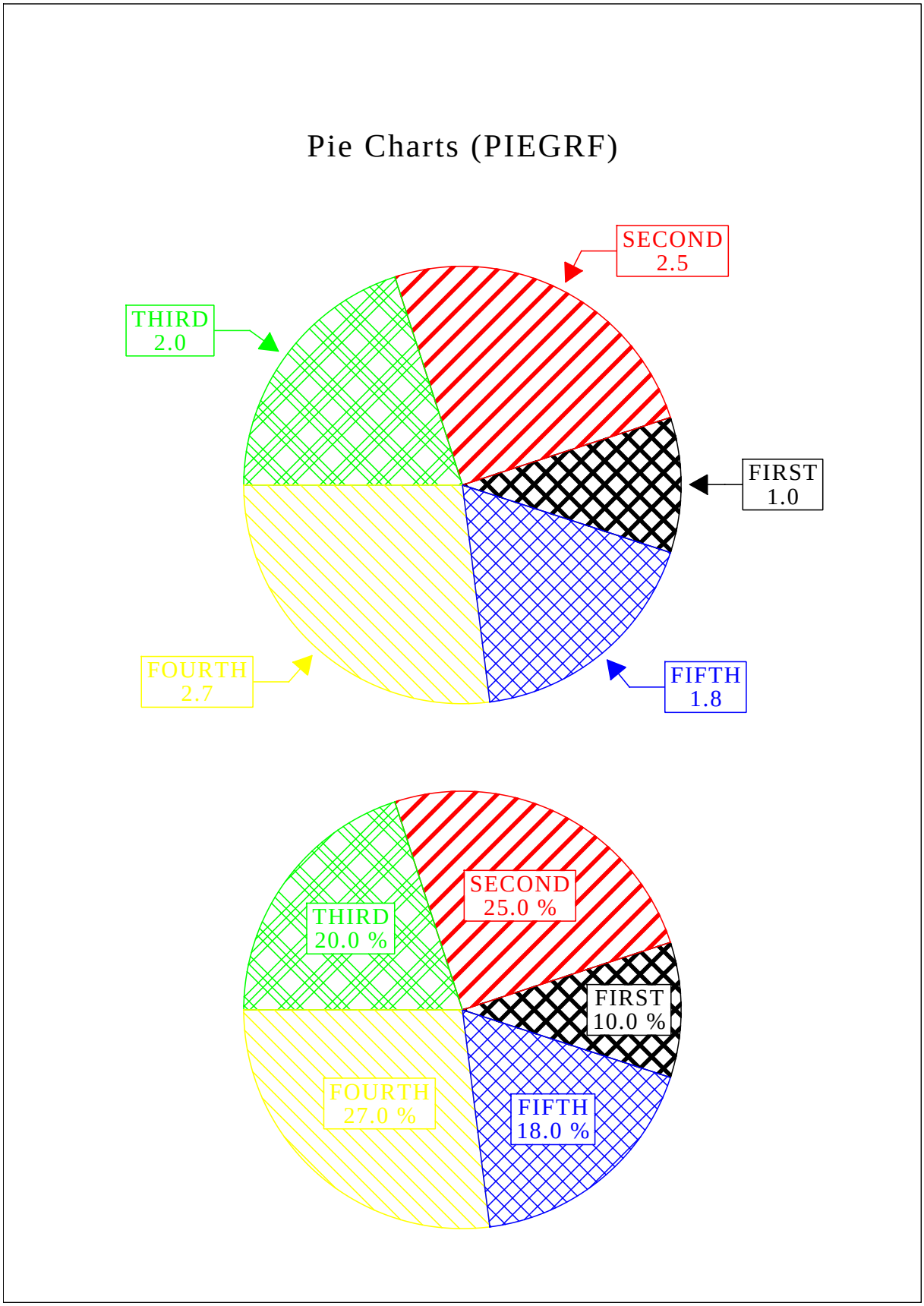

Figure B.15: Pie Charts

B.16 World Coastlines and Lakes

```
load dislin.so

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
```

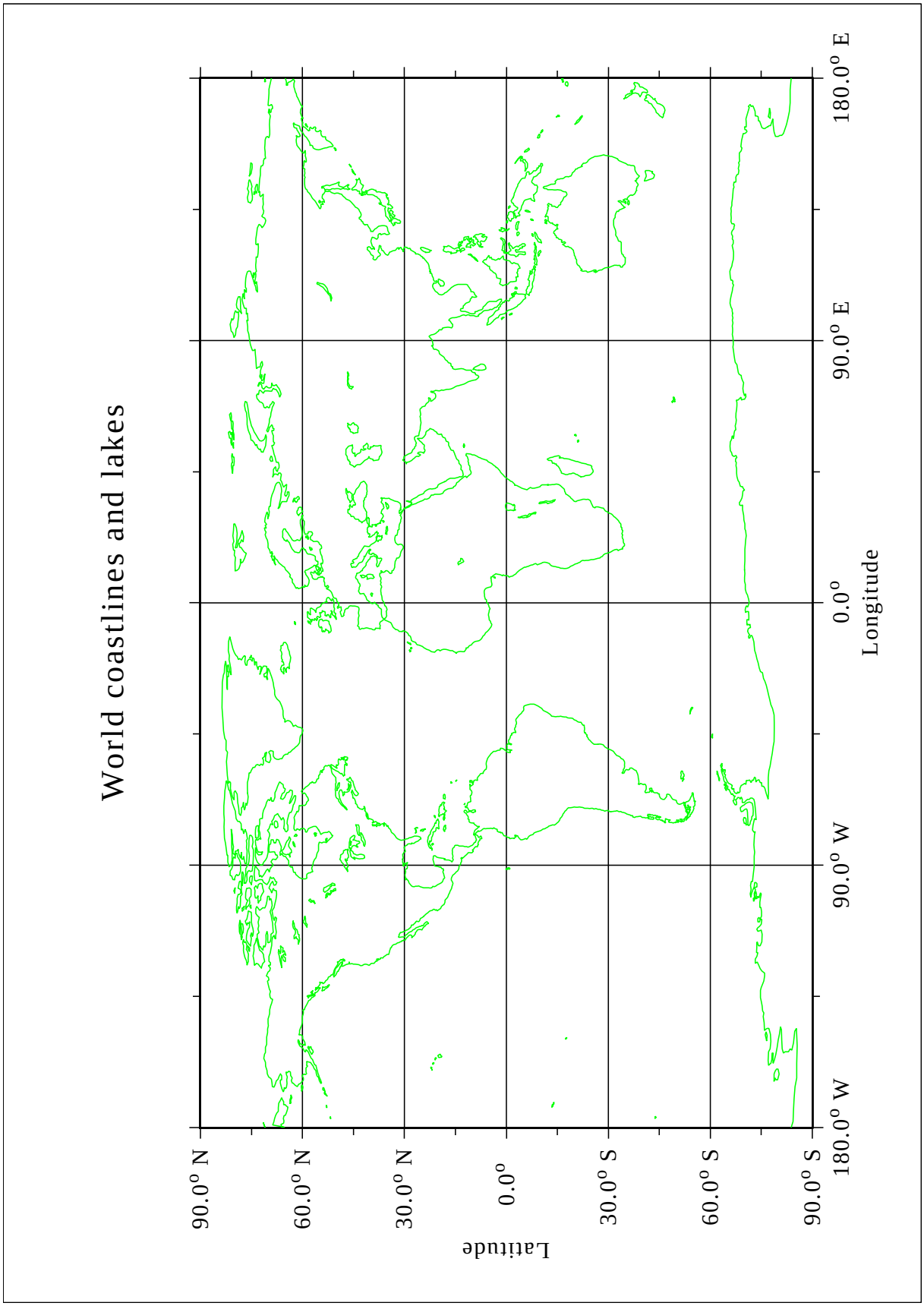

Figure B.16: World Coastlines and Lakes