

Shape 1

Surface No.: 1

Given:

Equations:

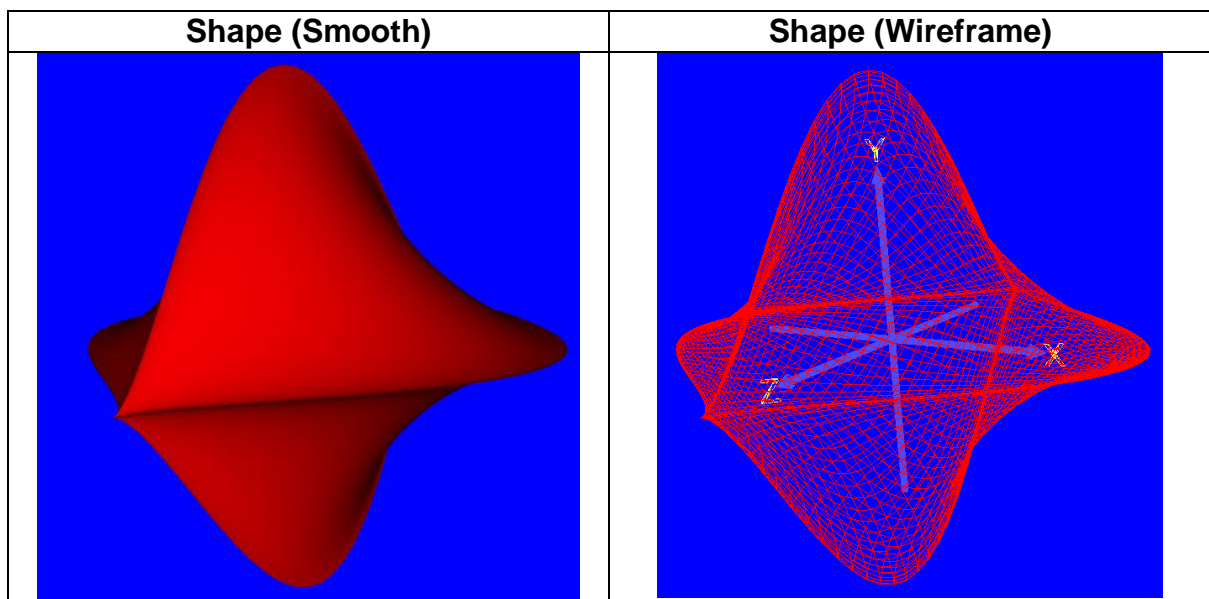
- $x = 1.6(\cos(\vartheta))^3$
- $y = 1.6(\cos(\theta)\sin(\vartheta))^3$
- $z = 1.6\sin(\theta)\sin(\vartheta)$

Parameters:

- $0 \leq \theta \leq 2\pi$
- $0 \leq \vartheta \leq \pi$

Result:

File: Shape1.wrl



Notes:

Parametric equations:

- $x1 = 1.6 \cdot \cos(\pi \cdot v)^3$;
- $y1 = 1.6 \cdot (\cos(2 \cdot \pi \cdot u) \cdot \sin(\pi \cdot v))^3$;
- $z1 = 1.6 \cdot \sin(2 \cdot \pi \cdot u) \cdot \sin(\pi \cdot v)$;

Parametric parameters:

- $u \in [0 \ 1]$

- $v \in [0, 1]$

The parameter range of θ is from $0 \leq \theta \leq 2\pi$. To convert θ into $u \in [0, 1]$, θ is converted into $2\pi u$. The parameter range of ϕ is from $0 \leq \phi \leq \pi$. To convert ϕ into $v \in [0, 1]$, ϕ is converted into πv .

Resolution: [75 75]

When the resolutions are [50 50], it results in an unsmooth surface. At resolution of [75 75], shape 1 has a smooth surface. Therefore, the higher the resolution, the smoother the surface of shape 1 as higher resolution results in higher number of polygons to be created when the shape is rendered.

Shape 2

Surface No.: 6

Given:

Equations:

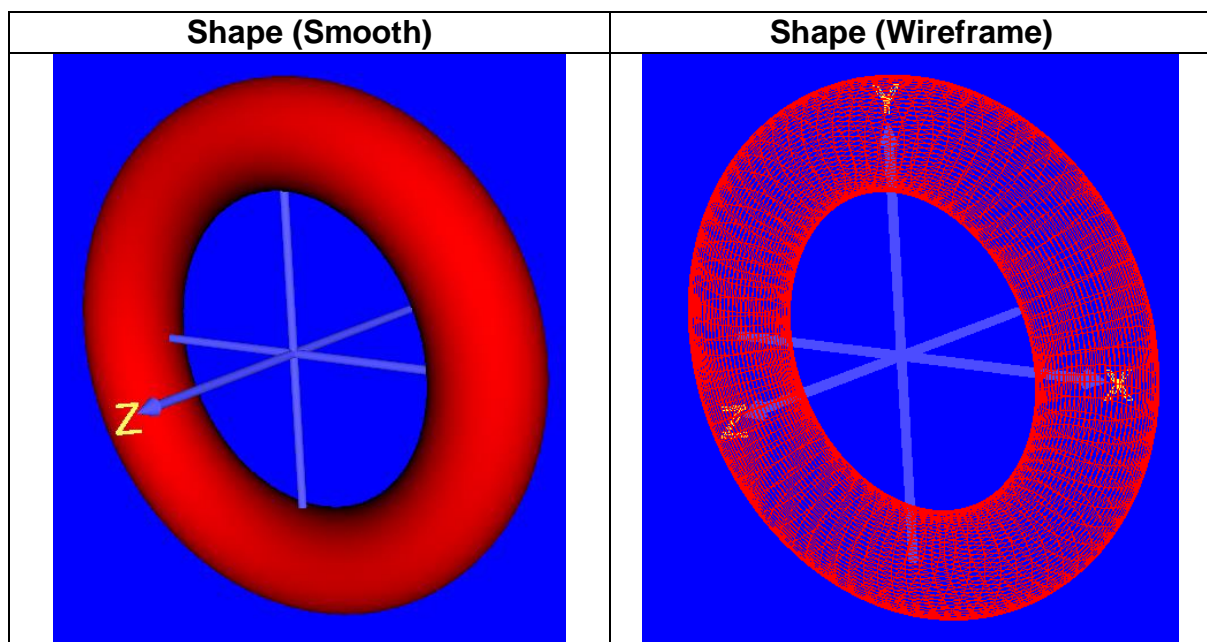
- $x = (1+0.25\cos(\theta))\cos(b\pi)$
- $y = (1+0.25\cos(\theta))\sin(b\pi)$
- $z = 0.25\sin(\theta)$

Parameters:

- $0 \leq \theta \leq 2\pi$
- $0 \leq b \leq 2$

Result:

File: Shape2.wrl



Notes:

Parametric equations:

- $x2 = (1+0.25*\cos(2*\pi*u))*\cos(2*v*\pi);$
- $y2 = (1+0.25*\cos(2*\pi*u))*\sin(2*v*\pi);$
- $z2 = 0.25*\sin(2*\pi*u);$

Parametric parameters:

- $u \in [0 \ 1]$
- $v \in [0 \ 1]$

The parameter range of θ is from $0 \leq \theta \leq 2\pi$. To convert θ into $u \in [0 \ 1]$, θ is converted into $2\pi u$. The parameter range of b is from $0 \leq b \leq 2$. To convert b into $v \in [0 \ 1]$, b is converted into $v\pi$.

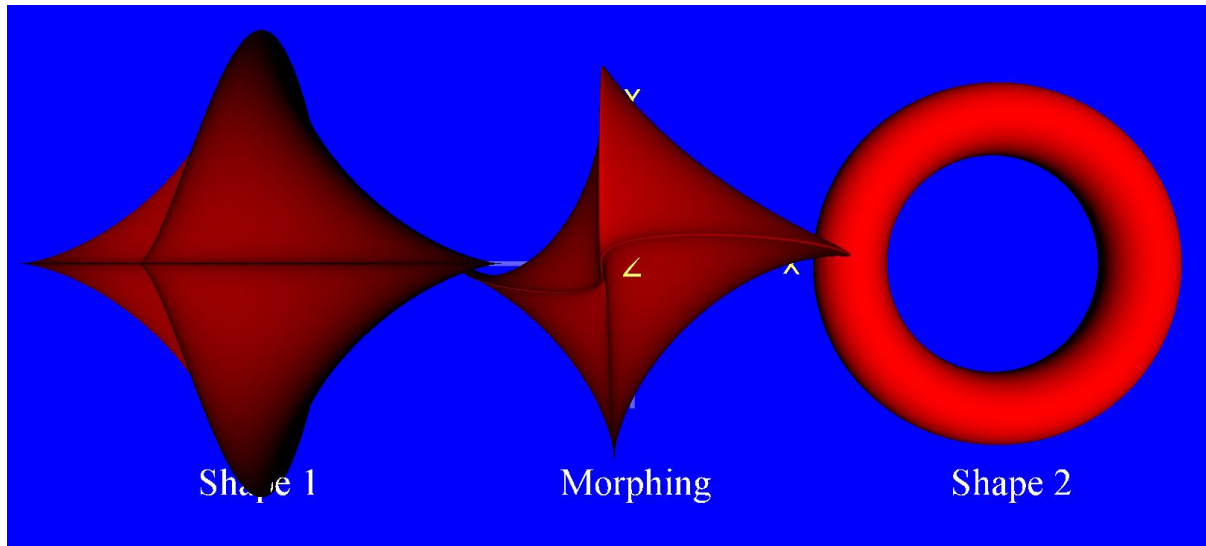
Resolution: [75 75]

Similar to shape 1, when the resolutions are [50 50], it results in an unsmooth surface. At resolution of [75 75], shape 2 have a smooth surface. Therefore, the higher the resolution, the smoother the surface of shape 2 as higher resolution results in higher number of polygons to be created when the shape is rendered.

Animated Shape

File:morphing.wrl

Shapes:



Notes:

Functions definition:

```
function parametric_x(u,v,w,t)
```

```
{ x1=x1=1.6*cos(pi*v)^3;  
  x2=(1+0.25*cos(2*pi*u))*cos(2*v*pi);  
  return x1+(x2-x1)*t;    }
```

```
function parametric_y(u,v,w,t)
```

```
{ y1=1.6*(cos(2*pi*u)*sin(pi*v))^3;  
  y2=(1+0.25*cos(2*pi*u))*sin(2*v*pi);  
  return y1+(y2-y1)*t;    }
```

```
function parametric_z(u,v,w,t)
```

```
{ z1=1.6*sin(2*pi*u)*sin(pi*v);  
  z2=0.25*sin(2*pi*u);  
  return z1+(z2-z1)*t;    }
```

To allow morphing from one shape to another, each shape is defined as a variable before using linear interpolation of each coordinate to transit from shape 1 to shape 2 and using time, t , as the parameter. The result is then returned to the caller that called the function.

Examples of linear interpolation of coordinates to transit from shape 1 to shape 2:

- $x1+(x2-x1)*t$
- $y1+(y2-y1)*t$
- $z1+(z2-z1)*t$

Resolution: [75 75]

When the resolutions are [50 50], it results in an unsmooth surface. At resolution of [100 100], the shapes have smooth surfaces. However, jitter could be observed during morphing transition animation from shape 1 to shape 2. At resolution of [75 75], both shapes have smooth surfaces and no jitter was observed during the morphing transition animation from shape 1 to shape 2. Therefore, the higher the resolution, the smoother the surface of shape 2 as higher resolution results in higher number of polygons to be created when the shape is rendered.