Overview

This is a program for use with POV Ray. Several interesting surfaces are described in Pickover's Mazes for the Mind in which he rendered the surfaces using wire frame of strings of spheres. This program allows the user to create similar images for the Banchoff, Mandala and Wiwianka surfaces (as named by Pickover). An include file is created containing a composite object with the bounding box. The composite object is made up of spheres colored according to the options provided by this program. The size and number of spheres is controlled by the user. The include file (v2.0) can then be used to create a POV image using a source file such as the following:

```
#include "colors.inc"
#include "textures.inc"
camera {
    location  <0, 10, -30>
    direction z*2
    up y
    right x*1.3333
    look_at <0, 0, 0>
}
object { light_source
       { < 20, 50, -100> color White }}
object {
   sphere {<0, 0, 0>, 1200}
   texture {
      Apocalypse
      scale <1000, 300, 1000>
      finish{ ambient 1.0
              diffuse 0.0
      }
   }
}
#include "banchoff.inc"
object {
    Banchoff
    scale 2.5
}
```

The object is translated to *<0, 0, 0>* and *bounded_by* a sphere. The radius of the sphere will provide the user with a good idea of the size of the object so that he/she can scale it for their own application.

The surface is displayed using the Painter's algorithm to give the user an approximate idea of the appearance and colors for the surface.

A 256 color card and appropriate Windows 3.1 device driver is highly desirable.

Banchoff Surface

The Banchoff Surface is described by the following set of parametric equations:

```
x = cos(u)*(cos(u/2)*(sqrt(2) + cos(v))
      + (sin(u/2)*sin(v)*cos(v)))

y = sin(u)*(cos(u/2)*(sqrt(2) + cos(v))
      + (sin(u/2)*sin(v)*cos(v)))

z = -sin(u/2)*(sqrt(2) + cos(v))
      + cos(u/2)*sin(v)*cos(v)
```

The ranges and increments of u and v are set by selecting <u>Configure</u> from the menu. Several coloring schemes are available (see <u>Color</u>) based upon the values of $u,\ v,\ x,\ y$ and z. Sphere size and rotation of the surface is set by selecting <u>Rotate</u> from the menu.

Mandala Surface

The Mandala Surface is described by the following set of parametric equations:

$x = u*cos(v)$

$y = u*sin(v)$

$z = v*cos(u)$

The ranges and increments of u and v are set by selecting <u>Configure</u> from the menu. Several coloring schemes are available (see <u>Color</u>) based upon the values of u, v, x, y and z. Sphere size and rotation of the surface is set by selecting <u>Rotate</u> from the menu.

Wiwianka Surface

The Wiwianka Surface is described by the following set of parametric equations:

```
x = (1 + exp(-100*u*u))*sin(pi*u)*sin(pi*v)
```

```
y = (1 + exp(-100*u*u))*sin(pi*u)*cos(pi*v)
```

```
z = (1 + exp(-100*u*u))*cos(pi*u)
```

The ranges and increments of u and v are set by selecting <u>Configure</u> from the menu. Several coloring schemes are available (see <u>Color</u>) based upon the values of u, v, x, y and z. Sphere size and rotation of the surface is set by selecting <u>Rotate</u> from the menu.

Commands

[Configure](#)
[Color](#)
[Rotate](#)
[Select](#)
[SaveAs](#)

Configure

The Configure dialog box allows the user to set the initial and final values for u and v and their increments in radians. The user is limited to a total of 16382 sets of u and v values. A warning dialog box will appear if that number is exceeded. If the warning box appears, increase the increment sizes and/or decrease the ranges for u and v until the warning box does not appear.

The Create Grid check box allows the selection of a *grid* wire frame rather than a *contour* wire fame. The default is for a *contour* wire frame.

As there are default settings for each surface, the Configure dialog box should be chosen after the choice of the surface (see Select).

Color

The Color dialog box allow the user to select up to four base colors for use with several coloring schemes that can also be selected. The colors are entered as R G B values between 0 and 1.0. The spheres will also have a phong=1.0 texture when rendered with POV Ray.

As there are default settings for each surface, the Color dialog box should   be chosen after the choice of the surface (see <u>Select</u>).

The coloring options are the following:

<u>Solid:</u>
   All spheres are colored the color of Color #1.

<u>Continous:</u>
   The sphere colors cycle continously between Color #1 and Color #2 according to the value of u.

<u>Odd on U:</u>
   If the integer portion of $u*1000$ is odd the sphere is colored with Color #1; otherwise it is colored with Color #2.

<u>Odd on V:</u>
   If the integer portion of $v*1000$ is odd the sphere is colored with Color #1; otherwise it is colored with Color #2.

<u>UV 4 Color:</u>
   The coloring scheme is based upon the   integer values of $u*1000$ and $v*1000$ according to the following:

   both $u*1000$ and $v*1000$ are odd: Color #1

   $u*1000$ odd and $v*1000$ even: Color #2

   $u*1000$ even and $v*1000$ odd: Color #3

   both $u*1000$ and $v*1000$ even: Color #4

<u>XY 4 Color:</u>
   The coloring scheme is based upon the   values of x and y according to   the following:

   both x and $y > 0$:   Color #1

   $x > 0$ and $y <= 0$:   Color #2

   $x <= 0$ and $y > 0$:   Color #3

   both x and $y <= 0$:   Color #4

<u>XZ 4 Color:</u>
   The coloring scheme is based upon the   values of x and z according to   the following:

both x and $z > 0$:   Color #1

$x > 0$ and $z <= 0$:   Color #2

$x <= 0$ and $z > 0$:   Color #3

both x and $z <= 0$:   Color #4

YZ 4 Color:
The coloring scheme is based upon the values of y and z according to the following:

both y and $z > 0$:   Color #1

$y > 0$ and $z <= 0$:   Color #2

$y <= 0$ and $z > 0$:   Color #3

both y and $z <= 0$:   Color #4

XYZ Plus:
The coloring scheme is based upon the values of x, y and z such that if $x*y*z > 0$ then Color #1 is used; otherwise Color #2 is used.

Rotate

This option allows the user to rotate the surface around the x, y and z axes, and to set the size of the spheres.

As there are default settings for each surface, the Rotate dialog box should   be chosen after the choice of the surface (see <u>Select</u>).

Select

This option allows the user to select the type of surface (<u>Banchoff</u>, <u>Mandala</u> or <u>Wiwianka</u>). Selection of a surface also initiates the calculations. Selection of <u>No Surface</u> will terminate any calculations in progress.

SaveAs

This option allows the user to save an include file for the displayed surface as a composite object of spheres. The coloring and sphere size will be as chosen (see <u>Color</u> and <u>Rotate</u>) or the default values. Phong=1.0 for all spheres.   The displayed surface will provide an approximate   representation of the image created with POV Ray.

the SaveAs dialog box will not display until the surface calculations are finished and the image starts to display.