Nanyang Technological University

**Lab 3 Report:**

**Parametric Surfaces and Solids**

CZ2003 Computer Graphics and Visualization

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**Parametric Surfaces (Experiment on Resolution)**

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| **Curve 1** | **Curve 2** | **Note/Explanation** |
| A screenshot of “3D Plane – 1.wrl” which defines a surface by parametric equations:  x=u  y=v  z=u  The domain for u and v is [0, 1].  The sampling resolution is [75 75]. | A screenshot of “3D Plane – 1.wrl” which defines a surface by parametric equations:  x=u  y=v  z=u  The domain for u and v is [0, 1].  The sampling resolution is [1 1]. | The drawing of a 3D plane only requires 4 lines. Therefore the sampling resolution [1 1] also works. |
| A screenshot of “3D triangle – 1.wrl” which defines a surface by parametric equations:  x= v - u\*v  y= 1-u  z= 0  The domain for u and v is [0, 1].  The sampling resolution is [75 75]. | A screenshot of “3D triangle – 2.wrl” which defines a surface by parametric equations:  x= v - u\*v  y= 1-u  z= 0  The domain for u and v is [0, 1].  The sampling resolution is [1 1]. | The explanation is the same as the case of the 3D Plane. |
| A screenshot of “bilinear surface – 1.wrl” which defines a bilinear surface by parametric equations:  x=0.5\*v + 0.5 \*u\*v  y=u\*v;  z=u  The domain for u and v is [0, 1].  The sampling resolution is [175 175]. | A screenshot of “bilinear surface – 2.wrl” which defines a bilinear surface by parametric equations:  x=0.5\*v + 0.5 \*u\*v  y=u\*v;  z=u  The domain for u and v is [0, 1].  The sampling resolution is [1 1]. | When the sampling resolution is [1 1], only 4 sampling points shall be used, hence decreases the accuracy of the bilinear surface. |
| A screenshot of “sphere – 1.wrl” which defines a sphere by parametric equations:  x=cos(pi\*u-pi/2)\*sin(2\*pi\*v-pi)  y=sin(pi\*u-pi/2)  z=cos(pi\*u-pi/2)\*cos(2\*pi\*v-pi)  The domain for u and v is [0, 1].  The sampling resolution is [75 75]. | A screenshot of “sphere – 2.wrl” which defines a sphere by parametric equations:  x=cos(pi\*u-pi/2)\*sin(2\*pi\*v-pi)  y=sin(pi\*u-pi/2)  z=cos(pi\*u-pi/2)\*cos(2\*pi\*v-pi)  The domain for u and v is [0, 1].  The sampling resolution is [3 3]. | The drawing of a sphere needs many sampling points to be accurate. Hence it is much more favorable to have a high sampling resolution. |
| A screenshot of “ellipsoid – 1.wrl” which defines an ellipsoid by parametric equations:  x=cos(pi\*u-pi/2)\*sin(2\*pi\*v-pi)  y=0.5\*sin(pi\*u-pi/2)  z=0.3\*cos(pi\*u-pi/2)\*cos(2\*pi\*v-pi)  The domain for u and v is [0, 1].  The sampling resolution is [75 75]. | A screenshot of “ellipsoid – 2.wrl” which defines an ellipsoid by parametric equations:  x=cos(pi\*u-pi/2)\*sin(2\*pi\*v-pi)  y=0.5\*sin(pi\*u-pi/2)  z=0.3\*cos(pi\*u-pi/2)\*cos(2\*pi\*v-pi)  The domain for u and v is [0, 1].  The sampling resolution is [3 3]. | The explanation for this case is similar to the case of the sphere. |
| A screenshot of “cone – 1.wrl” which defines a cone by parametric equations:  x=u  y=u\*cos(2\*pi\*v)  z=u\*sin(2\*pi\*v)  The domain for u and v is [0, 1].  The sampling resolution is [75 75]. | A screenshot of “cone – 2.wrl” which defines a cone by parametric equations:  x=u  y=u\*cos(2\*pi\*v)  z=u\*sin(2\*pi\*v)  The domain for u and v is [0, 1].  The sampling resolution is [3 3]. |  |

**Conversion of a closed surface to a solid object by introducing the third parameter**

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| **Curve 1** | **Curve 2** | **Note/Explanation** |
| A screenshot of “cone – 1.wrl” which defines a cone by parametric equations:  x=u  y=u\*cos(2\*pi\*v)  z=u\*sin(2\*pi\*v)  The domain for u and v is [0, 1].  The sampling resolution is [75 75]. | A screenshot of “solid.wrl” which defines a surface by parametric equations:  x=u;  y=w\*u\*cos(2\*pi\*v)  z=w\*u\*sin(2\*pi\*v)  The domain for u, v and w is [0, 1].  The sampling resolution is [75 75 75]. | Conversion from a cone surface to a solid cone is done by introducing a third parameter w. |

**Rotational & Translational Sweeping on y = sin(x) to make a surface**

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| Translational Sweeping | A screenshot of “y=sin(x)surface.wrl” which defines a surface by parametric equations:  x=u\*2\*pi;  y=sin(u\*2\*pi) + v;  z=0;  The domain for u and v is [0, 1].  The sampling resolution is [75 75].  This is the surface obtained by applying translational sweeping on the curve y = sin(x) along the y-axis. |
| Rotational Sweeping | A screenshot of “y=sin(x)solid.wrl” which defines a solid by parametric equations:  x=u\*cos(1.5\*pi\*w);  y=sin(u\*2\*pi) + v;  z=u\*sin(1.5\*pi\*w);  The domain for u, v and w is [0, 1].  The sampling resolution is [75 75 75].  This is the solid obtained by applying rotational sweeping 270 degrees to the surface with the parametric equations : x = u; y=sin(u\*2\*pi) + v; z = 0.  (In this case, I am not using the surface defined in “y=sin(x)surface.wrl” for the rotational sweeping because it would be too large to display). |