https://github.com/t-o-k/Maxima-bezier/bezier_surface_with_control_grid_3d.wxmx

(%i1)
```
kill(all)$
```

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

(%i3)
```
combine_xyz(xx, yy, zz) := map(lambda([ x, y, z ], [ x, y, z ]), xx, yy, zz)$
```

(%i4)
```
points2a_x:
  [
    [ 0.0,  1.0,  2.0,  3.0 ],
    [ 0.0,  1.0,  2.0,  4.0 ],
    [ 0.0,  1.0,  2.0,  2.5 ],
    [ 0.0,  1.0,  2.0,  3.0 ]
  ]
$
```

(%i5)
```
points2a_y:
  [
    [ 0.0,  0.0,  1.0,  0.0 ],
    [ 1.0,  1.0,  2.0,  1.0 ],
    [ 2.0,  2.0,  3.0,  2.0 ],
    [ 3.0,  3.0,  5.0,  3.0 ]
  ]
$
```

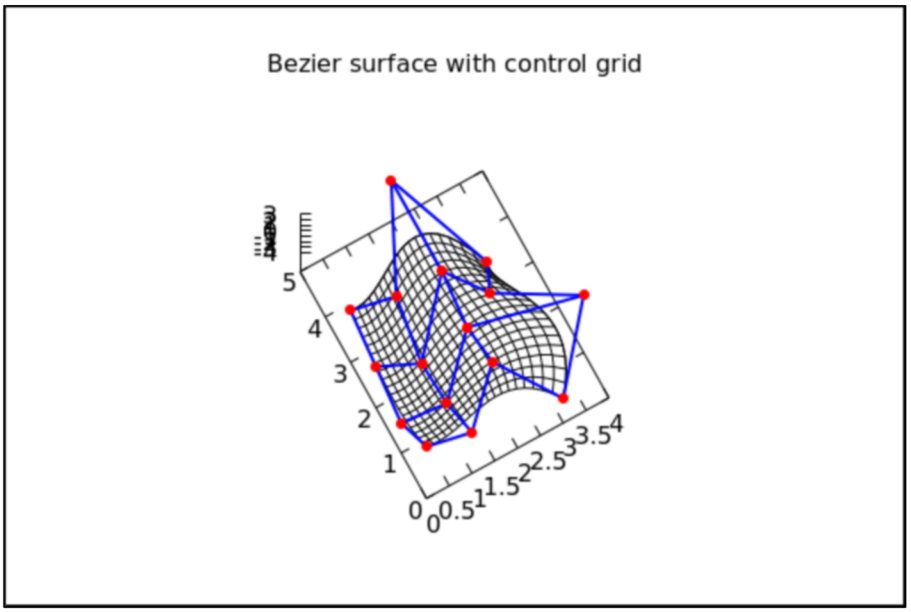
(%i6)
```
points2a_z:
  [
    [ 2.0,  0.0,  0.0, -3.0 ],
    [-2.0, -3.0, -2.0,  3.0 ],
    [ 0.0, -4.0,  0.0,  2.0 ],
    [ 2.0,  0.0,  0.0, -3.0 ]
  ]
$
```

(%i9)
```
p_x: apply(matrix, points2a_x)$
p_y: apply(matrix, points2a_y)$
p_z: apply(matrix, points2a_z)$
```

```
(%i12) define(s_x(u, v), bezier_function_2a(p_x, u, v))$
       define(s_y(u, v), bezier_function_2a(p_y, u, v))$
       define(s_z(u, v), bezier_function_2a(p_z, u, v))$

(%i13) expand(s_x(u, v));
                  3  3        3  2        3
(%o13) 4.5 u  v  - 7.5 u  v  + 3.0 u  v + 3.0 u

(%i14) expand(s_y(u, v));
                   3  3        2  3              3        2
(%o14) - 3.0 u  v  + 3.0 u  v  + 3.0 v - 3.0 u  + 3.0 u

(%i15) expand(s_z(u, v));
                  3  3         2  3          3        3        3  2
(%o15) 36.0 u  v  - 54.0 u  v  + 27.0 u v  - 6.0 v  - 57.0 u  v  +
          2  2          2        2        3                3
       54.0 u  v  - 36.0 u v  + 18.0 v  + 21.0 u  v + 9.0 u v - 12.0 v - 5.0 u
          2
       + 6.0 u  - 6.0 u + 2.0

(%i16) surface:
          parametric_surface(
             s_x(u, v),
             s_y(u, v),
             s_z(u, v),
             u, 0, 1,
             v, 0, 1
          )
       $

(%i18) points2a_xyz:
          map(
             combine_xyz,
             points2a_x,
             points2a_y,
             points2a_z
          )
       $
       control_grid: apply(mesh, points2a_xyz)$

(%i20) points1a_xyz:
          combine_xyz(
             flatten(points2a_x),
             flatten(points2a_y),
             flatten(points2a_z)
          )
       $
       control_points: points(points1a_xyz)$
```

```
(%i21) wxdraw3d(
         title = "Bezier surface with control grid",
         proportional_axes = xyz,
         xu_grid = 20,
         yv_grid = 20,
         view = [ 6, 331 ],
         color = black,
         line_width = 1,
         wired_surface = true,
         surface,
         color = blue,
         line_width = 2,
         control_grid,
         color = red,
         point_type = filled_circle,
         point_size = 1,
         control_points
       );
```

(%t21)



(%o21)