https://github.com/t-o-k/Maxima-bezier/rational_bezier_surface_3d.wxmx

(%i1)
```
load("draw")$
```

(%i2)
```
load("bezier")$
```

(%i3)
```
tau: 2*%pi;
```
(tau) $2\,\pi$

(%i4)
```
angle: tau/4;
```
(angle) $\frac{\pi}{2}$

(%i5)
```
w: matrix([ 1.0, cos(angle/2), 1.0 ]);
```
(w) $$\begin{pmatrix} 1.0 & \frac{1}{\sqrt{2}} & 1.0 \end{pmatrix}$$

(%i6)
```
weights: transpose(w).w;
```
(weights) $$\begin{pmatrix} 1.0 & \frac{1.0}{\sqrt{2}} & 1.0 \\ \frac{1.0}{\sqrt{2}} & \frac{1}{2} & \frac{1.0}{\sqrt{2}} \\ 1.0 & \frac{1.0}{\sqrt{2}} & 1.0 \end{pmatrix}$$

The 9 points; <x, y, z> in the control grid:

[<3, 2, 1>, <5, 2, 1>, <5, 4, 1>]
[<3, 2, 2>, <5, 2, 2>, <5, 4, 2>]
[<3, 3, 2>, <4, 3, 2>, <4, 4, 2>]

This will create a surface that is 1/8 of the surface of a torus with major radius 2 and minor radius 1.

(%i7)
```
points_x:
   matrix(
      [ 3, 5, 5 ],
      [ 3, 5, 5 ],
      [ 3, 4, 4 ]
   )$
```

(%i8)
```
points_y:
   matrix(
      [ 2, 2, 4 ],
      [ 2, 2, 4 ],
      [ 3, 3, 4 ]
   )$
```

(%i9)
```
points_z:
   matrix(
      [ 1, 1, 1 ],
      [ 2, 2, 2 ],
      [ 2, 2, 2 ]
   )$
```

(%i10)
```
define(f_x(u, v), rational_bezier_function_2a(points_x, weights, u, v));
```

(%o10)
$$f_x(u,v):=(4.0\,u^2\,v^2+4.0\sqrt{2}\,(1-u)\,u\,v^2+3.0\,(1-u)^2\,v^2+5.0\sqrt{2}\,u^2\,(1-v)\,v+10\,(1-u)\,u\,(1-v)\,v+3.0\sqrt{2}\,(1-u)^2\,(1-v)\,v+5.0\,u^2\,(1-v)^2+5.0\sqrt{2}\,(1-u)\,u\,(1-v)^2+3.0\,(1-u)^2\,(1-v)^2)/(1.0\,u^2\,v^2+1.0\sqrt{2}\,(1-u)\,u\,v^2+1.0\,(1-u)^2\,v^2+1.0\sqrt{2}\,u^2\,(1-v)\,v+2\,(1-u)\,u\,(1-v)\,v+1.0\sqrt{2}\,(1-u)^2\,(1-v)\,v+1.0\,u^2\,(1-v)^2+1.0\sqrt{2}\,(1-u)\,u\,(1-v)^2+1.0\,(1-u)^2\,(1-v)^2)$$

(%i11)
```
define(f_y(u, v), rational_bezier_function_2a(points_y, weights, u, v));
```

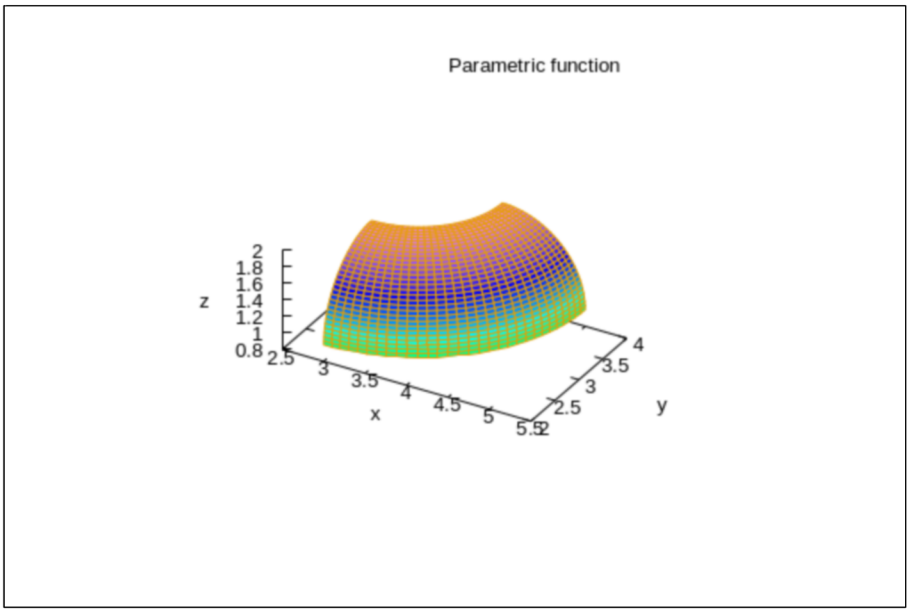
(%o11)
$$f_y(u,v):=(4.0\,u^2\,v^2+3.0\sqrt{2}\,(1-u)\,u\,v^2+3.0\,(1-u)^2\,v^2+4.0\sqrt{2}\,u^2\,(1-v)\,v+4\,(1-u)\,u\,(1-v)\,v+2.0\sqrt{2}\,(1-u)^2\,(1-v)\,v+4.0\,u^2\,(1-v)^2+2.0\sqrt{2}\,(1-u)\,u\,(1-v)^2+2.0\,(1-u)^2\,(1-v)^2)/(1.0\,u^2\,v^2+1.0\sqrt{2}\,(1-u)\,u\,v^2+1.0\,(1-u)^2\,v^2+1.0\sqrt{2}\,u^2\,(1-v)\,v+2\,(1-u)\,u\,(1-v)\,v+1.0\sqrt{2}\,(1-u)^2\,(1-v)\,v+1.0\,u^2\,(1-v)^2+1.0\sqrt{2}\,(1-u)\,u\,(1-v)^2+1.0\,(1-u)^2\,(1-v)^2)$$

(%i12)
```
define(f_z(u, v), rational_bezier_function_2a(points_z, weights, u, v));
```

(%o12)
$$f_z(u,v):=(2.0\,u^2\,v^2+2.0\sqrt{2}\,(1-u)\,u\,v^2+2.0\,(1-u)^2\,v^2+2.0\sqrt{2}\,u^2\,(1-v)\,v+4\,(1-u)\,u\,(1-v)\,v+2.0\sqrt{2}\,(1-u)^2\,(1-v)\,v+1.0\,u^2\,(1-v)^2+1.0\sqrt{2}\,(1-u)\,u\,(1-v)^2+1.0\,(1-u)^2\,(1-v)^2)/(1.0\,u^2\,v^2+1.0\sqrt{2}\,(1-u)\,u\,v^2+1.0\,(1-u)^2\,v^2+1.0\sqrt{2}\,u^2\,(1-v)\,v+2\,(1-u)\,u\,(1-v)\,v+1.0\sqrt{2}\,(1-u)^2\,(1-v)\,v+1.0\,u^2\,(1-v)^2+1.0\sqrt{2}\,(1-u)\,u\,(1-v)^2+1.0\,(1-u)^2\,(1-v)^2)$$

(%i13)
```
wxplot3d(
   [ f_x(u, v), f_y(u, v), f_z(u, v) ],
   [ u, 0, 1 ],
   [ v, 0, 1 ],
   same_xyz
);
```

(%t13)



(%o13)