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| Nanyang Technological University |
| Lab 3 report: Parametric Surfaces and Solids |
| CZ2003 Computer Graphics and Visualization |

Fang Ran (U1521819L)

SSP4

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| **Parametric Surface** | **Screenshot** | **Notes** |
| 3D\_planeA |  | definition "  x = -2+4\*u;  y = 2\*v;  z = (-2)\*v;"  parameters [0 1 0 1]  The surface is a straight lines on the x-z plane because y and z shares the same parameter v. |
| 3D\_planeB |  | Changing the resolution has no effect in rendering the flat surface. |
| 3D\_triangleA |  | definition "x=u\*5;  y=5\*(1-u)\*v;  z=0;"  parameters [0 1 0 1]  resolution [75 75]  The sides of the triangle are 5 units because of the 5 coefficient in the x and y equation. |
| 3D\_triangleB |  | Reducing the resolution to [1 1] produces a gradient shadow. |
| 3D\_triangleC |  | definition "  x=u;  y=u\*v;  z=0;"  I replaced (1-u) to u and this flips the triangle from y=0 to y=1 along the x-axis in the positive direction. |
| Bi surface\_A |  | definition "  x= 2\*u-1;  y= 2\*v-1;  z=0;"  parameters [0 1 0 1]  resolution [75 75]  This is a simple square plane on the xy plane as z=0 and centred at the origin. |
| Bi surface\_B |  | The bilinear surface parametric representation is P=P1 + u(P2-P1) + v(P3-P1+ v(P4-P3-(P2-P1))).  definition "x= -1 +u\*(2)+v\*((-1)-(-1)+u\*(1-(-1)-1+(-1))) ;    y=-1+u\*(-1-(-1))+v\*(1-(-1)+u\*(1-1-(-1)+(-1)));    z=1+u\*(0-1)+v\*(1-1+u\*(0-1-0+1));" |
| Bi surface\_C |  |  |
| Bi surface\_D |  |  |
| Surface\_sphereA |  | definition "x=cos((2\*pi\*u)-(pi))\*cos((4\*pi\*v)-(2\*pi\*v));  y=cos((2\*pi\*u)-(pi))\*sin((4\*pi\*v)-(2\*pi\*v));  z=sin((2\*pi\*u)-(pi));" |
| Surface\_sphereB |  | Sphere is halved to show it’s hollow |
| Surface\_coneA |  | Cone is produced by a rotational sweeping of a straight line segment. |
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| Solid\_BoxA |  | definition "  x=u-0.5;  y=v-0.5;  z=w-0.5;"  Using the default template with  definition “  x=u;  y=v;  z=w;”,  The minus 0.5 units centralises the entire solid box because the xyz values ranges from negative to positive values.    parameters [0 1 0 1 0 1]  For the parameters domain, since there are now three parameters  (u, v, w), the domain for each parameter must be defined.  This is where it is different from surfaces, where there are only two parameters. In solids, we use three parameters when there is no animation. |
| Solid\_BoxB |  | definition "  x=u;  y=2\*(v-0.5);  z=w-0.5;"  parameters [0 1 0 1 0 1]  The box is now rectangular because of the 2 coefficient of the y value.  . |
| Solid\_SphereA |  | definition "x=w\*cos((2\*pi\*u)-(pi))\*cos((4\*pi\*v)-(2\*pi\*v));  y=w\*cos((2\*pi\*u)-(pi))\*sin((4\*pi\*v)-(2\*pi\*v));  z=w\*sin((2\*pi\*u)-(pi));"  parameters [0 1 0 1 0 1]  resolution [75 75 75] |
| Solid\_SphereB |  | definition "x=w\*cos((pi\*u)-(pi/2))\*cos((2\*pi\*v)-(pi\*v));  y=w\*cos((pi\*u)-(pi/2))\*sin((2\*pi\*v)-(pi\*v));  z=w\*sin((pi\*u)-(pi/2));"  parameters [0 1 0 1 0 1]  This definition defines a solid sphere. (REMOVE TJE GRADIENT) |
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| Solid\_SphereD |  | definition "x=w\*cos((2\*pi\*u)-(pi))\*cos((4\*pi\*v)-(2\*pi\*v));  y=w\*cos((2\*pi\*u)-(pi))\*sin((4\*pi\*v)-(2\*pi\*v));  z=w\*sin((2\*pi\*u)-(pi));"  parameters [0 10 0 10 0 1]  resolution [50 50 50]  Instead of only increasing the domain for parameter u, I increase the domain for parameter v as well. What happens is that each “circle” drawn along the x-y direction along the z-axis are now jagged instead of smooth.  The sampling resolution is again kept the same. |
| Solid\_CylinderA |  | definition "  x = u\*cos(v\*2\*pi);  y = -1+2\*w;  z = u\*sin(v\*2\*pi);"  parameters [0 1 0 1 0 1]  resolution [50 50 50]  This solid cylinder extending from -1 to 1 has a radius of 1.  Parameter u of range from 0 to 1 makes the entire cylinder is filled. |
| Solid\_CylinderB |  | definition "  x = u\*cos(v\*pi);  y = -1+2\*w;  z = u\*sin(v\*pi);"  parameters [0 1 0 1 -1 1]  resolution [50 50 50]  For half a cylinder, removing 2 in sin and cos results in that only pi angle of the cylinder is drawn out. |
|  | NEED CHANGE SAMPLING RES |  |
| Solid\_CylinderD (Sweeping) |  | definition "  x = u\*cos(v\*2\*pi);  y = -1+2\*w\*t;  z = u\*sin(v\*2\*pi);"  There is a time parameter t in the y, hence there is a sweeping movement in the positive y direction from -1 to 1  parameters [0 1 0 1 0 1]  resolution [50 50 50] |
| Solid\_CylinderE (Sweeping) |  | Rotational and translational sweeping. The shape is translated in the positive y direction and sweepsanti- clockwise aroung the y axis  x = u\*cos(v\*2\*pi\*t);  y = -1+2\*w\*t;  z = u\*sin(v\*2\*pi\*t);"  This is because of the parameter t. the t in the cos and sin causes the solid to sweep in a anti-clockwise direction  it forms a solid cylinder ofradius 1 and height 2. |
| Solid\_ConeA |  | definition "  x = v\*w\*cos(((2\*pi)\*u-(pi)));  y = -1 + w\*(1-(-1));  z = v\*w\*sin(((2\*pi)\*u-(pi)));"    parameters [0 1 0 1 0 1]  resolution [50 50 50]  CHECK NEED OR NOT  This is a solid cone that starts at y=-1 to y=1. |
| Solid\_ConeB (sweeping) |  | This is an animated sweeping cone that starts along the x-y plane and does rotational sweep about the y-axis.  DEF morph FShape {  cycleInterval 3  loop TRUE  geometry FGeometry {  definition "  x = v\*w\*cos(((2\*pi)\*u-(pi))\*t);  y = -1 + w\*(1-(-1));  z = v\*w\*sin(((2\*pi)\*u-(pi))\*t);"    parameters [0 1 0 1 0 1]  resolution [50 50].  The time parameter t is introduced to the parametric functions of x and z that we use to define the circles in the cone. |