

Appendix A

Short Description of Routines

Initialization and Introductory Routines

DISINI	initializes DISLIN.
ERASE	clears the screen.
FILBOX	defines the position and size of included metafiles.
HWORIG	defines the origin of the PostScript hardware page.
HWPAGE	defines the size of the PostScript hardware page.
INCFIL	includes metafiles into a graphics.
METAFL	defines the plotfile format.
NEWPAG	creates a new page.
ORIGIN	defines the origin.
PAGE	sets the page size.
PAGERA	plots a page border.
PAGHDR	plots a page header.
PAGMOD	selects a page rotation.
SCLFAC	defines a scaling factor for the entire plot.
SCLMOD	defines a scaling mode.
SCRMOD	swaps back- and foreground colours.
SETFIL	sets the plotfile name.
SETPAG	selects a predefined page format.
SETXID	defines an external X window or pixmap.
SYMFIL	sends a plotfile to a device.
UNIT	defines the logical unit for messages.

Termination and Parameter Resetting

DISFIN	terminates DISLIN.
ENDGRF	terminates an axis system and sets the level to 1.
RESET	resets parameters to default values.

Plotting Text and Numbers

ANGLE	defines the character angle.
CHAANG	defines an inclination angle for characters.
CHASPC	affects character spacing.
CHAWTH	affects the width of characters.
FIXSPC	sets a constant character width.
FRMESS	defines the thickness of text frames.
HEIGHT	defines the character height.
MESSAG	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.
NLMESS	returns the length of character strings in plot coordinates.
NUMBER	plots floating-point numbers.
NUMFMT	determines the format of numbers.
NUMODE	modifies the appearance of numbers.
RLMESS	plots text where the position is specified in user coordinates.
RLNUMB	plots numbers where the position is specified in user coordinates.
SETBAS	determines the position of indices and exponents.
SETEXP	determines the character height of indices and exponents.
SETMIX	defines global control signs for plotting indices and exponents.
TXTJUS	defines the alignment of text and numbers.

Fonts

BASALF	defines the base alphabet.
COMPLX	sets a complex font.
DUPLX	sets a double-stroke font.
DISALF	sets the default font.
EUSHFT	defines a shift character for special 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	sets a PostScript font.
SERIF	sets a complex shaded font.
SIMPLX	sets a single-stroke font.
SMXALF	defines shift characters for alternate alphabets.
TRIPLX	sets a triple-stroke font.

Symbols

HSYMBL	defines the height of symbols.
RLSYMB	plots symbols where the centre is specified in user coordinates.
SYMBOL	plots symbols.
SYMROT	defines a rotation angle for symbols.

Axis Systems

AX2GRF	suppresses the plotting of the upper X- and the left Y-axis.
AX3LEN	defines axis lengths for a coloured 3-D axis system.
AXGIT	plots the lines $X = 0$ and $Y = 0$.
AXSLEN	defines axis lengths for a 2-D axis system.
AXSORG	determines the position of crossed axis systems.
AXSPOS	determines the position of axis systems.
AXSTYP	selects rectangular or crossed axis systems.
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	defines the frame thickness of axis systems.
GRACE	affects the clipping margin of axis systems.
GRAF	plots a two-dimensional axis system.
GRAF3	plots an axis system for colour graphics.

GRDPOL	plots a polar grid.
GRID	overlays a grid on an axis system.
NOCLIP	suppresses clipping of user coordinates.
NOGRAF	suppresses the plotting of an axis system.
SETGRF	suppresses parts of an axis system.
SETSCL	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.

Secondary Axes

XAXIS	plots a linear X-axis.
XAXLG	plots a logarithmic X-axis.
YAXIS	plots a linear Y-axis.
YAXLG	plots a logarithmic Y-axis.
ZAXIS	plots a linearly scaled colour bar.
ZAXLG	plots a logarithmically scaled colour bar.

Modification of Axes

AXCLRS	defines colours for axis elements.
AXENDS	suppresses certain labels.
DIGITS	sets the number of decimal places for labels.
HNAME	defines the character height of axis names.
INTAX	defines integer numbering for all axes.
LABDIS	sets the distance between labels and ticks.
LABELS	selects labels.
LABJUS	defines the alignment of axis labels.
LABPOS	determines the position of labels.
LABTYP	defines vertical or horizontal labels.
LOGTIC	modifies the appearance of logarithmic ticks.
MYLAB	sets user-defined labels.
NAMDIS	sets the distance between axis names and labels.
NAME	defines axis titles.
NAMJUS	defines the alignment of axis titles.
NOLINE	suppresses the plotting of axis lines.
RGTLAB	right-justifies labels.
RVYNAM	defines an angle for Y-axis names.
SCALE	defines the axis scaling.
TICKS	sets the number of ticks.
TICLEN	sets the length of ticks.
TICPOS	determines the position of ticks.
TIMOPT	modifies time labels.

Axis System Titles

HTITLE	defines the character height of titles.
LFTTIT	left-justifies title lines.
LINESP	defines line spacing.
TITJUS	defines the alignment of titles.
TITLE	plots axis system titles.
TITLIN	defines text lines for titles.
TITPOS	defines the position of titles.
VKYTIT	shifts titles in the vertical direction.

Plotting Data Points

BARS	plots a bar graph.
CHNATT	changes curve attributes.
CHNCRV	defines attributes changed automatically by CURVE.
COLOR	defines the colour used for text and lines.
CRVMAT	plots a coloured surface.
CURVE	plots curves.
CURVE3	plots coloured rectangles.
CURVX3	plots rows of coloured rectangles.
CURVY3	plots columns of coloured rectangles.
ERRBAR	plots error bars.
FIELD	plots a vector field.
GAPCRV	defines gaps plotted by CURVE.
INCCRV	defines the number of curves plotted with equal attributes.
INCMRK	selects symbols or lines for CURVE.
MARKER	sets the symbols plotted by CURVE.
NOCHEK	suppresses listing of data points that lie outside of the axis scaling.
PIEGRF	plots a pie chart.
POLCRV	defines the interpolation method used by CURVE.
RESATT	resets curve attributes.
SETRES	sets the size of coloured rectangles.
SHDCRV	plots shaded areas between curves.
SPLMOD	modifies spline interpolation.
THKCRV	defines the thickness of curves.

Legends

FRAME	sets the frame thickness of legends.
LEGEND	plots legends.
LEGINI	initializes legends.
LEGLIN	defines text for legend lines.
LEGOPT	modifies the appearance of legends.
LEGPAT	stores curve attributes.
LEGPOS	determines the position of legends.
LEGTIT	defines the legend title.
LINESP	affects line spacing.
MIXLEG	enables multiple text lines in legends.
NXLEGN	returns the width of legends in plot coordinates.
NYLEGN	returns the height of legends in plot coordinates.

Line Styles and Shading Patterns

CHNDOT	sets a dotted-dashed line style.
CHNSH	sets a dashed-dotted line style.
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	defines a line style.
LINWID	sets the line width.
LNCAP	sets the line cap parameter.

LNJOIN	sets the line join parameter.
LNMLT	sets the miter limit parameter.
MYLINE	sets a user-defined line style.
MYPAT	defines a global shading pattern.
PENWID	sets the pen width.
SHDPAT	selects a shading pattern.
SOLID	sets a solid line style.

Cycles

CLRCYC	modifies the colour cycle.
LINCYC	modifies the line style cycle.
PATCYC	modifies the pattern cycle.

Base Transformations

TRFRES	resets base transformations.
TRFROT	affects the rotation of plot vectors.
TRFSCL	affects the scaling of plot vectors.
TRFSHF	affects the shifting of plot vectors.

Shielding

SHIELD	defines automatic shielding.
SHLCIR	defines circles as shielded areas.
SHLDEL	deletes shielded areas.
SHLELL	defines ellipses as shielded areas.
SHLIND	returns the index of a shielded area.
SHLPIE	defines pie segments as shielded areas.
SHLPOL	defines polygons as shielded areas.
SHLRCT	defines rotated rectangles as shielded areas.
SHLREC	defines rectangles as shielded areas.
SHLRES	deletes shielded areas.
SHLVIS	enables or disables shielded areas.

Parameter Requesting Routines

GETANG	returns the current angle used for text and numbers.
GETCLP	returns the current clipping window.
GETCLR	returns the current colour number.
GETDIG	returns the number of decimal places used in labels.
GETFIL	returns the current plotfile name.
GETGRF	returns the scaling of the current axis system.
GETHGT	returns the current character height.
GETIND	returns the RGB coordinates for a colour index.
GETLAB	returns the current labels.
GETLEN	returns the current axis lengths.
GETLEV	returns the current level.
GETLIN	returns the current line width.
GETMFL	returns the current file format.
GETOR	returns the current origin.
GETPAG	returns the current page size.
GETPAT	returns the current shading pattern.
GETPLV	returns the patchlevel of the current DISLIN library.

GETPOS	returns the position of the axis system.
GETRAN	returns the range of colour bars.
GETRES	returns the size of points used in 3-D colour graphics.
GETRGB	returns the RGB coordinates of the current colour.
GETSCL	returns the current axis scaling.
GETSP1	returns the distance between axis ticks and labels.
GETSP2	returns the distance between axis labels and names.
GETSYM	returns the current symbol number and height.
GETTCL	returns the current tick lengths.
GETTIC	returns the number of ticks plotted between labels.
GETTYP	returns the current line style.
GETUNI	returns the current unit used for messages.
GETVER	returns the version number of the currently used DISLIN library.
GETVK	returns the current lengths used for shifting.
GETVLT	returns the current colour table.
GETWID	returns the width of colour bars.
GETWIN	returns the position and size of the graphics window.
GETXID	returns the X window ID.

Elementary Plot Routines

ARCELL	plots elliptical arcs.
AREAF	plots polygons.
CIRCLE	plots circles.
CONNPT	plots a line to a point.
ELLIPS	plots ellipses.
LINE	plots lines.
NOARLN	suppresses the outline of geometric figures.
PIE	plots pie segments.
POINT	plots coloured rectangles where the position is defined by the centre point.
RECFLL	plots coloured rectangles.
RECTAN	plots rectangles.
RNDREC	plots a rectangle with rounded corners.
RLARC	plots elliptical arcs for user coordinates.
RLAREA	plots polygons for user coordinates.
RLCIRC	plots circles for user coordinates.
RLELL	plots ellipses for user coordinates.
RLINE	plots lines for user coordinates.
RLPIE	plots pie segments for user coordinates.
RLPOIN	plots coloured rectangles for user coordinates.
RLREC	plots rectangles for user coordinates.
RLRND	plots for user coordinates a rectangle with rounded corners.
RLSEC	plots coloured pie sectors for user coordinates.
RLVEC	plots vectors for user coordinates.
SECTOR	plots coloured pie sectors.
STRTPT	moves the pen to a point.
VECTOR	plots vectors.
XMOVE	moves the pen to a point.
XDRAW	plots a line to a point.

Conversion of Coordinates

COLRAY	converts Z-coordinates to colour numbers.
NXPOSN	converts X-coordinates to plot coordinates.
NYPOSN	converts Y-coordinates to plot coordinates.
NZPOSN	converts Z-coordinates to colour numbers.
TRFCO1	converts one-dimensional coordinates.
TRFCO2	converts two-dimensional coordinates.
TRFCO3	converts three-dimensional coordinates.
TRFREL	converts X- and Y-coordinates to plot coordinates.
XINVR	converts X plot coordinates to user coordinates.
XPOSN	converts X-coordinates to real plot coordinates.
YINVR	converts Y plot coordinates to user coordinates.
YPOSN	converts Y-coordinates to real plot coordinates.

Utility Routines

BEZIER	calculates a Bezier interpolation.
BITSI2	allows bit manipulation on 16 bit variables.
BITSI4	allows bit manipulation on 32 bit variables.
FCHA	converts floating-point numbers to character strings.
FLEN	calculates the number of digits for floating-point numbers.
HISTOG	calculates a histogram.
INTCHA	converts integers to character strings.
INTLEN	calculates the number of digits for integers.
NLMESS	returns the length of character strings in plot coordinates.
NLNUMB	returns the length of numbers in plot coordinates.
SORTR1	sorts floating-point numbers.
SORTR2	sorts points in the X-direction.
SPLINE	returns splined points as calculated in CURVE.
SWAPI2	swaps the bytes of 16 bit variables.
SWAPI4	swaps the bytes of 32 bit variables.
TRMLN	calculates the number of characters in character strings.
UPSTR	converts a character string to uppercase letters.

Binary File I/O

CLOSFL	closes a file.
OPENFL	opens a file for binary I/O.
POSIFL	skips to a certain position relative to the start.
READFL	reads a given number of bytes.
SKIPFL	skips a number of bytes from the current position.
TELLFL	returns the file position.
WRITFL	writes a given number of bytes.

Bar Graphs

BARGRP	affects clustered bars.
BARPOS	selects predefined positions for bars.
BARS	plots bar graphs.
BARTYP	selects vertical or horizontal bars.
DIGITS	defines the number of decimal places in bar labels.
LABCLR	defines the colour of bar labels.
LABELS	defines bar labels.
LABPOS	defines the position of bar labels.

Pie Charts

CHNPIE	defines colour and pattern attributes for pie segments.
DIGITS	defines the number of decimal places in segment labels.
LABCLR	defines the colour of segment labels.
LABELS	defines pie labels.
LABPOS	defines the position of segment labels.
LABTYP	modifies the appearance of segment labels.
PIEEXP	defines exploded pie segments.
PIELAB	sets additional character strings plotted in segment labels.
PIEVEC	modifies the arrow plotted between labels and segments.
SHDPIE	plots pie charts.
USRPIE	is a user-defined subroutine to modify pie charts.

Coloured 3-D Graphics

AX3LEN	defines axis lengths.
COLOR	defines colours.
COLRAN	defines the range of colour bars.
CRVMAT	plots a coloured surface.
CURVE3	plots coloured rectangles.
CURVX3	plots rows of coloured rectangles.
CURVY3	plots columns of coloured rectangles.
ERASE	erases the screen.
GRAF3	plots a coloured axis system.
HSVRGB	converts HSV to RGB coordinates.
MYVLT	changes the current colour table.
NOBAR	suppresses the plotting of colour bars.
NOBGD	suppresses the plotting of points which have the same colour as the background.
NZPOSN	converts a Z-coordinate to a colour number.
POINT	plots coloured rectangles.
RECFL	plots coloured rectangles.
REVSCR	exchanges the colours with the indices 0 and 255.
RGBHSV	converts RGB to HSV coordinates.
RLPOIN	plots coloured rectangles for user coordinates where the position is defined by the centre point.
RLSEC	plots coloured pie sectors for user coordinates.
SECTOR	plots coloured pie sectors.
SETCLR	defines colours.
SETIND	changes the current colour table.
SETRES	defines the size of coloured rectangles.
SETRGB	defines colours.
SETVLT	selects a colour table.
VKXBAR	shifts colour bars in the X-direction.
VKYBAR	shifts colour bars in the Y-direction.
WIDBAR	defines the width of colour bars.
ZAXIS	plots linearly scaled colour bars.
ZAXLG	plots logarithmically scaled colour bars.

3-D Graphics

ABS3PT	converts absolute 3-D coordinates to plot coordinates.
AXIS3D	defines the lengths of the 3-D box.
BOX3D	plots a border around the 3-D box.
CONN3D	plots a line to a point in 3-D space.
CURV3D	plots curves or symbols.
FLAB3D	disables the suppression of axis labels.
GETMAT	calculates a function matrix from randomly distributed data points.
GRAF3D	plots an axis system.
GRFFIN	terminates a projection into 3-D space.
GRFINI	initializes projections in 3-D space.
GRID3D	plots a grid.
MDFMAT	modifies the algorithm used in GETMAT.
NOHIDE	disables the hidden-line algorithm.
POS3PT	converts user coordinates to absolute 3-D coordinates.
REL3PT	converts user coordinates to plot coordinates.
SHDMOD	defines flat or smooth shading for surfaces.
SHLSUR	protects surfaces from overwriting.
STR3D	moves the pen to a point.
SURCLR	selects surface colours.
SURFCE	plots the surface of a function matrix.
SURFCP	plots a shaded surface of a parametric function.
SURFUN	plots the surface of the function $Z = F(X,Y)$.
SURMAT	plots the surface of a function matrix.
SURSHD	plots a coloured surface.
SURVIS	determines the visible part of surfaces.
VANG3D	defines the field of view.
VECTR3	plots vectors in 3-D space.
VFOC3D	defines the focus point.
VIEW3D	defines the viewpoint.
VUP3D	defines the camera orientation.
ZBFFIN	terminates the Z-buffer.
ZBFINI	allocates space for a Z-buffer.
ZBFLIN	plots lines.
ZBFTRI	plots triangles.
ZSCALE	defines a Z-scaling for coloured surfaces.

Geographical Projections

CURVMP	plots curves or symbols.
GRAFMP	plots a geographical axis system.
GRIDMP	plots a grid.
MAPMOD	modifies the connection of points used in CURVMP.
MAPPOL	defines the map pole used for azimuthal projections.
MAPREF	defines two latitudes used for conical projections.
POS2PT	converts user coordinates to plot coordinates.
PROJECT	selects a projection.
SHDEUR	shades European countries.
SHDMAP	shades continents.
WORLD	plots coastlines and lakes.
XAXMAP	plots a secondary X-axis.
YAXMAP	plots a secondary Y-axis.

Contouring

CONCRV	plots generated contours.
CONGAP	affects the spacing between contour lines and labels.
CONLAB	defines a character string used for contour labels.
CONMAT	plots contours.
CONMOD	affects the position of contour labels.
CONPTS	generates contours.
CONSHD	plots shaded contours.
CONTUR	plots contours.
LABCLR	defines the colour of contour labels.
LABDIS	defines the distance between labels.
LABELS	defines contour labels.
SHDMOD	sets the algorithm for shaded contours.

Image Routines

IMGINI	initializes transferring of image data.
IMGFIN	terminates transferring of image data.
RIMAGE	copies an image from memory to a file.
RPIXEL	reads a pixel from memory.
RPIXLS	reads image data from memory.
RPXROW	reads a row of image data from memory.
RTIFF	stores an image as a TIFF file.
TIFORG	defines the position of TIFF files copied with WTIFF.
TIFWIN	defines a clipping window for TIFF files copied with WTIFF.
WIMAGE	copies an image from file to memory.
WPIXEL	writes a pixel to memory.
WPIXLS	writes image data to memory.
WPXROW	write a row of image data to memory.
WTIFF	copies a TIFF file created by DISLIN to memory.

Window Routines

CLSWIN	closes a window.
OPNWIN	opens a window for graphics output.
SELWIN	selects a window for graphics output.
WINDOW	defines the position and size of windows.
WINID	returns the ID of the currently selected window.
WINMOD	affects the handling of windows in the termination routine DISFIN.
WINSIZ	defines the size of windows.
WINTIT	sets the title of the currently selected window.

Widget Routines

DWGBUT	displays a message that can be answered with 'Yes' or 'No'.
DWGFIL	creates a file selection box.
DWGLIS	gets a selection from a list of items.
DWGMSG	displays a message.
DWGTXT	prompts an user for input.
GETDSP	returns the terminal type.
GWGBOX	requests the value of a box widget.
GWGBUT	requests the status of a button widget.
GWGFIL	requests the value of a file widget.

GWGLIS	requests the value of a list widget.
GWGSCL	requests the value of a scale widget.
GWGTX	requests the value of a text widget.
ITMCAT	concatenates an element to a list string.
ITMCNT	calculates the number of elements in a list string.
ITMSTR	extracts an element from a list string.
MSGBOX	prints a message.
SWGBOX	changes the selection of a box widget.
SWGBUT	changes the status of a button widget.
SWGCB	connects a widget with a callback routine.
SWGFI	changes the value of a file widget.
SWGHL	sets a character string that will be displayed if the Help menu is clicked.
SWGJUS	defines the alignment of label widgets.
SWGLIS	changes the selection of a list widget.
SWGMI	defines control characters.
SWGMO	defines ASCII or X Window mode for widgets.
SWGMR	defines widget margins.
SWGPO	modifies the appearance of the popup menubar.
SWGPO	defines the position of widgets.
SWGSC	changes the value of a scale widget.
SWGSI	defines the size of widgets.
SWGTI	sets a title for the main widget.
SWGTX	changes the value of a text widget.
SWGTY	modifies the appearance of widgets.
SWGWI	defines the position and size of widgets.
SWGWT	sets the default width of widgets.
WGAPP	creates an entry in a popup menu.
WGBAS	creates a container widget.
WGBOX	creates a list widget where the list elements are displayed as toggle buttons.
WGBUT	creates a button widget.
WGCMD	creates a command widget.
WGFI	creates a file widget.
WGFIN	terminates widget routines.
WGINI	creates a main widget and initializes widget routines.
WGLAB	creates a label widget.
WGLIS	creates a list widget.
WGLTX	creates a labeled text widget.
WGOK	creates a OK push button widget.
WGPBU	creates a push button widget.
WGPO	creates a popup menu.
WGQUI	creates a QUIT push button widget.
WGSCL	creates a scale widget.
WGTX	creates a text widget.

MPAe Emblem

MPAEPL	plots the MPAe emblem.
MPLANG	defines a rotation angle for the MPAe emblem.
MPLCLR	defines the fore- and background colours of the MPAe emblem.
MPLPOS	defines the position of the MPAe emblem.
MPLSI	defines the size of the MPAe emblem.
NOFILL	suppresses the shading of the MPAe emblem.

Appendix B

Examples

B.1 Demonstration of CURVE

```
PROGRAM EXA_1
PARAMETER (N=301)
DIMENSION XRAY(N),Y1RAY(N),Y2RAY(N)

PI=3.1415926
FPI=PI/180.
STEP=360./(N-1)

DO I=1,N
    XRAY(I)=(I-1)*STEP
    X=XRAY(I)*FPI
    Y1RAY(I)=SIN(X)
    Y2RAY(I)=COS(X)
END DO

CALL DISINI
CALL PAGERA
CALL COMPLX

CALL AXSPOS(450,1800)
CALL AXSLEN(2200,1200)

CALL NAME('X-axis','X')
CALL NAME('Y-axis','Y')

CALL DIGITS(-1,'X')
CALL TICKS(10,'XY')

CALL TITLIN('Demonstration of CURVE',1)
CALL TITLIN('SIN(X), COS(X)',3)

CALL GRAF(0.,360.,0.,90.,-1.,1.,-1.,0.5)
CALL TITLE

CALL CURVE(XRAY,Y1RAY,N)
CALL CURVE(XRAY,Y2RAY,N)

CALL DASH
CALL XAXGIT

CALL DISFIN
END
```

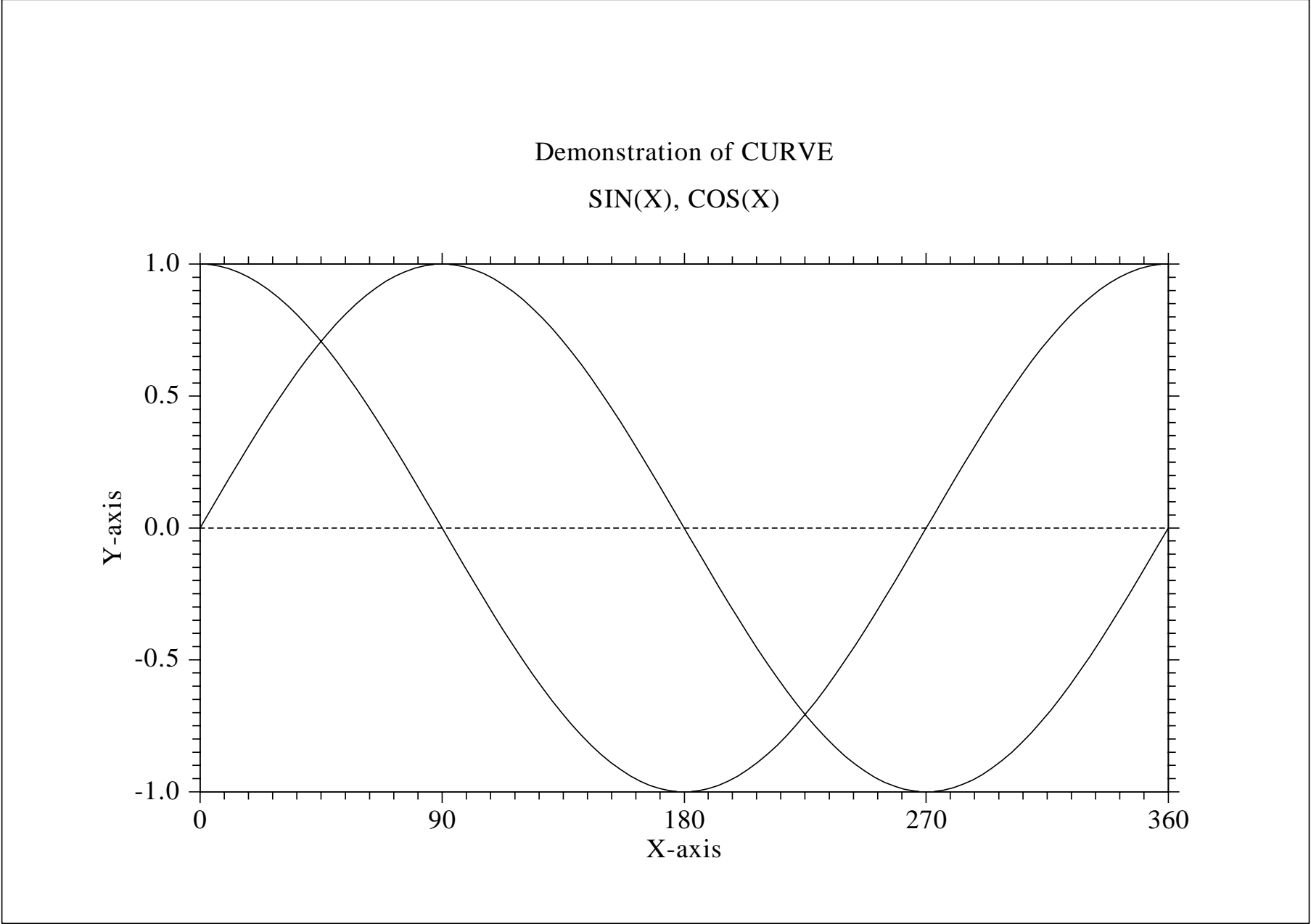


Figure B.1: Demonstration of CURVE

B.2 Symbols

```
PROGRAM EXA_2
CHARACTER*20 CTIT,CSTR*2
CTIT='Symbols'

CALL SETPAG('DA4P')
CALL DISINI
CALL COMPLX
CALL PAGERA
CALL PAGHDR('H. Michels  (','')',2,0)

CALL HEIGHT(60)

NL=NLMESS(CTIT)
CALL MESSAG(CTIT,(2100-NL)/2,200)

CALL HEIGHT(50)
CALL HSYMBL(120)

NY=150

DO I=0,21
  IF(MOD(I,4).EQ.0) THEN
    NY=NY+400
    NXP=550
  ELSE
    NXP=NXP+350
  END IF

  IF(I.LT.10) THEN
    WRITE(CSTR,'(I1)') I
  ELSE
    WRITE(CSTR,'(I2)') I
  END IF

  NL=NLMESS(CSTR)/2
  CALL MESSAG(CSTR,NXP-NL,NY+150)
  CALL SYMBOL(I,NXP,NY)
END DO

CALL DISFIN
END
```


Symbols



0



1



2



3



4



5



6



7



8



9



10



11



12



13



14



15



16



17



18



19



20



21

H. Michels (07.02.94, 11:56:51, DISLIN 5.3)

Figure B.2: Symbols

B.3 Logarithmic Scaling

```
PROGRAM EXA_3
CHARACTER*60 CTIT,CLAB(3)*5
DATA CLAB/'LOG','FLOAT','ELOG'//

CTIT='Logarithmic Scaling'

CALL SETPAG('DA4P')
CALL DISINI
CALL PAGERA
CALL COMPLX
CALL AXSLEN(1400,500)

CALL NAME('X-axis','X')
CALL NAME('Y-axis','Y')
CALL SCALE('LOG','XY')

CALL TITLIN(CTIT,2)

DO I=1,3
    NYA=2650-(I-1)*800
    CALL DIGITS(-1,'XY')
    IF(I.EQ.2)THEN
        CALL DIGITS(1,'Y')
        CALL NAME(' ','X')
    END IF

    CALL AXSPOS(500,NYA)
    CALL MESSAG('Labels: '//CLAB(I),600,NYA-400)
    CALL LABELS(CLAB(I),'XY')
    CALL GRAF(0.,3.,0.,1.,-1.,2.,-1.,1.)

    IF(I.EQ.3) THEN
        CALL HEIGHT(50)
        CALL TITLE
    END IF

    CALL ENDGRF
END DO

CALL DISFIN
END
```

Logarithmic Scaling

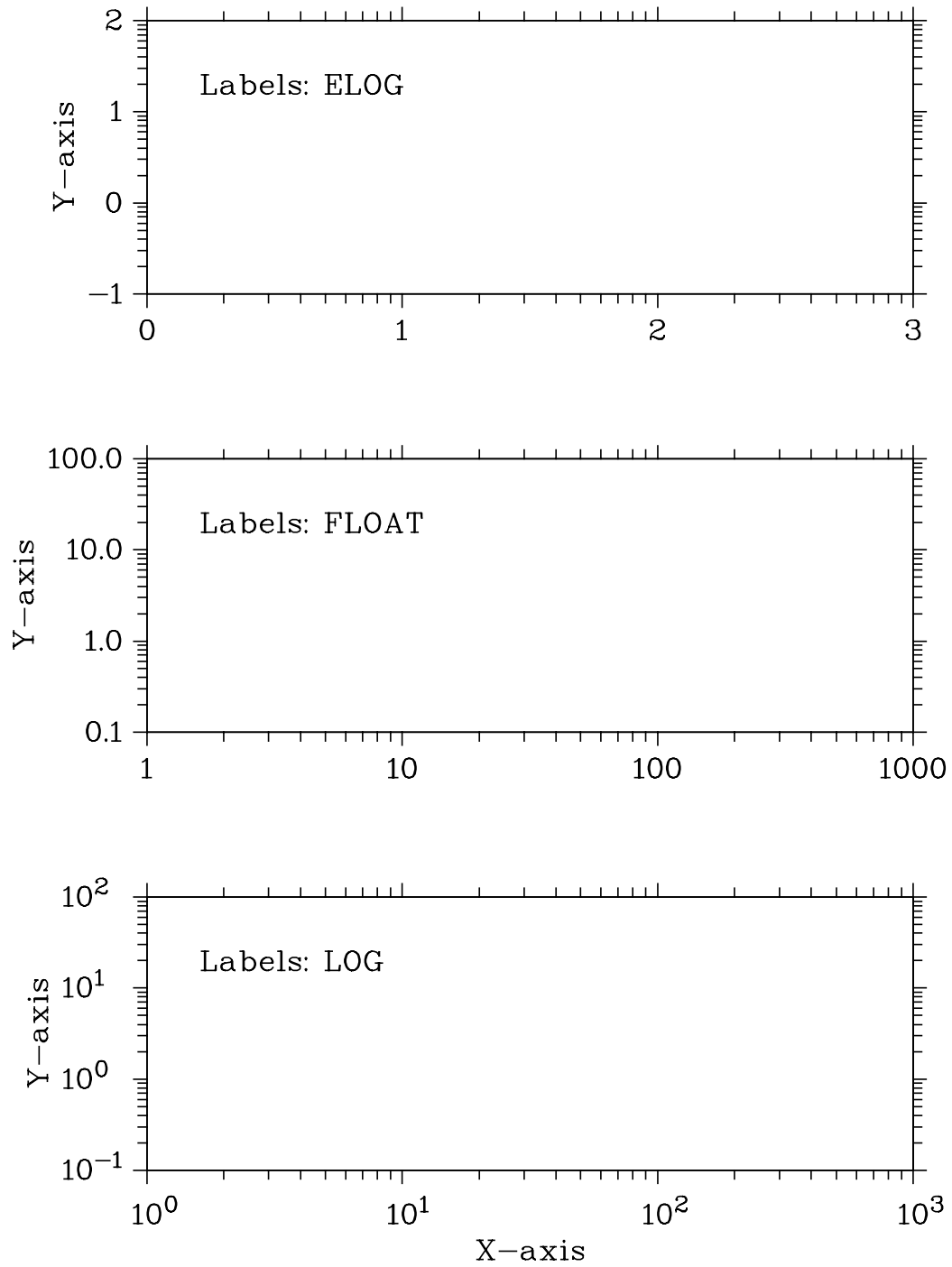


Figure B.3: Logarithmic Scaling

B.4 Interpolation Methods

```
PROGRAM EXA_4

DIMENSION X(16), Y(16)
CHARACTER*8 CPOL(6),CTIT*60

DATA X/0.,1.,3.,4.5,6.,8.,9.,11.,12.,12.5,13.,
*      15.,16.,17.,19.,20./,
* Y/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'/
* NYA/2700/

CTIT='Interpolation Methods'

CALL SETPAG('DA4P')
CALL DISINI
CALL PAGERA
CALL COMPLX
CALL INCMRK(1)
CALL HSYMBL(25)
CALL TITLIN(CTIT,1)
CALL AXSLEN(1500,350)
CALL SETGRF('LINE','LINE','LINE','LINE')

DO I=1,6
  CALL AXSPOS(350,NYA-(I-1)*350)
  CALL POLCRV(CPOL(I))
  CALL MARKER(0)

  CALL GRAF(0.,20.,0.,5.,0.,10.,0.,5.)
  NX=NXPOSN(1.)
  NY=NYPOSN(8.)
  CALL MESSAG(CPOL(I),NX,NY)
  CALL CURVE(X,Y,16)

  IF(I.EQ.6) THEN
    CALL HEIGHT(50)
    CALL TITLE
  END IF
  CALL ENDGRF
END DO

CALL DISFIN
END
```

Interpolation Methods

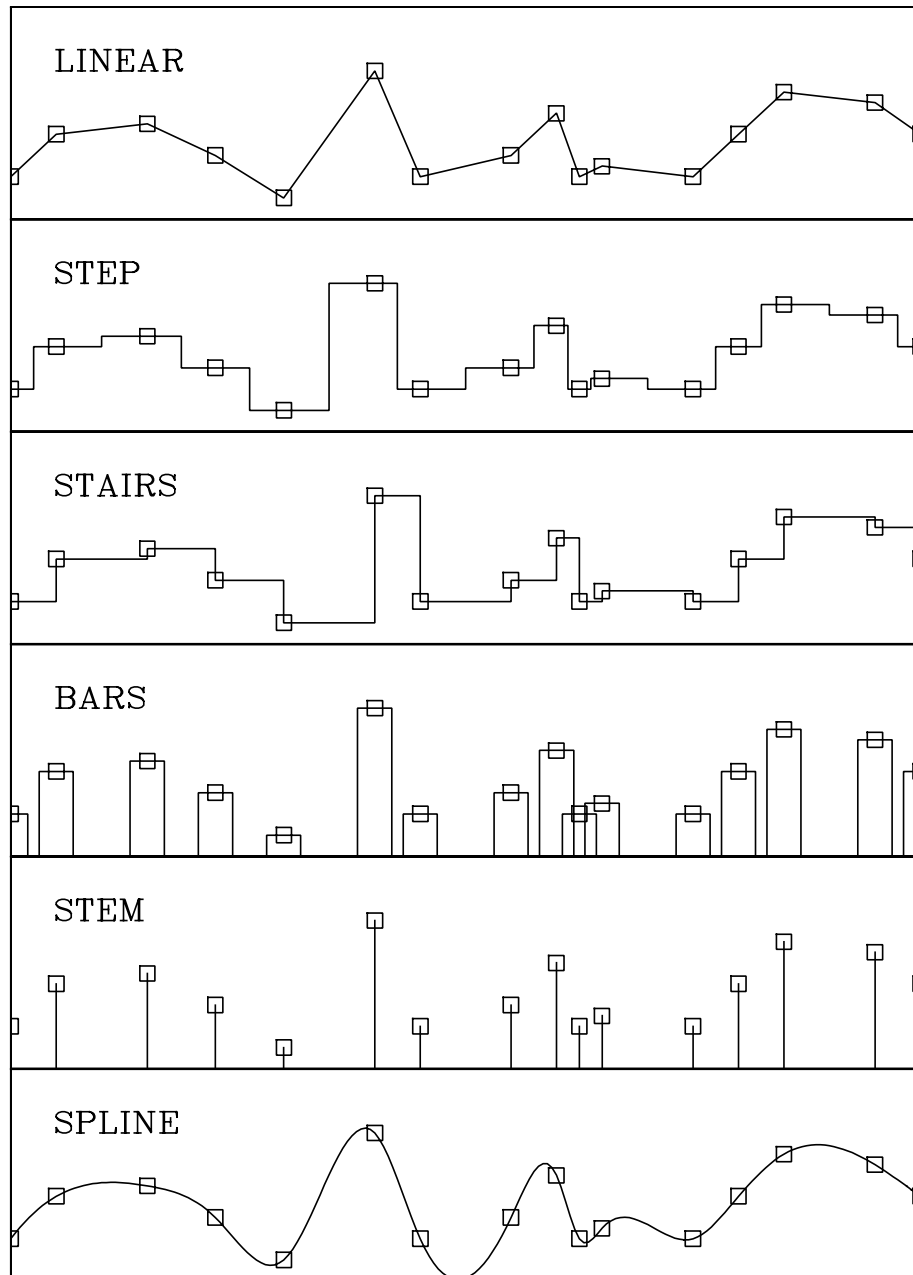


Figure B.4: Interpolation Methods

B.5 Line Styles

```
PROGRAM EXA_5
DIMENSION X(2),Y(2)
CHARACTER*6 CTYP(8)
DATA X/3.,9./CTYP/'SOLID','DOT','DASH','CHNDSH',
*                'CHNDOT','DASHM','DOTL','DASHL'/

CALL SETPAG('DA4P')
CALL DISINI
CALL PAGERA
CALL COMPLX
CALL CENTER
CALL CHNCRV('LINE')

CALL NAME('X-axis','X')
CALL NAME('Y-axis','Y')

CALL TITLIN('Demonstration of CURVE',1)
CALL TITLIN('Line Styles',3)

CALL GRAF(0.,10.,0.,2.,0.,10.,0.,2.)
CALL TITLE

DO I=1,8
  Y(1)=9.5-I
  Y(2)=9.5-I
  NY=NYPOSN(Y(1))
  NX=NXPOSN(1.0)
  CALL MESSAG(CTYP(I),NX,NY-20)
  CALL CURVE(X,Y,2)
END DO

CALL DISFIN
END
```

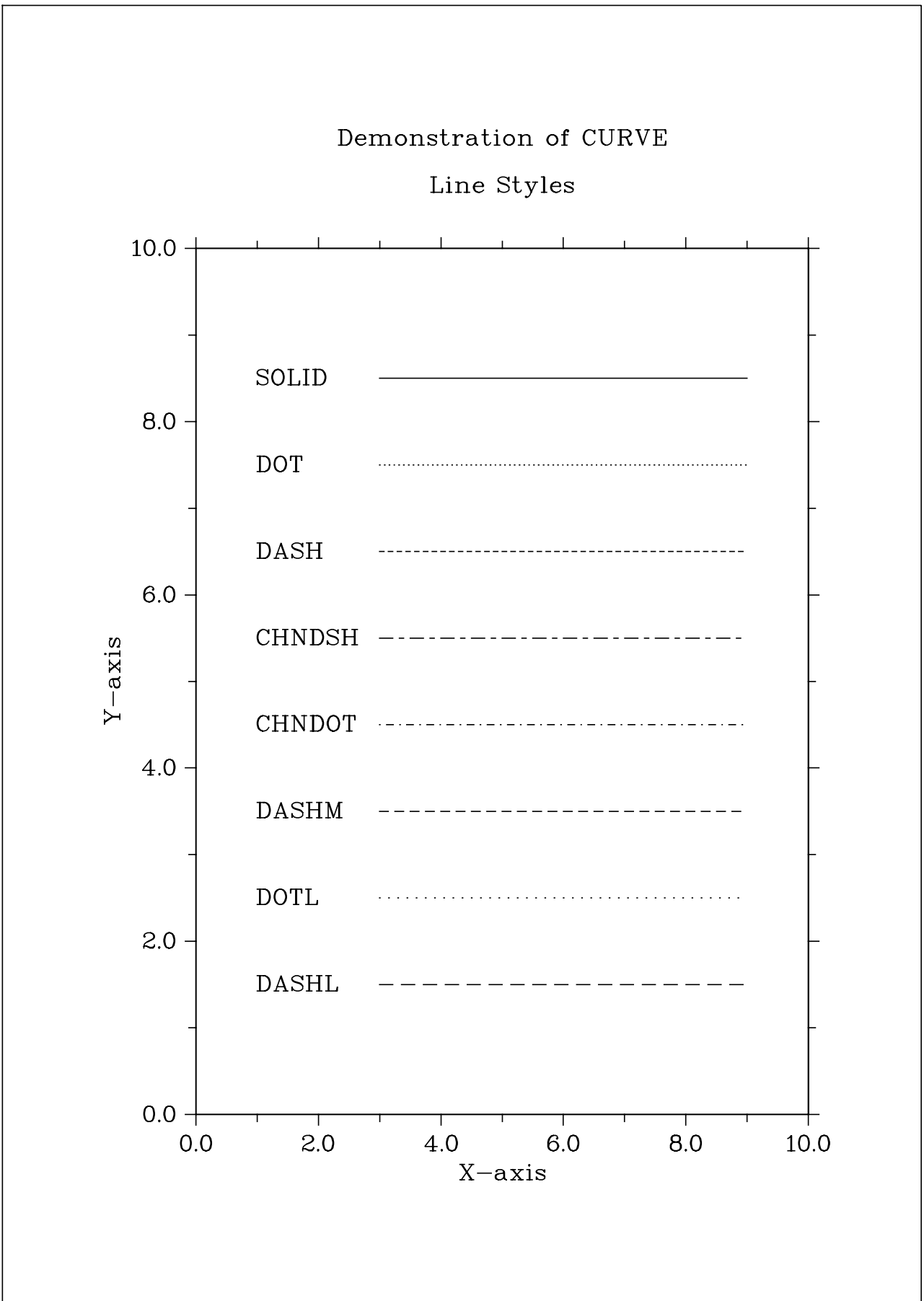


Figure B.5: Line Styles

B.6 Legends

```
PROGRAM EXA_6
PARAMETER(N=301)
DIMENSION XRAY(N),Y1RAY(N),Y2RAY(N)
CHARACTER*14 CBUF

FPI=3.1415926/180.
STEP=360./(N-1)
DO I=1,N
    XRAY(I)=(I-1)*STEP
    X=XRAY(I)*FPI
    Y1RAY(I)=SIN(X)
    Y2RAY(I)=COS(X)
END DO

CALL DISINI
CALL PAGERA
CALL COMPLX
CALL AXSPOS(450,1800)
CALL AXSLEN(2200,1200)

CALL NAME('X-axis','X')
CALL NAME('Y-axis','Y')
CALL TITLIN('Demonstration of CURVE',1)
CALL TITLIN('Legend',3)
CALL DIGITS(-1,'X')
CALL TICKS(10,'XY')

CALL GRAF(0.,360.,0.,90.,-1.,1.,-1.,0.5)
CALL TITLE
CALL XAXGIT

CALL CHNCRV('LINE')
CALL CURVE(XRAY,Y1RAY,N)
CALL CURVE(XRAY,Y2RAY,N)

CALL LEGINI(CBUF,2,7)      ! Legend statements
NX=NXPOSN(190.)
NY=NYPOSN(0.75)
CALL LEGPOS(NX,NY)
CALL LEGLIN(CBUF,'sin (x)',1)
CALL LEGLIN(CBUF,'cos (x)',2)
CALL LEGTIT('Legend')
CALL LEGEND(CBUF,3)

CALL DISFIN
END
```


Demonstration of CURVE

Legend

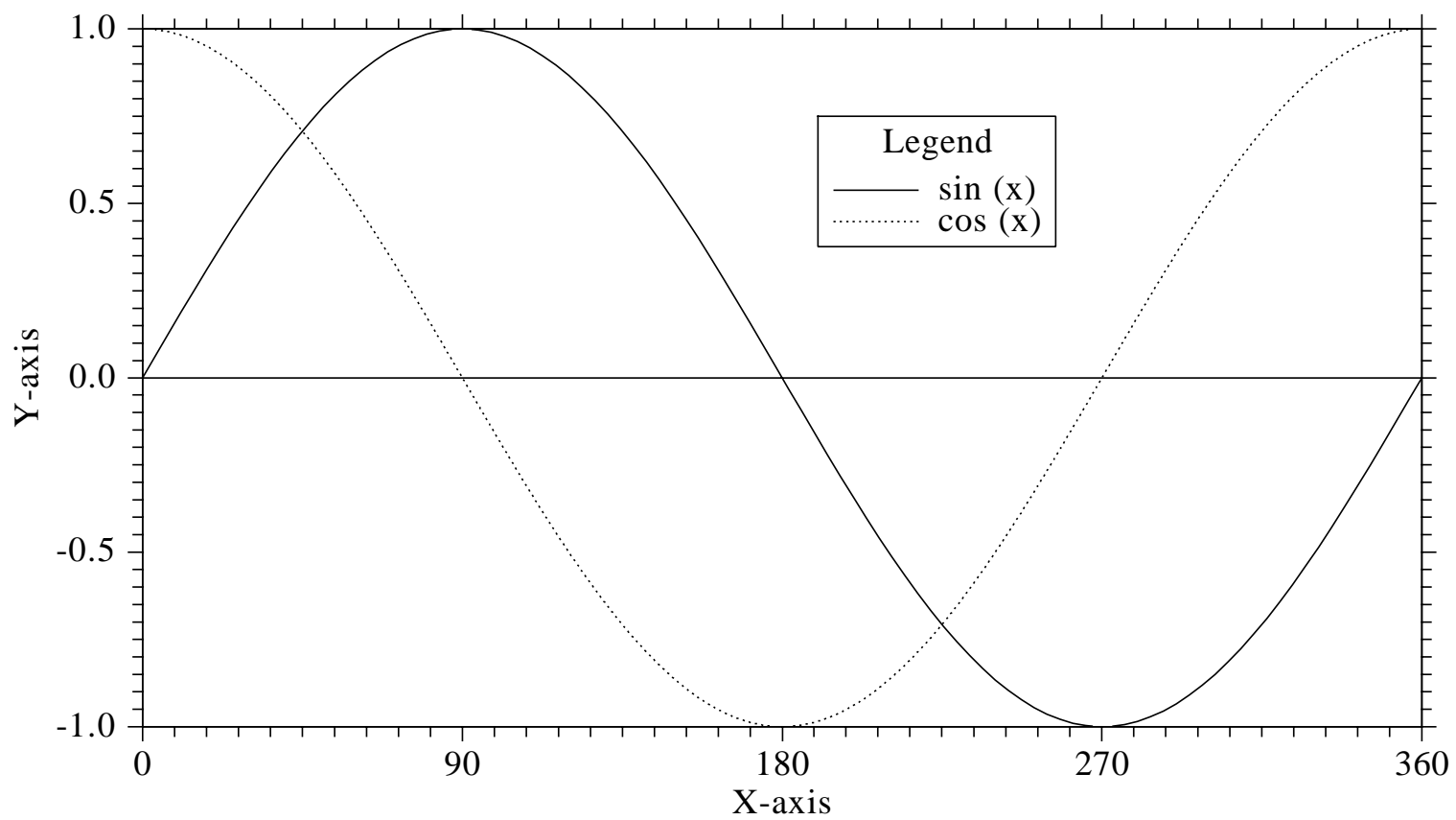


Figure B.6: Legends

B.7 Shading Patterns (AREAF)

```
PROGRAM EXA_7
DIMENSION IXP(4),IYP(4),IX(4),IY(4)
CHARACTER*60 CTIT,CSTR*2
DATA IX/0,300,300,0/IY/0,0,400,400/

CTIT='Shading Patterns (AREAF)'

CALL DISINI
CALL PAGERA
CALL COMPLX

CALL HEIGHT(50)
NL=NLMESS(CTIT)
NX=(2970-NL)/2
CALL MESSAG(CTIT,NX,200)

NX0=335
NY0=350

DO I=1,3
  NY=NY0+(I-1)*600
  DO J=1,6
    NX=NX0+(J-1)*400
    II=(I-1)*6+J-1
    CALL SHDPAT(II)
    WRITE(CSTR,'(I2)') II

    DO K=1,4
      IXP(K)=IX(K)+NX
      IYP(K)=IY(K)+NY
    END DO
    CALL AREAF(IXP,IYP,4)

    NL=NLMESS(CSTR)
    NX=NX+(300-NL)/2
    CALL MESSAG(CSTR,NX,NY+460)
  END DO
END DO

CALL DISFIN
END
```

Shading Patterns (AREAF)

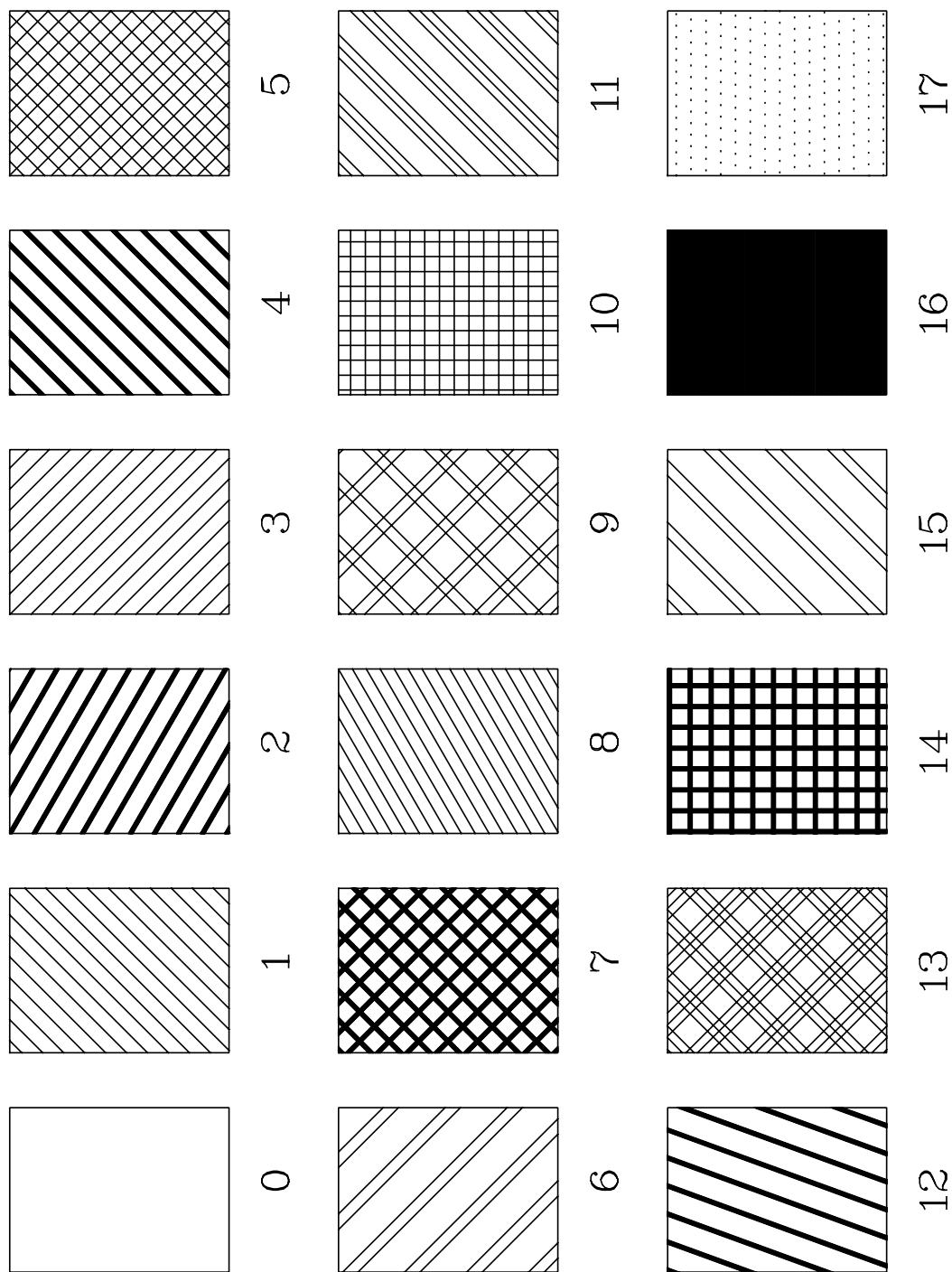


Figure B.7: Shading Patterns

B.8 Vectors

```
PROGRAM EXA_8
DIMENSION IVEC(20)
CHARACTER*60 CTIT,CNUM*4
DATA IVEC/0,1111,1311,1421,1531,1701,1911,
*          3111,3311,3421,3531,3703,4221,4302,
*          4413,4522,4701,5312,5502,5703/

CTIT='Vectors'

CALL DISINI
CALL PAGERA
CALL COMPLX

CALL HEIGHT(60)
NL=NLMESS(CTIT)
NX=(2970-NL)/2
CALL MESSAG(CTIT,NX,200)

CALL HEIGHT(50)
NX=300
NY=400

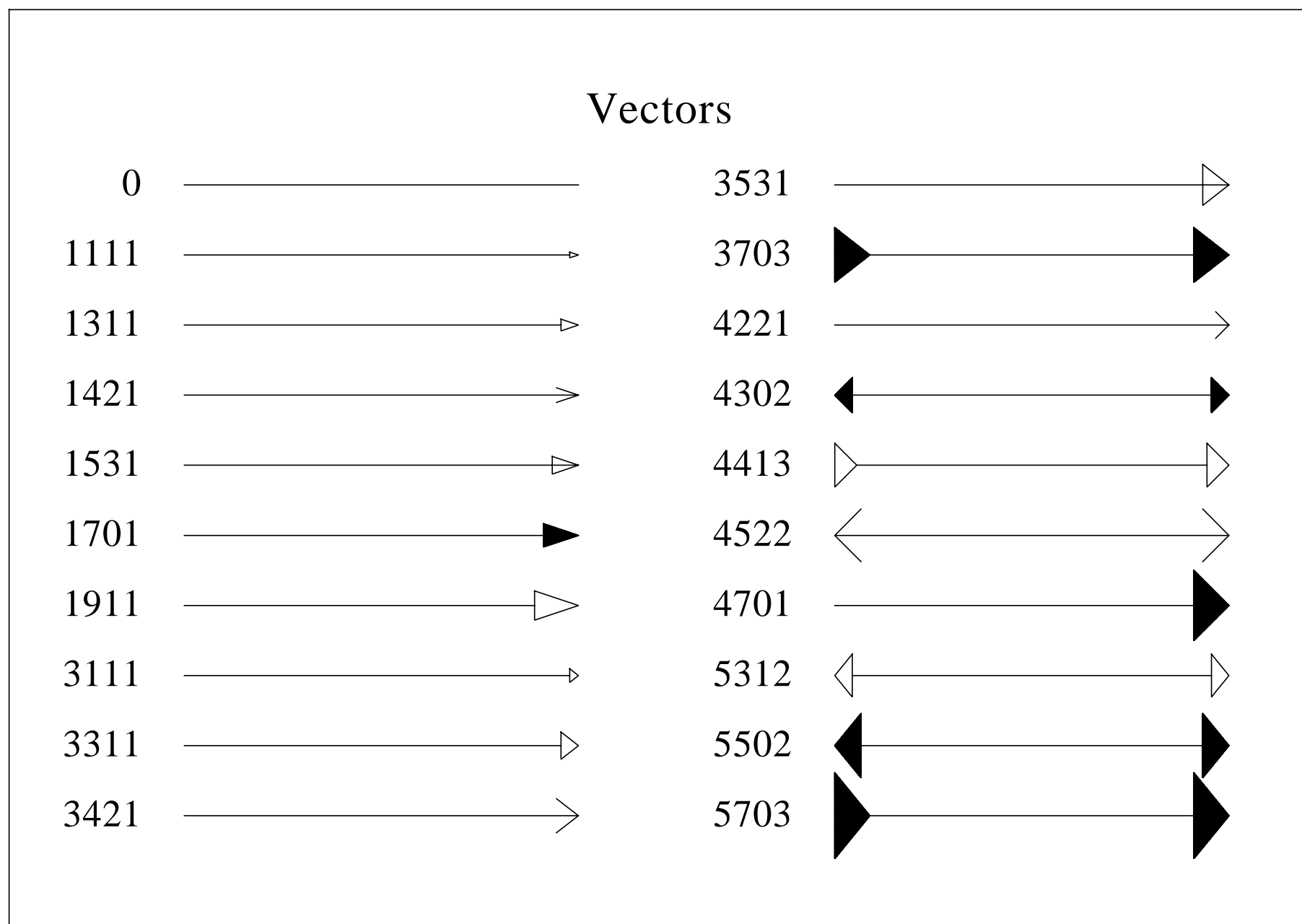
DO I=1,20
  IF(I.EQ.11) THEN
    NX=NX+2970/2
    NY=400
  END IF

  WRITE(CNUM,'(I4)') IVEC(I)
  NL=NLMESS(CNUM)
  CALL MESSAG(CNUM,NX-NL,NY-25 )

  CALL VECTOR(NX+100,NY,NX+1000,NY,IVEC(I))
  NY=NY+160
END DO

CALL DISFIN
END
```

Figure B.8: Vectors



B.9 Shading Patterns (PIEGRF)

```
PROGRAM EXA_9
DIMENSION XRAY(18)
CHARACTER*60 CTIT,CBUF*36,CSTR*2
DATA XRAY/18*1./

CTIT='Shading Patterns (PIEGRF)'

CALL SETPAG('DA4P')
CALL DISINI
CALL PAGERA
CALL COMPLX

CALL AXSPOS(250,2700)
CALL AXSLEN(1600,2200)
CALL TITLIN(CTIT,3)
CALL HEIGHT(50)

CALL LEGINI(CBUF,18,2)

DO I=1,18
    WRITE(CSTR,'(I2)') I-1
    CALL LEGLIN(CBUF,CSTR,I)
END DO

CALL LABELS('NONE','PIE')
CALL PIEGRF(CBUF,1,XRAY,18)
CALL TITLE

CALL DISFIN
END
```

Shading Patterns (PIEGRF)

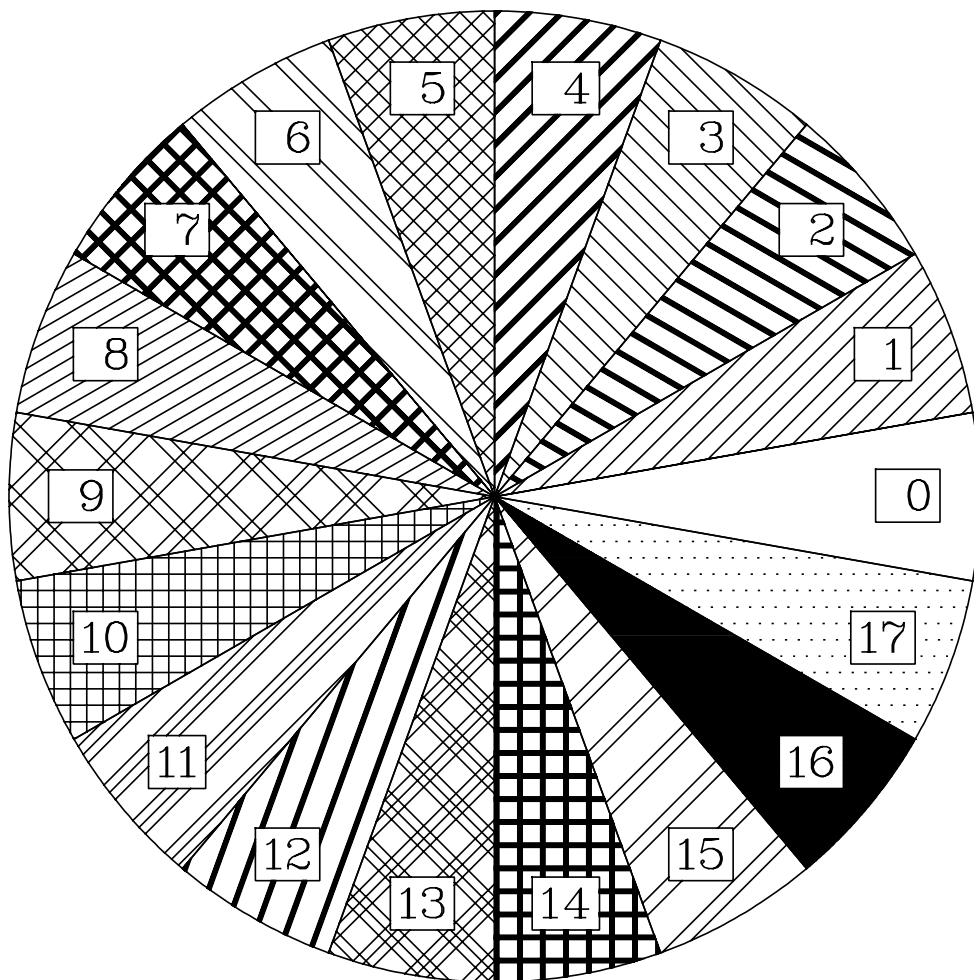


Figure B.9: Shading Patterns

B.10 Surface Plot (SURFUN)

```
PROGRAM EXA_10
CHARACTER*60 CTIT1,CTIT2
EXTERNAL ZFUN

CTIT1='Surface Plot (SURFUN)'
CTIT2='F(X,Y) = 2*SIN(X)*SIN(Y)'

CALL SETPAG('DA4P')
CALL DISINI
CALL PAGERA
CALL COMPLX

CALL AXSPOS(200,2600)
CALL AXSLEN(1800,1800)

CALL NAME('X-axis','X')
CALL NAME('Y-axis','Y')
CALL NAME('Z-axis','Z')

CALL TITLIN(CTIT1,2)
CALL TITLIN(CTIT2,4)

CALL VIEW3D(-5.,-5.,4.,'ABS')
CALL GRAF3D(0.,360.,0.,90.,0.,360.,0.,90.,
*          -3.,3.,-3.,1.)
CALL HEIGHT(50)
CALL TITLE

CALL SURFUN(ZFUN,1,10.,1,10.)

CALL DISFIN
END

FUNCTION ZFUN(X,Y)
FPI=3.14159/180.
ZFUN=2*SIN(X*FPI)*SIN(Y*FPI)
END
```


Surface Plot (SURFUN)
 $F(X,Y) = 2*\sin(X)*\sin(Y)$

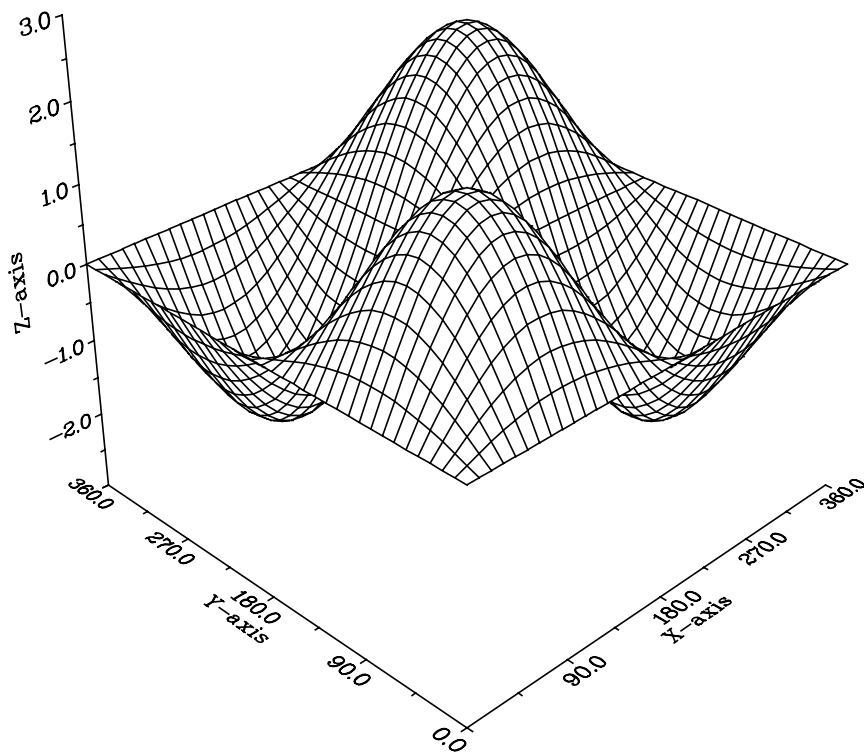


Figure B.10: Surface Plot

B.11 Map Plot

```
PROGRAM EXA_11
DIMENSION XC(9),YC(9)
CHARACTER*12 CSTR(9)

DATA XC/-22.,18.,37.5,0.,2.5,12.5,23.5,-3.75,14.25/
*      YC/64.,59.6,56.,51.5,48.5,42.,38.,40.3,50.1/
*      CSTR/'Reykjavik','Stockholm','Moskau','London',
*          'Paris','Rom','Athen','Madrid','Prag'/

CALL METAFL('POST')
CALL DISINI
CALL PAGERA
CALL HWFONT

CALL AXSPOS(500,1850)
CALL AXSLEN(2200,1400)

CALL DIGITS(-1,'xy')
CALL TICKS(1,'xy')
CALL NAME('Longitude','x')
CALL NAME('Latitude','y')

CALL TITLIN('Map Plot',3)
CALL INCMRK(-1)

CALL LABELS('MAP','xy')
CALL PROJCT('LAMBERT')
CALL FRAME(3)
CALL GRAFMP(-40.,60.,-40.,20.,35.,70.,40.,10.)

CALL WORLD
CALL CURVMP(XC,YC,9)

DO I=1,9
    CALL POS2PT(XC(I),YC(I),XP,YP)
    NXP=XP+30
    NYP=YP
    CALL MESSAG(CSTR(I),NXP,NYP)
END DO

CALL GRIDMP(1,1)

CALL HEIGHT(50)
CALL TITLE
CALL DISFIN
END
```

Map Plot

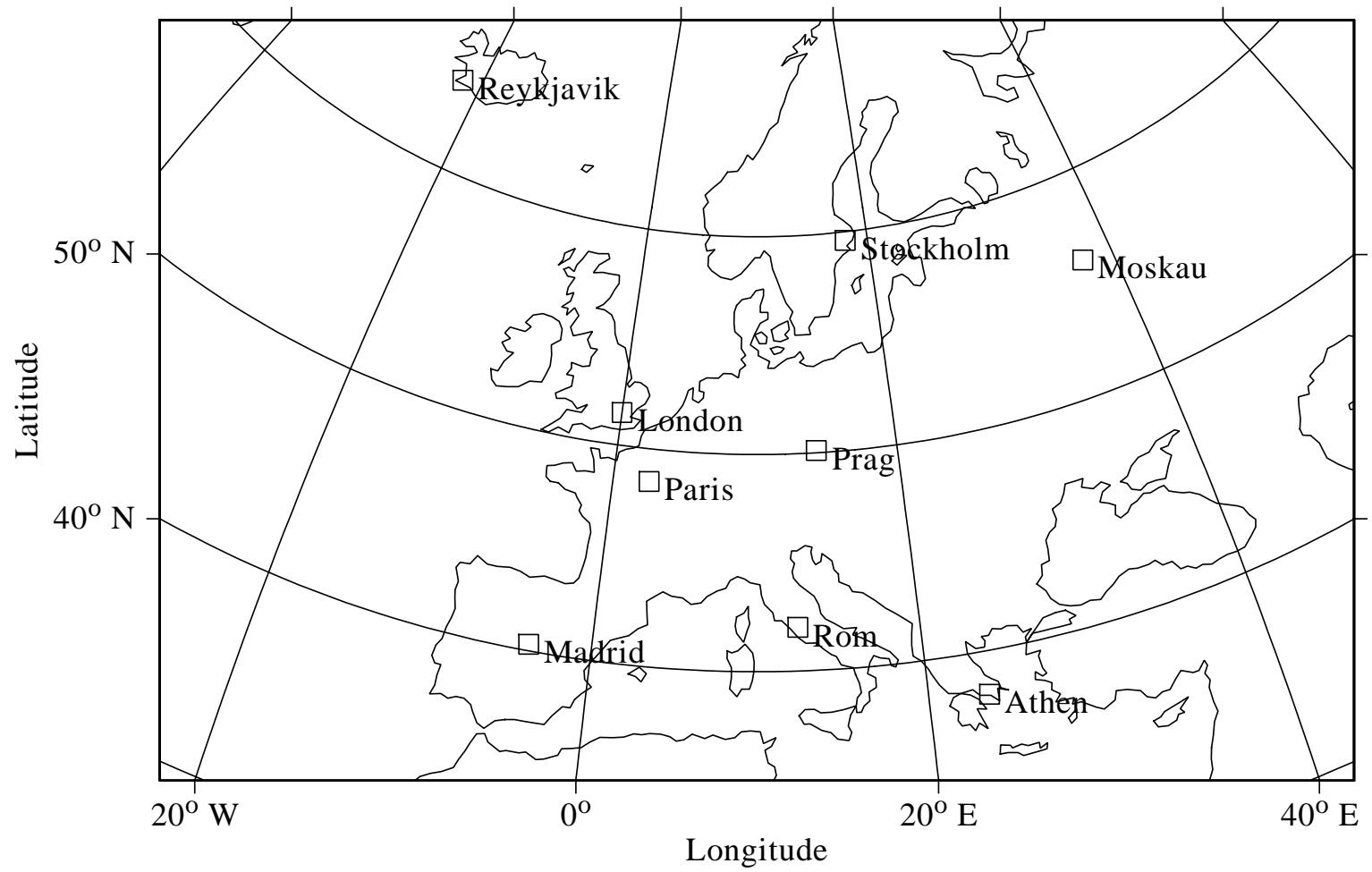


Figure B.11: Map Plot

Appendix C

Index

This appendix presents all routines in the graphics library in alphabetical order. For parameters, the following conventions are used:

- INTEGER variables begin with the character N or I
- CHARACTER variables begin with the character C
- other variables are REAL
- arrays end with the keyword 'RAY'.

The abbreviations have the meaning:

- ps denotes a parameter setting routine
- rq denotes a parameter requesting routine
- p denotes a plot routine.
- w denotes a widget routine.

Routine	Parameter	Level		Page
ABS3PT	(X, Y, Z, XP, YP)	3		132
ANGLE	(NGRAD)	1,2,3	ps	43
ARCELL	(NX, NY, NA, NB, A, B, T)	1,2,3	p	80
AREAF	(NXRAY, NYRAY, N)	1,2,3	p	80
AUTRES	(IXDIM, IYDIM)	1	ps	106
AX2GRF	none	1,2,3	ps	39
AX3LEN	(NXL, NYL, NZL)	1	ps	107
AXCLRS	(NCLR, COPT, CAX)	1,2,3	ps	41
AXENDS	(CSTR, CAX)	1,2,3	ps	39
AXGIT	none	2,3	p	17
AXIS3D	(X3AXIS, Y3AXIS, Z3AXIS)	1,2,3	ps	119
AXSLEN	(NXL, NYL)	1	ps	32
AXSORG	(NX, NY)	1	ps	32
AXSPOS	(NXA, NYA)	1	ps	31
AXSTYP	(COPT)	1	ps	31
BARGRP	(NGRP, GAP)	1,2,3	ps	92
BARPOS	(COPT)	1,2,3	ps	92
BARS	(XRAY, Y1RAY, Y2RAY, N)	2,3	p	91

Routine	Parameter	Level		Page
BARTYP	(CTYP)	1,2,3	ps	91
BARWTH	(FACTOR)	1,2,3	ps	63, 92
BASALF	(CALPH)	1,2,3	ps	46
BEZIER	(XRAY, YRAY, N, XPRAY, YPRAY, NP)	0,1,2,3		87
BITSI2	(NBITS, NINP2, IINP, NOUT2, IOUT, IOPT)	0,1,2,3		88
BITSI4	(NBITS, NINP, IINP, NOUT, IOUT, IOPT)	0,1,2,3		88
BOX2D	none	1,2,3	p	16
BOX3D	none	3	p	122
CENTER	none	1,2,3	ps	32
CHAANG	(ANGLE)	1,2,3	ps	45
CHASPC	(XSPC)	1,2,3	ps	44
CHAWTH	(XWTH)	1,2,3	ps	45
CHNATT	none	1,2,3	ps	61
CHNCRV	(CATT)	1,2,3	ps	61
CHNDOT	none	1,2,3	ps	64
CHNDSH	none	1,2,3	ps	64
CHNPIE	(CATT)	1,2,3	ps	94
CIRCLE	(NX, NY, NR)	1,2,3	p	79
CIRCSP	(NSPC)	1,2,3	ps	81
CLIP3D	(COPT)	1,2,3	ps	126
CLOSFL	(NLU)	0,1,2,3		89
CLPBOR	(COPT)	2,3	ps	40
CLPWIN	(NX, NY, NW, NH)	1,2,3	ps	40
CLRCYC	(INDEX, ICLR)	1,2,3	ps	67
CLRMOD	(CMOD)	0	ps	109
CLSWIN	(ID)	1,2,3	ps	114
COLOR	(CCOL)	1,2,3	ps	26
COLRAN	(NCA, NCE)	1,2,3	ps	108
COLRAY	(ZRAY, NRAY, N)	3		116
COMPLX	none	1,2,3	ps	45
CONCRV	(XRAY, YRAY, N, ZLEV)	2,3	p	153
CONGAP	(XFAC)	1,2,3	ps	157
CONLAB	(CSTR)	1,2,3	ps	156
CONMAT	(ZMAT, N, M, ZLEV)	2,3	p	154
CONMOD	(XFAC, XQUOT)	1,2,3	ps	157
CONN3D	(X, Y, Z)	3	p	131
CONNPT	(X, Y)	1,2,3	p	77
CONPTS	(XRAY, N, YRAY, M, ZMAT, ZLEV, XPTS, YPTS, MAXPTS, IRAY, MAXCRV, NCRV)	0,1,2,3		155
CONSHD	(XRAY, N, YRAY, M, ZMAT, ZLVRAY, NLEV)	2,3	p	154
CONTUR	(XRAY, N, YRAY, M, ZMAT, ZLEV)	2,3	p	153
CROSS	none	2,3	p	17
CRVMAT	(ZMAT, N, M, IXPTS, IYPTS)	3	p	105
CURV3D	(XRAY, YRAY, ZRAY, N)	3	p	122
CURVE	(XRAY, YRAY, N)	2,3	p	19
CURVE3	(XRAY, YRAY, ZRAY, N)	3	p	105

Routine	Parameter	Level		Page
CURVMP	(XRAY, YRAY, N)	2	p	142
CURVX3	(XRAY, Y, ZRAY, N)	3	p	105
CURVY3	(X, YRAY, ZRAY, N)	3	p	105
DASH	none	1,2,3	ps	64
DASHL	none	1,2,3	ps	64
DASHM	none	1,2,3	ps	64
DIGITS	(NDIG, CAX)	1,2,3	ps	37
DISALF	none	1,2,3	ps	45
DISFIN	none	1,2,3	ps	11
DISINI	none	0		11
DOT	none	1,2,3	ps	64
DOTL	none	1,2,3	ps	64
DUPLX	none	1,2,3	ps	45
DWGBUT	(CSTR, IVAL)	0	w	177
DWGFI	(CLAB, CFIL, CMASK)	0	w	177
DWGLIS	(CLAB, CLIS, ISEL)	0	w	177
DWGMSG	(CSTR)	0	w	176
DWGTXT	(CLAB, CSTR)	0	w	177
ELLIPS	(NX, NY, NA, NB)	1,2,3	p	79
ENDGRF	none	2,3		16
ERASE	none	1,2,3	p	104
ERRBAR	(XRAY, YRAY, E1RAY, E2RAY, N)	2,3	p	22
EUSHFT	(CNAT, CHAR)	1,2,3	ps	47
EXPZLB	(CSTR)	1,2,3	ps	110
FCHA	(X, NDIG, NL, CSTR)	0,1,2,3		86
FIELD	(X1RAY, Y1RAY, X2RAY, Y2RAY, N, IVEC)	2, 3	p	23
FILBOX	(NX, NY, NW, NH)	1,2,3	ps	14
FILCLR	(CMOD)	1,2,3	ps	14
FILMOD	(CMOD)	0,1,2,3	ps	28
FIXSPC	(XFAC)	1,2,3	ps	45
FLAB3D	none	1,2,3	ps	122
FLEN	(X, NDIG, NL)	0,1,2,3		86
FRAME	(NFRM)	1,2,3	ps	41
FRMESS	(NFRM)	1,2,3	ps	43
GAPCRV	(XGAP)	1,2,3	ps	62
GETANG	(NANG)	1,2,3	rq	72
GETBPP	(NBPP)	1,2,3	rq	75
GETCLP	(NX, NY, NW, NH)	1,2,3	rq	76
GETCLR	(NCOL)	1,2,3	rq	73
GETDIG	(NXDIG, NYDIG, NZDIG)	1,2,3	rq	72
GETDSP	(CDSP)	0	rq	175
GETFIL	(CFIL)	1,2,3	rq	71
GETGRF	(XA, XE, XOR, XSTP, CAX)	2,3	rq	72
GETHGT	(NHCHAR)	1,2,3	rq	72
GETIND	(INDEX, XR, XG, XB)	1,2,3	rq	75
GETLAB	(CXLAB, CYLAB, CZLAB)	1,2,3	rq	73

Routine	Parameter	Level		Page
GETLEN	(NXL, NYL, NZL)	1,2,3	rq	72
GETLEV	(NLEV)	1,2,3	rq	74
GETLIN	(NWIDTH)	1,2,3	rq	74
GETMAT	(XRAY, YRAY, ZRAY, N, ZMAT, NX, NY, ZVAL, IMAT, WMAT)	2,3		127
GETMFL	(CFMT)	1,2,3	rq	71
GETOR	(NX0, NY0)	1,2,3	rq	71
GETPAG	(NXPAG, NYPAG)	1,2,3	rq	71
GETPAT	(NPAT)	1,2,3	rq	74
GETPLV	(NPLV)	1,2,3	rq	74
GETPOS	(NXA, NYA)	1,2,3	rq	72
GETRAN	(NCA, NCE)	1,2,3	rq	75
GETRES	(NPB, NPH)	1,2,3	rq	74
GETRGB	(XR, XG, XB)	1,2,3	rq	75
GETSCL	(NXSCL, NYSCL, NZSCL)	1,2,3	rq	73
GETSP1	(NXDIS, NYDIS, NZDIS)	1,2,3	rq	73
GETSP2	(NXDIS, NYDIS, NZDIS)	1,2,3	rq	73
GETSYM	(NSYM, NHSYM)	1,2,3	rq	74
GETTCL	(NMAJ, NMIN)	1,2,3	rq	73
GETTIC	(NXTIC, NYTIC, NZTIC)	1,2,3	rq	72
GETTYP	(NTYP)	1,2,3	rq	74
GETUNI	(NU)	1,2,3	rq	73
GETVER	(XVER)	0,1,2,3	rq	73
GETVK	(NV, NVFX, NVFY)	1,2,3	rq	75
GETVLT	(CVLT)	1,2,3	rq	75
GETWID	(NZB)	1,2,3	rq	75
GETWIN	(NX, NY, NW, NH)	1,2,3	rq	76
GETXID	(IVAL, CTYPE)	1,2,3	rq	76
GOTHIC	none	1,2,3	ps	45
GRACE	(NGRACE)	1,2,3	ps	40
GRAF	(XA, XE, XOR, XSTP, YA, YE, YOR, YSTP)	1	p	15
GRAF3	(XA, XE, XOR, XSTP, YA, YE, YOR, YSTP, ZA, ZE, ZOR, ZSTP)	1	p	104
GRAF3D	(XA, XE, XOR, XSTP, YA, YE, YOR, YSTP, ZA, ZE, ZOR, ZSTP)	1	p	121
GRAFMP	(XA, XE, XOR, XSTP, YA, YE, YOR, YSTP)	1	p	137
GRDPOL	(IXGRID, IYGRID)	2,3	p	16
GRFFIN	none	1,2,3	ps	130
GRFINI	(X1, Y1, Z1, X2, Y2, Z2, X3, Y3, Z3)	3	ps	130
GRID	(IXGRID, IYGRID)	2,3	p	16
GRID3D	(IXGRID, IYGRID, COPT)	2,3	p	122
GRIDMP	(IXGRID, IYGRID)	2	p	137
GWGBOX	(ID, ISEL)	0	rq	175
GWGBUT	(ID, IVAL)	0	rq	174
GWGFIL	(ID, CFIL)	0	rq	174
GWGLIS	(ID, ISEL)	0	rq	175

Routine	Parameter	Level		Page
GWGSCL	(ID, XVAL)	0	rq	175
GWGTX	(ID, CSTR)	0	rq	174
HEIGHT	(NHCHAR)	1,2,3	ps	43
HELVE	none	1,2,3	ps	45
HELVES	none	1,2,3	ps	45
HISTOG	(XRAY, N, XHRAY, YHRAY, NH)	0,1,2,3	ps	87
HNAME	(NHNAME)	1,2,3	ps	38
HSVRGB	(XH, XS, XV, XR, XG, XB)	0,1,2,3		109
HSYMBL	(NHSYM)	1,2,3	ps	62
HTITLE	(NHTIT)	1,2,3	ps	42
HWFONT	none	1,2,3	ps	46
HWORIG	(NX, NY)	0	ps	30
HWPAGE	(NW, NH)	0	ps	30
IMGFIN	none	1,2,3	ps	111
IMGINI	none	1,2,3	ps	111
INCCRV	(NCRV)	1,2,3	ps	61
INCFIL	(CFIL)	1,2,3	p	14
INCMRK	(NMRK)	1,2,3	ps	62
INTAX	none	1,2,3	ps	37
INTCHA	(NX, NL, CSTR)	0,1,2,3		86
INTLEN	(NX, NL)	0,1,2,3		85
ITMCAT	(CLIS, CITEM)	0,1,2,3		176
= ITMCNT	(CLIS)	0,1,2,3		176
ITMSTR	(CLIS, IDX, CITEM)	0,1,2,3		175
LABCLR	(ICLR, COPT)	1,2,3	ps	156
LABDIS	(NDIS, CAX)	1,2,3	ps	37,156
LABELS	(CLAB, CAX)	1,2,3	ps	37,156
LABJUS	(CJUS, CAX)	1,2,3	ps	35
LABPOS	(CPOS, CAX)	1,2,3	ps	36
LABTYP	(CTYP, CAX)	1,2,3	ps	36
LEGCLR	none	1,2,3	ps	21
LEGEND	(CBUF, NCOR)	2,3	p	20
LEGINI	(CBUF, NLIN, NMAXLN)	1,2,3	ps	20
LEGLIN	(CBUF, CSTR, ILIN)	1,2,3	ps	20
LEGOPT	(XF1, XF2, XF3)	1,2,3	ps	21
LEGPAT	(ITYP, ITHK, ISYM, ICLR, IPAT, ILIN)	1,2,3	ps	21
LEGPOS	(NX, NY)	1,2,3	ps	21
LEGTIT	(CSTR)	1,2,3	ps	21
LFTTIT	none	1,2,3	ps	42
LINCYC	(INDEX, ITYP)	1,2,3	ps	67
LINE	(NX, NY, NU, NV)	1,2,3	p	78
LINESP	(XFAC)	1,2,3	ps	42
LINTYP	(NTYP)	1,2,3	ps	64
LINWID	(NWIDTH)	1,2,3	ps	64
LNCAP	(CAP)	1,2,3	ps	65
LNJOIN	(CJOIN)	1,2,3	ps	65

Routine	Parameter	Level		Page
LNMLT	(XFC)	1,2,3	ps	65
LOGTIC	(CMOD)	1,2,3	ps	34
MAPMOD	(CMODE)	1,2,3	ps	143
MAPPOL	(XPOL, YPOL)	1	ps	142
MAPREF	(YLOWER, YUPPER)	1	ps	143
MAPSPH	(XRAD)	1	ps	142
MARKER	(NSYM)	1,2,3	ps	62
MDFMAT	(IX, IY, WEIGHT)	1,2,3	ps	128
MESSAG	(CSTR, NX, NY)	1,2,3	p	11
METAFL	(CFMT)	0	ps	27
MIXALF	none	1,2,3	ps	56
MIXLEG	none	1,2,3	ps	21
MPAEPL	(IOPT)	1,2,3	p	183
MPLANG	(XANG)	1,2,3	ps	184
MPLCLR	(NBG, NFG)	1,2,3	ps	183
MPLPOS	(NX, NX)	1,2,3	ps	183
MPLSIZ	(NSIZE)	1,2,3	ps	184
MSGBOX	(CSTR)	0	w	176
MYLAB	(CSTR, ITICK, CAX)	1,2,3	ps	35
MYLINE	(NRAY, N)	1,2,3	ps	64
MYPAT	(IANG, ITYPE, IDENS, ICROSS)	1,2,3	ps	66
MYVLT	(XRRAY, XGRAY, XBRAY, N)	0,1,2,3	ps	108
NAMDIS	(NDIS, CAX)	1,2,3	ps	38
NAME	(CSTR, CAX)	1,2,3	ps	38
NAMJUS	(CJUS, CAX)	1,2,3	ps	38
NEGLOG	(EPS)	1,2,3	ps	19
NEWMIX	none	1,2,3	ps	56
NEWPAG	none	1	ps	29
= NLMESS	(CSTR)	1,2,3		85
= NLNUMB	(X, NDIG)	1,2,3		85
NOARLN	none	1,2,3	ps	66
NOBAR	none	1,2,3	ps	108
NOBGD	none	1,2,3	ps	108
NOCHEK	none	1,2,3	ps	63
NOCLIP	none	1,2,3	ps	40
NOFILL	none	1,2,3	ps	184
NOGRAF	none	1	ps	39
NOHIDE	none	1,2,3	ps	125
NOLINE	(CAX)	1,2,3	ps	39
NUMBER	(X, NDIG, NX, NY)	1,2,3	p	11
NUMFMT	(COPT)	1,2,3	ps	43
NUMODE	(CDEC, CGRP, CPOS, CFIX)	1,2,3	ps	44
=NXLEGN	(CBUF)	2,3		21
=NXPOSN	(X)	2,3		83
=NYLEGN	(CBUF)	2,3		21
=NYPOSN	(Y)	2,3		83

Routine	Parameter	Level	Page
=NZPOSN	(Z)	3	116
OPENFL	(CFIL, NLU, IRW, ISTAT)	0,1,2,3	89
OPNWIN	(ID)	1,2,3	114
ORIGIN	(NX0, NY0)	1 ps	25
PAGE	(NWPAGE, NHPAGE)	0 ps	26
PAGERA	none	1,2,3 p	13
PAGHDR	(CSTR1, CSTR2, IOPT, IDIR)	1,2,3 p	13
PAGMOD	(CMOD)	0 ps	28
PATCYC	(INDEX, IPAT)	1,2,3 ps	67
PENWID	(XWIDTH)	1,2,3 ps	64
PIE	(NXM, NYM, NR, ALPHA, BETA)	1,2,3 p	80
PIEEXP	none	1,2,3 ps	96
PIEGRF	(CBUF, NLIN, XRAY, NSEG)	1 p	94
PIELAB	(CLAB, CPOS)	1,2,3 ps	96
PIEVEC	(IVEC, COPT)	1,2,3 ps	96
POINT	(NX, NY, NB, NH, NCOL)	1,2,3 p	115
POLCRV	(CPOL)	1,2,3 ps	63
POS2PT	(X, Y, XP, YP)	2	143
POS3PT	(X, Y, Z, XABS, YABS, ZABS)	3	132
POSIFL	(NLU, NBYTE, ISTAT)	0,1,2,3	90
PROJECT	(CPROJ)	1 ps	139
PSFONT	(CFONT)	1,2,3 ps	46
READFL	(NLU, IRAY, NBYTE, ISTAT)	0,1,2,3	89
RECFL	(NX, NY, NW, NH, NCOL)	1,2,3 p	115
RECTAN	(NX, NY, NW, NH)	1,2,3 p	79
REL3PT	(X, Y, Z, XP, YP)	3	132
RESATT	none	1,2,3 ps	61
RESET	(CNAME)	1,2,3 ps	25
REVSCR	none	1,2,3 ps	110
RGBHSV	(XR, XG, XB, XH, XS, XV)	0,1,2,3	109
RGTLAB	none	1,2,3 ps	37
RIMAGE	(CFIL)	1,2,3	112
RLARC	(XM, YM, XA, XB, A, B, T)	2,3 p	81
RLAREA	(XRAY, YRAY, N)	2,3 p	81
RLCIRC	(XM, YM, R)	2,3 p	81
RLELL	(XM, YM, A, B)	2,3 p	81
RLINE	(X, Y, U, V)	2,3 p	78
RLMESS	(CSTR, X, Y)	2,3 p	12
RLNUMB	(X, NDIG, XP, YP)	2,3 p	12
RLPIE	(XM, YM, R, ALPHA, BETA)	2,3 p	81
RLPOIN	(X, Y, NB, NH, NCOL)	2,3 p	115
RLREC	(X, Y, WIDTH, HEIGHT)	2,3 p	81
RLRND	(X, Y, WIDTH, HEIGHT, IOPT)	2,3 p	81
RLSEC	(XM, YM, R1, R2, ALPHA, BETA, NCOL)	2,3 p	116
RLSYMB	(NSYM,X,Y)	2,3 p	12
RLVEC	(X1, Y1, X2, Y2, IVEC)	2,3 p	79

Routine	Parameter	Level		Page
RNDREC	(NX, NY, NW, NH, IOPT)	1,2,3	p	79
RPIXEL	(IX, IY, NCLR)	1,2,3		111
RPIXLS	(IRAY, IX, IY, NW, NH)	1,2,3		111
RPXROW	(IRAY, IX, IY, N)	1,2,3		112
RTIFF	(CFIL)	1,2,3		113
RVYNAM	none	1,2,3	ps	38
SCALE	(CSCL,CAX)	1,2,3	ps	32
SCLFAC	(XFAC)	0	ps	27
SCLMOD	(CMODE)	0	ps	28
SCRMOD	(CMODE)	0	ps	29
SECTOR	(NX, NY, NR1, NR2, ALPHA, BETA, NCOL)	1,2,3	p	115
SELWIN	(ID)	1,2,3	ps	114
SENDBF	none	1,2,3		103
SERIF	none	1,2,3	ps	45
SETBAS	(XFAC)	1,2,3	ps	56
SETCLR	(NCOL)	1,2,3	ps	106
SETEXP	(FEXP)	1,2,3	ps	56
SETFIL	(CFIL)	0		27
SETGRF	(C1, C2, C3, C4)	1	ps	39
SETIND	(INDEX, XR, XG, XB)	1,2,3	ps	109
SETMIX	(CHAR, CMIX)	1,2,3	ps	57
SETPAG	(CPAG)	0		26
SETRES	(NPB, NPH)	1,2,3	ps	106
SETRGB	(XR, XG, XB)	1,2,3	ps	107
SETSCL	(XRAY, N, CAX)	1,2,3	ps	33
SETVLT	(CVLT)	1,2,3	ps	108
SETXID	(ID,COPT)	0	ps	30
SHDCHA	none	1,2,3	ps	46
SHDCRV	(X1RAY, Y1RAY, N1, X2RAY, Y2RAY, N2)	2,3	p	22
SHDEUR	(INRAY, IPRAY, ICRAY, N)	2	p	141
SHDMAP	(CMAP)	2,3	p	141
SHDMOD	(CMOD, CTYPE)	1,2,3	ps	125, 157
SHDPAT	(IPAT)	1,2,3	ps	65
SHIELD	(CAREA, CMODE)	1,2,3	ps	68
SHLCIR	(NX, NY, NR)	1,2,3	ps	69
SHLDEL	(ID)	1,2,3	ps	69
SHLELL	(NX, NY, NA, NB, THETA)	1,2,3	ps	69
SHLIND	(ID)	1,2,3	ps	69
SHLPIE	(NX, NY, NR, A, B)	1,2,3	ps	69
SHLPOL	(NXRAY, NYRAY, N)	1,2,3	ps	69
SHLRCT	(NX, NY, NW, NH, THETA)	1,2,3	ps	69
SHLREC	(NX, NY, NW, NH)	1,2,3	ps	69
SHLRES	(N)	1,2,3	ps	70
SHLSUR	none	1,2,3	ps	125
SHLVIS	(ID, CMODE)	1,2,3	ps	70
SIMPLX	none	1,2,3	ps	45

Routine	Parameter	Level		Page
SKIPFL	(NLU, NBYTE, ISTAT)	0,1,2,3		90
SMXALF	(CALPH, C1, C2, N)	1,2,3	ps	47
SOLID	none	1,2,3	ps	64
SORTR1	(XRAY, N, COPT)	0,1,2,3		86
SORTR2	(XRAY, YRAY, N, COPT)	0,1,2,3		86
SPLINE	(XRAY, YRAY, N, XSRAY, YSRAY, NSPL)	1,2,3		87
SPLMOD	(NGRAD, NPTS)	1,2,3	p	63
STRT3D	(X, Y, Z)	3	p	131
STRTPT	(X, Y)	1,2,3	p	77
SURCLR	(ICTOP, ICBOT)	1,2,3	ps	124
SURFCE	(XRAY, N, YRAY, M, ZMAT)	3	p	125
SURFCP	(ZFUN, T1, T2, TSTP, U1, U2, USTP)	3	p	124
SURFUN	(ZFUN, IXPTS, XD, IYPTS, YD)	3	p	124
SURMAT	(ZMAT, NX, NY, IXPTS, IYPTS)	3	p	123
SURMSH	(COPT)	1,2,3	ps	126
SURSHD	(XRAY, N, YRAY, M, ZMAT)	3	p	124
SURSIZE	(XMIN, XMAX, YMIN, YMAX)	1,2,3	ps	123
SURVIS	(CVIS)	1,2,3	ps	125
SWAPI2	(IRAY2, N)	0,1,2,3		88
SWAPI4	(IRAY, N)	0,1,2,3		88
SWGBOX	(ID, ISEL)	0	ps	173
SWGBUT	(ID, IVAL)	0	ps	173
SWGCB	(IP, ROUTINE, IRAY)	0	ps	173
SWGFI	(ID, CFIL)	0	ps	174
SWGHL	(CSTR)	0	ps	171
SWGJUS	(CJUS, CLASS)	0	ps	172
SWGLIS	(ID, ISEL)	0	ps	173
SWGMI	(CHAR, CMIX)	0	ps	172
SWGMO	(CMOD)	0	ps	170
SWGMR	(IVAL, CMRG)	0	ps	172
SWGPO	(NX, NY)	0	ps	171
SWGSC	(ID, XVAL)	0	ps	174
SWGSI	(NW, NH)	0	ps	171
SWGTT	(CTIT)	0	ps	170
SWGTT	(ID, CSTR)	0	ps	173
SWGTY	(CTYPE, CLASS)	0	ps	171
SWGWI	(NX, NY, NW, NH)	0	ps	171
SGWTH	(NWTH)	0	ps	170
SYMBOL	(NSYM, NX, NY)	1,2,3	p	12
SYMFIL	(CDEV, CSTAT)	0		13
SYMROT	(ANGLE)	1,2,3	ps	12
TELLFL	(NLU, NBYTE)	0,1,2,3		90
THKCRV	(NTHK)	1,2,3	ps	62
TICKS	(ITICK, CAX)	1,2,3	ps	33
TICLEN	(NMAJ, NMIN)	1,2,3	ps	34
TICPOS	(CPOS, CAX)	1,2,3	ps	33

Routine	Parameter	Level		Page
TIFORG	(NX, NY)	1,2,3	ps	113
TIFWIN	(NX, NY, NW, NH)	1,2,3	ps	113
TIMOPT	none	1,2,3	ps	37
TITJUS	(CJUS)	1,2,3	ps	41
TITLE	none	2,3	p	16
TITLIN	(CSTR, N)	1,2,3	ps	41
TITPOS	(CPOS)	1,2,3	ps	42
TRFCO1	(XRAY, N, CFROM, CTO)	0,1,2,3		84
TRFCO2	(XRAY, YRAY, N, CFROM, CTO)	0,1,2,3		84
TRFCO3	(XRAY, YRAY, ZRAY, N, CFROM, CTO)	0,1,2,3		84
TRFREL	(XRAY, YRAY, N)	2,3		83
TRFRES	none	1,2,3	ps	68
TRFROT	(XANG, NX, NY)	1,2,3	ps	68
TRFSCL	(XSCL, YSCL)	1,2,3	ps	68
TRFSHL	(NXSHFT, NYSHFT)	1,2,3	ps	67
TRIPLX	none	1,2,3	ps	45
= TRMLN	(CSTR)	0,1,2,3		85
TXTJUS	(CJUS)	1,2,3	ps	43
UNIT	(NU)	1,2,3	ps	25
UPSTR	(CSTR)	0,1,2,3		85
USRPIE	(ISEG, XD, XP, NR, NOFF, ANG, NVX, NVY, IDRW, IANN)	1,2,3	ps	97
VANG3D	(ANG)	1,2,3	ps	121
VCLP3D	(XCLP1, XCLP2)	1,2,3	ps	126
VECTOR	(NX1, NY1, NX2, NY2, IVEC)	1,2,3	p	78
VECTR3	(X1, Y1, Z1, X2, Y2, Z2, IVEC)	3	p	131
VFOC3D	(X, Y, Z, COPT)	1,2,3	ps	121
VIEW3D	(XVU, YVU, ZVU, CVU)	1,2,3	ps	121
VKXBAR	(NVFX)	1,2,3	ps	107
VKYBAR	(NVFY)	1,2,3	ps	107
VKYTIT	(NV)	1,2,3	ps	42
VUP3D	(ANG)	1,2,3	ps	121
WGAPP	(IP, CLAB, ID)	0	w	166
WGBAS	(IP, COPT, ID)	0	w	166
WGBOX	(IP, CLIS, ISEL, ID)	0	w	168
WGBUT	(IP, CLAB, IVAL, ID)	0	w	167
WGCMD	(IP, CLAB, CMD, ID)	0	w	169
WGFIL	(IP, CLAB, CFIL, CMASK, ID)	0	w	167
WGFIN	none)	0	w	165
WGINI	(COPT, ID)	0	w	165
WGLAB	(IP, CSTR, ID)	0	w	166
WGLIS	(IP, CLIS, ISEL, ID)	0	w	168
WGLTXT	(IP, CLAB, CSTR, NWTH, ID)	0	w	167
WGOK	(IP, ID)	0	w	169
WGPBUT	(IP, CLAB, ID)	0	w	169
WGPOP	(IP, CLAB, ID)	0	w	166
WGQUIT	(IP, ID)	0	w	169

Routine	Parameter	Level		Page
WGSCL	(IP, CLAB, XMIN, XMAX, XVAL, NDEZ, ID)	0	w	168
WGTX	(IP, CSTR, ID)	0	w	167
WIDBAR	(NZB)	1,2,3	ps	107
WIMAGE	(CFIL)	1,2,3	p	112
WINDOW	(NX, NY, NW, NH)	0	ps	29
WINID	(ID)	1,2,3	rq	114
WINMOD	(CMOD)	1,2,3	ps	110
WINSIZ	(NW, NH)	0,1,2,3	ps	30
WINTIT	(CTIT)	1,2,3	ps	115
WORLD	none	2,3	p	141
WPIXEL	(IX, IY, NCLR)	1,2,3	p	111
WPIXLS	(IRAY, IX, IY, NW, NH)	1,2,3	p	111
WPXROW	(IRAY, IX, IY, N)	1,2,3	p	112
WRITFL	(NLU, IRAY, NBYTE, ISTAT)	0,1,2,3		90
WTIFF	(CFIL)	1,2,3	p	113
X11MOD	(CMOD)	0	ps	110
= X2DPOS	(X, Y)	2		143
= X3DABS	(X, Y, Z)	3		132
= X3DPOS	(X, Y, Z)	3		132
= X3DREL	(X, Y, Z)	3		132
XAXGIT	none	2,3	p	17
XAXIS	(XA, XE, XOR, XSTP, NL, CX, IT, NX, NY)	1,2,3	p	18
XAXLG	(XA, XE, XOR, XSTP, NL, CX, IT, NX, NY)	1,2,3	p	18
XAXMAP	(XA, XE, XOR, XSTP, CX, IT, NY)	2	p	137
XCROSS	none	2,3	p	17
XDRAW	(X, Y)	1,2,3	p	77
=XINVRS	(NXP)	2,3		83
XMOVE	(X, Y)	1,2,3	p	77
=XPOSN	(X)	2,3		83
= Y2DPOS	(X, Y)	2		143
= X3DABS	(X, Y, Z)	3		132
= X3DPOS	(X, Y, Z)	3		132
= X3DREL	(X, Y, Z)	3		132
XAXGIT	none	2,3	p	17
XAXIS	(XA, XE, XOR, XSTP, NL, CX, IT, NX, NY)	1,2,3	p	18
XAXLG	(XA, XE, XOR, XSTP, NL, CX, IT, NX, NY)	1,2,3	p	18
XAXMAP	(XA, XE, XOR, XSTP, CX, IT, NY)	2	p	137
XCROSS	none	2,3	p	17
XDRAW	(X, Y)	1,2,3	p	77
=XINVRS	(NXP)	2,3		83
XMOVE	(X, Y)	1,2,3	p	77
=XPOSN	(X)	2,3		83
= Y2DPOS	(X, Y)	2		143
= Y3DABS	(X, Y, Z)	3		132
= Y3DPOS	(X, Y, Z)	3		132

Routine	Parameter	Level		Page
= Y3DREL	(X, Y, Z)	3		132
YAXGIT	none	2,3	p	17
YAXIS	(YA, YE, YOR, YSTP, NL, CY, IT, NX, NY)	1,2,3	p	18
YAXLG	(YA, YE, YOR, YSTP, NL, CY, IT, NX, NY)	1,2,3	p	18
YAXMAP	(YA, YE, YOR, YSTP, CY, IT, NX)	2	p	138
YCROSS	none	2,3	p	17
=YINVRS	(NYP)	2,3		83
=YPOSN	(Y)	2,3		83
= Z3DPOS	(X, Y, Z)	3		132
ZAXIS	(A, B, OR, STEP, NL, CZ, IT, ID, NX, NY)	1,2,3	p	105
ZAXLG	(A, B, OR, STEP, NL, CZ, IT, ID, NX, NY)	1,2,3	p	105
ZBFFIN	none	1,2,3		130
ZBFINI	(IRET)	1,2,3		130
ZBFLIN	(X1, Y1, Z1, X2, Y2, Z2)	3	p	131
ZBFTRI	(XRAY, YRAY, ZRAY, IRAY)	3	p	131
ZSCALE	(ZMIN, ZMAX)	1,2,3	ps	126