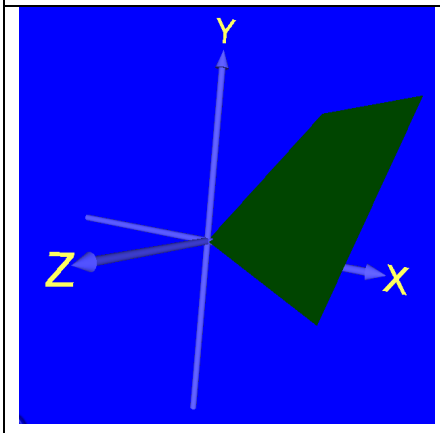
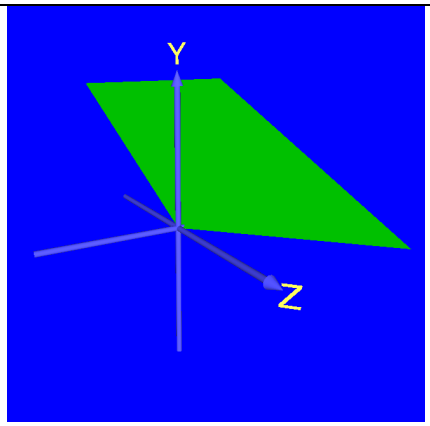
LAB 3 REPORT: PARAMETRIC SURFACES AND SOLIDS

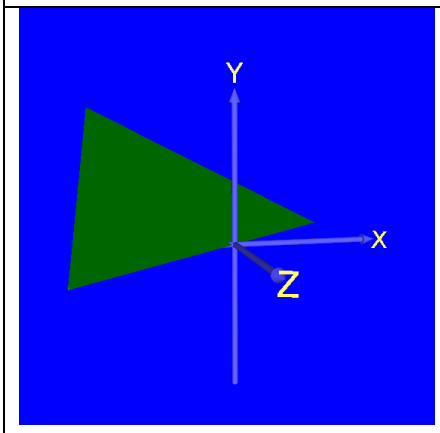
Escobero Hernández Guillermo (N1804693E) (SSR 1)

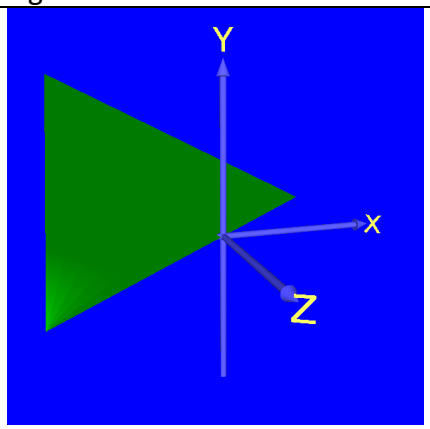
CZ2003 Computer Graphics and Visualization | Nanyang Technological University

Experiment on resolution (surfaces)

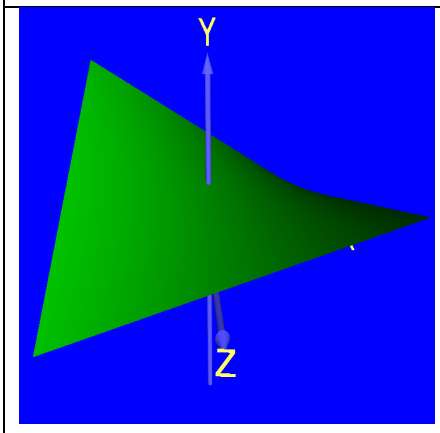
<table>
<tr><th colspan="2">3D Plane</th><th>Notes</th></tr>
<tr>
<td> 

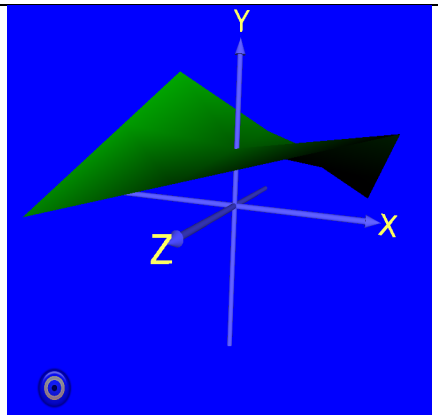
“3dplane.wrl”
x=u
y=v
z=u-2*v
Par. domain [0,1][0,1]
Sampling resolution 75
</td>
<td> 

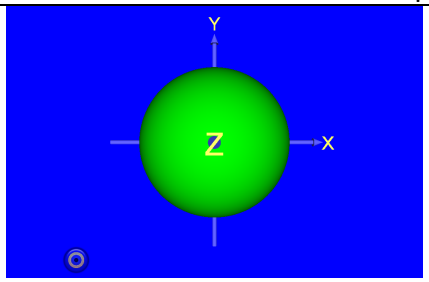
“3dplane2.wrl”
x=u
y=v
z=u-2*v
Par. domain [0,1][0,1]
Sampling resolution 2
</td>
<td rowspan="2">With 2 parameters, we only need a sampling resolution of 1, we get 4 points, enough to generate the plane.</td>
</tr>
<tr><th colspan="2">3D Triangle</th></tr>
<tr>
<td> 

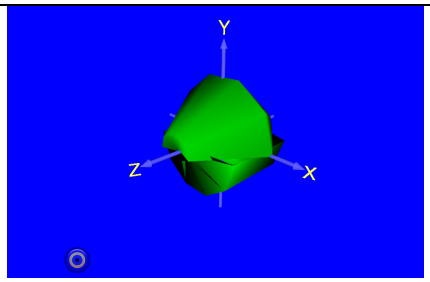
“3dtriangle.wrl”
x=-1+2*u+v*(-2*u)
y=1-u+v*(-1+u)
z=-1+2*v
Par. domain [0,1][0,1]
Sampling resolution 75
</td>
<td> 

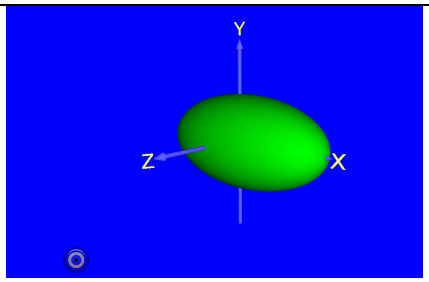
“3dtriangle2.wrl”
x=-1+2*u+v*(-2*u)
y=1-u+v*(-1+u)
z=-1+2*v
Par. domain [0,1] [0,1]
Sampling resolution 2
</td>
<td>With 2 parameters, we only need a sampling resolution of 1, we get 4 points, enough to generate the triangle.</td>
</tr>
</table>

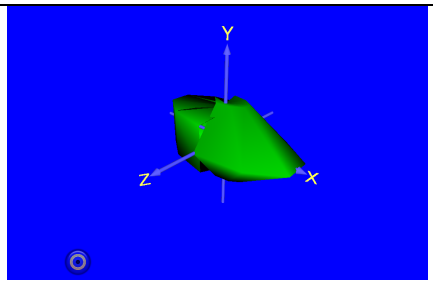
<table>
<tr><td colspan="2">Bilinear surface</td><td></td></tr>
<tr>
<td> 

“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
</td>
<td> 

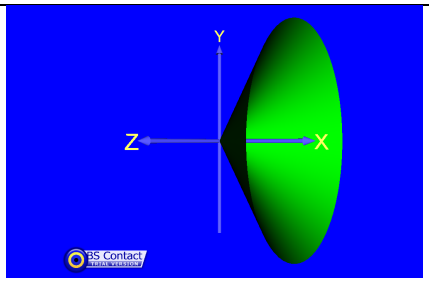
“bilinearsurface2.wrl”
x=-1+2*u
y=1-u+v*(-1+1.5*u)
z=-1+2*v
Par. domain [0,1] [0,1]
Sampling resolution 2
</td>
<td>With 2 parameters, we only need a sampling resolution of 1, we get 4 points, enough to generate the plane. However, this surface is curved, so we get edges on the surface if the resolution is low.</td>
</tr>
<tr><td colspan="2">Sphere</td><td></td></tr>
<tr>
<td> 

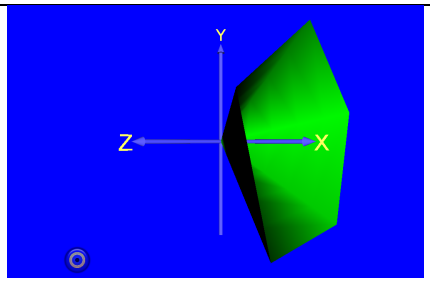
“sphere.wrl”
x=0.7*cos(2pi*u)cos(pi*v)
y=0.7*cos(2pi*u)sin(pi*v)
z=0.7*sin(2pi*u)
Par. domain [0,1][0,1]
Sampling resolution 75
</td>
<td> 

“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
</td>
<td>With a resolution of 5, we do not get enough polygons to generate a decent sphere.</td>
</tr>
<tr><td colspan="2">Ellipsoid</td><td></td></tr>
<tr>
<td> 

“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
</td>
<td> 

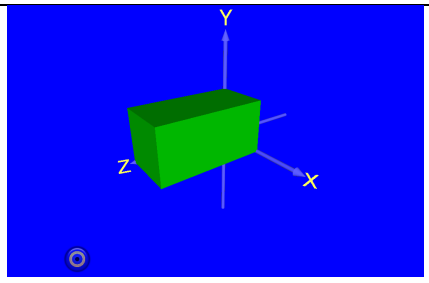
“ellipsoid2.wrl”
x=1*cos(2pi*u)*sin(pi*v)
y=0.5*sin(2*pi*u)
z=0.5*cos(2pi*u)cos(pi*v)
Parameter domain [0,1]
Sampling resolution 5
</td>
<td>With a resolution of 5, we do not get enough polygons to generate a decent ellipsoid.</td>
</tr>
</table>

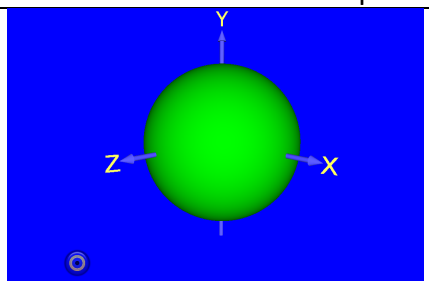
<table>
<tr><td colspan="2">Cone</td><td></td></tr>
<tr>
<td> 

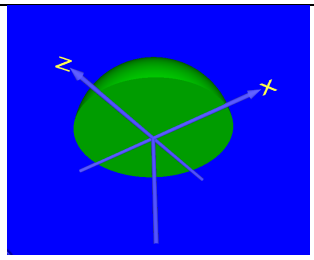
“cone.wrl”
x=u
y=u*cos(2*pi*v)
z=u*sin(2*pi*v)
Par. domain [0,1] [0,1]
Sampling resolution 75
</td>
<td> 

“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
</td>
<td>With a resolution of 5, we get a “pyramid” with pentagonal base, because we get 5 edges.</td>
</tr>
</table>

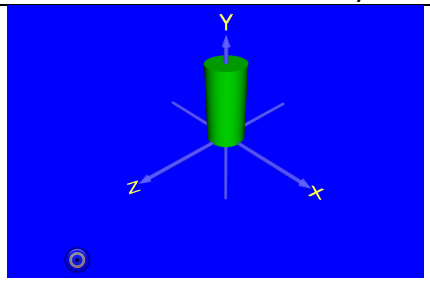
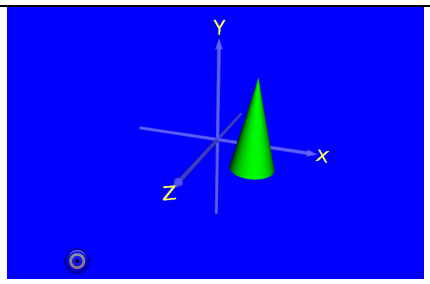
Experiment on solids

<table>
<tr><td colspan="2">Box</td></tr>
<tr>
<td> 

“solid_box.wrl”
x=u
y=v
z=w
Par. domain [0, 0.5][0, 0.5][0, 1]
Sampling resolution 75
</td>
<td></td>
</tr>
<tr><td colspan="2">Sphere</td></tr>
<tr>
<td> 

“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
</td>
<td> 

Proof of being solid</td>
</tr>
</table>

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

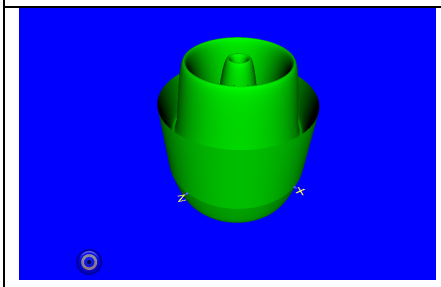
One simple example is the case of the sphere.

- 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]

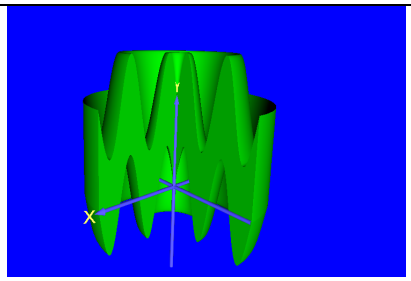
  With this parametric equations we will get a sphere, but not a solid one. For this, we need to add a new parameter 'w', this parameter will make the radius variable to 'fill' the sphere. This parameter will have domain [0, R].

- 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

<table>
<tr><td colspan="3">Sine function converted into a solid</td></tr>
<tr>
<td> 

“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

</td>
<td> 
Note: cut of the solid</td>
<td>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.</td>
</tr>
</table>