*Escobero Hernández Guillermo (N1804693E) (SSR 1)*

*CZ2003 Computer Graphics and Visualization | Nanyang Technological University*

*Lab 3 report: Parametric Surfaces and solids*

*[Subtítulo del documento]*

# Experiment on resolution (surfaces)

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| 3D Plane | | Notes |
| * “3dplane.wrl” * x=u   y=v  z=u-2\*v   * Par. domain [0,1][0,1] * Sampling resolution 75 | * “3dplane2.wrl” * x=u   y=v  z=u-2\*v   * Par. domain [0,1][0,1] * Sampling resolution 2 | With 2 parameters, we only need a sampling resolution of 1, we get 4 points, enough to generate the plane. |
| 3D Triangle | |  |
| * “3dtriangle.wrl” * x=-1+2\*u+v\*(-2\*u)   y=1-u+v\*(-1+u)  z=-1+2\*v   * Par. domain [0,1][0,1] * Sampling resolution 75 | * “3dtriangle2.wrl” * x=-1+2\*u+v\*(-2\*u)   y=1-u+v\*(-1+u)  z=-1+2\*v   * Par. domain [0,1] [0,1] * Sampling resolution 2 | With 2 parameters, we only need a sampling resolution of 1, we get 4 points, enough to generate the triangle. |

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| Bilinear surface | |  |
| * “bilinearsurface.wrl” * x=-1+2\*u   y=1-u+v\*(-1+1.5\*u)  z=-1+2\*v   * Par. domain [0,1] [0,1] * Sampling resolution 75 | * “bilinearsurface2.wrl” * x=-1+2\*u   y=1-u+v\*(-1+1.5\*u)  z=-1+2\*v   * Par. domain [0,1] [0,1] * Sampling resolution 2 | With 2 parameters, we only need a sampling resolution of 1, we get 4 points, enough to generate the plane. However, this surface is curved, so we get edges on the surface if the resolution is low. |
| Sphere | |  |
| * “sphere.wrl” * x=0.7\*cos(2pi\*u)cos(pi\*v)   y=0.7\*cos(2pi\*u)sin(pi\*v)  z=0.7\*sin(2pi\*u)   * Par. domain [0,1][0,1] * Sampling resolution 75 | * “sphere2.wrl” * x=0.7cos(2pi\*u)cos(pi\*v)   y=0.7cos(2pi\*u)\*sin(pi\*v)  z=0.7sin(2pi\*u)   * Par. domain [0,1][0,1] * Sampling resolution 5 | With a resolution of 5, we do not get enough polygons to generate a decent sphere. |
| Ellipsoid | |  |
| * “ellipsoid.wrl” * x=1\*cos(2pi\*u)\*sin(pi\*v) y=0.5\*sin(2\*pi\*u)   z=0.5\*cos(2pi\*u)cos(pi\*v)   * Parameter domain [0,1] * Sampling resolution 75 | * “ellipsoid2.wrl” * x=1\*cos(2pi\*u)\*sin(pi\*v) y=0.5\*sin(2\*pi\*u)   z=0.5\*cos(2pi\*u)cos(pi\*v)   * Parameter domain [0,1] * Sampling resolution 5 | With a resolution of 5, we do not get enough polygons to generate a decent ellipsoid. |
| Cone | |  |
| * “cone.wrl” * x=u   y=u\*cos(2\*pi\*v)  z=u\*sin(2\*pi\*v)   * Par. domain [0,1] [0,1] * Sampling resolution 75 | * “cone2.wrl” * x=u   y=u\*cos(2\*pi\*v)  z=u\*sin(2\*pi\*v)   * Par. domain [0,1] [0,1] * Sampling resolution 5 | With a resolution of 5, we get a “pyramid” with pentagonal base, because we get 5 edges. |

# Experiment on solids

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| Box | |
| * “solid\_box.wrl” * x=u   y=v  z=w   * Par. domain [0, 0.5][0, 0.5][0, 1] * Sampling resolution 75 |  |
| Sphere | |
| * “solid\_sphere.wrl” * x=w\*cos(2\*pi\*u)\*sin(2\*pi\*v)   y=w\*sin(2\*pi\*u)  z=w\*cos(2\*pi\*u)\*cos(2\*pi\*v)   * Par. domain [0, 1] [0, 1][0, 0.75] * Sampling resolution 75 | Proof of being solid |
| Cylinder | |
| * “solid\_cylinder.wrl” * x=u\*0.2\*sin(2\*pi\*v)   y=w\*0.8  z=u\*0.2\*cos(2\*pi\*v)   * Par. domain [0, 1] [0, 1][0, 1] * Sampling resolution 75 |  |
| Cone | |
| * “solid\_cone.wrl” * x=u\*0.2\*(1-w)\*sin(2\*pi\*v)+0.5   y=w\*0.8  z=u\*0.2\*(1-w)\*cos(2\*pi\*v)+0.5   * Par. domain [0, 1] [0, 1][0 ,1] * Sampling resolution 75 |  |

# Converting a closed surface into a solid object

One simple example is the case of the sphere.

* x=1\*cos(2\*pi\*u)\*sin(2\*pi\*v)

y=1\*sin(2\*pi\*u)

z=1\*cos(2\*pi\*u)\*cos(2\*pi\*v)

u,v [0,1]

With this parametric equations we will get a sphere, but not a solid one. For this, we need to add a new parameter ‘w’, this parameter will make the radius variable to ‘fill’ the sphere. This parameter will have domain [0, R].

* x=w\*cos(2\*pi\*u)\*sin(2\*pi\*v)

y=w\*sin(2\*pi\*u)

z=w\*cos(2\*pi\*u)\*cos(2\*pi\*v)

u,v [0,1] w [0, 0.75]

# Experiment with sine function: rotational and translational sweeping

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| Sine function converted into a solid | | |
| * “solid\_sine.wrl” * x=u\*cos(2\*pi\*v)   y=(sin(4\*pi\*u)/2)+w  z=u\*sin(2\*pi\*v)   * Par. domain [0, 1]   [0, 1][0 ,1]   * Sampling resolution 75 | Note: cut of the solid | To generate this solid, first of all, the sine function is rotated about the y-axis. Then, is translated one unit up in the y-axis. |